

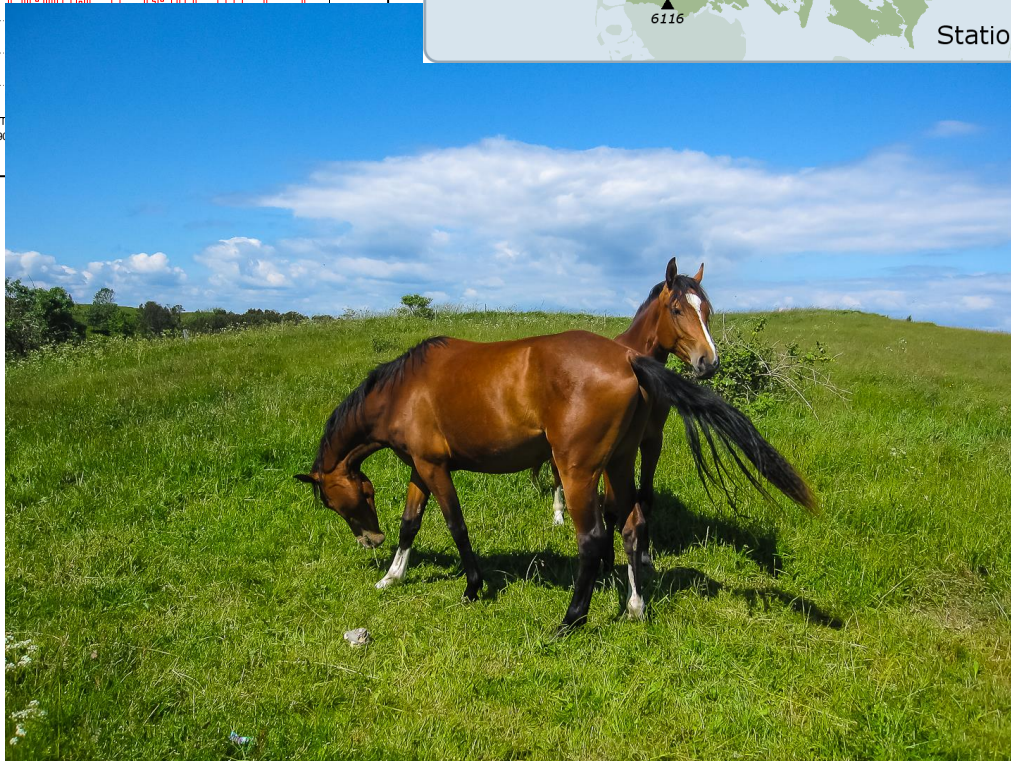
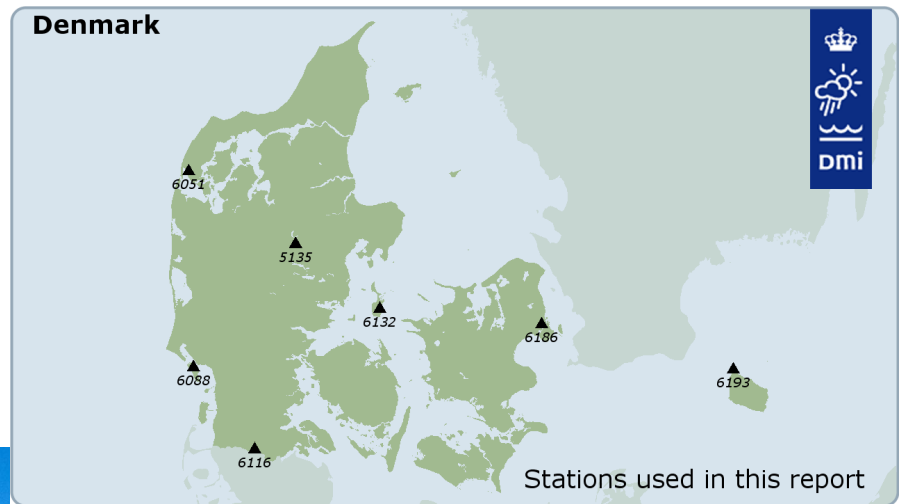
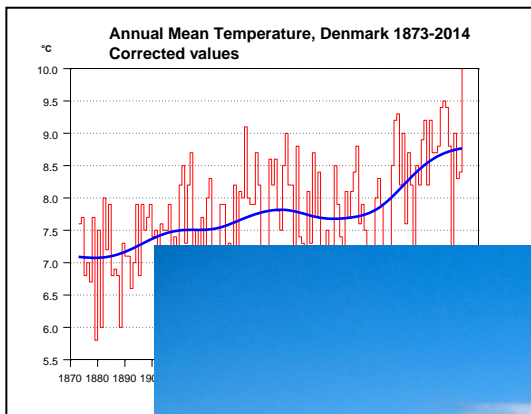


Technical Report 15-02

Denmark - DMI Historical Climate Data Collection 1768-2014

-with Danish Abstracts

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Copenhagen 2015



Colophon

Serial title:

Technical Report 15-02

Title:

Denmark - DMI Historical Climate Data Collection 1768-2014

Subtitle:

- with Danish Abstracts

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Responsible institution:

Danish Meteorological Institute

Language:

English

Keywords:

Denmark, atmospheric pressure observations, daily, monthly and annual climate data, time series, extremes, graphics, standard normal values, country-wise values, storm list, temperature, atmospheric pressure, precipitation, cloud cover, hours of bright sunshine, snow cover, weather

Url: http://www.dmi.dk/fileadmin/user_upload/Rapporter/TR/2015/Tr15-02.pdf

ISSN: 1399-1388

Website: www.dmi.dk

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Important note:

This report is an annual update (2014 data) of the “DMI daily, monthly, annual and country-wise Danish climate data collection” published for the first time in that form in 1) DMI Technical Report 08-05: DMI Daily Climate Data Collection 1873-2007, Denmark, The Faroe Islands and Greenland - including Air Pressure Observations 1874-2007 (WASA Data Sets). Copenhagen 2008 [14], 2) DMI Technical Report 04-03: DMI Daily Climate Data Collection 1873-2003, Denmark and Greenland. Copenhagen 2004 [37], 3) DMI Technical Report 03-26: DMI Monthly Climate Data Collection 1860-2002, Denmark, The Faroe Island and Greenland. An update of: NACD, REWARD, NORDKLIM and NARP datasets, Version 1. Copenhagen 2003 [29], 4) DMI Technical Report 05-06: DMI annual climate data collection 1873-2004, Denmark, The Faroe Islands and Greenland - with Graphics and Danish Abstracts. Copenhagen 2005 [12], 5) DMI Teknisk Rapport 06-02: Dansk vejr siden 1874 - måned for måned med temperatur, nedbør og soltimer samt beskrivelser af vejret with English translations. København 2006 [13] and 6) DMI Teknisk Rapport 09-12: Storm og ekstrem vind i Danmark – opgørelser og analyser september 2009. København 2009 [15].

Front Page:

Spring, Northern part of Samsø, Denmark May 2014. Photo: John Cappelen



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Abstract

This report contains the available DMI historical data collection 1768-2014 for Denmark, including observations (atmospheric pressure), long daily, monthly and annual series of station based data, country-wise values and a list of storms.

Resumé

Denne rapport indeholder tilgængelige historiske DMI datasamlinger 1768-2014 for Danmark. Det drejer sig om observationer af lufttryk, lange daglige, månedlige og årlige stationsdataserier, landstallet og en stormliste.



1. Preface

This report contains a DMI historical data collection 1768-2014 for Denmark, including long series of station based data comprising observations of atmospheric pressure plus daily, monthly and annual values of selected parameters. Finally selected country-wise values and a list of storms for Denmark are published. Description of the general weather and climate in Denmark [31] is included.

This information has been published earlier in different DMI reports [16], [17], [18], [19], [20] and [25]. It is now published in one report divided in sections covering the different data types.

The data collection comprises observational, monthly and annual blended data sets with a long record (blended station data series) and daily station data series, not blended. A description of the blending and other metadata can be found in Appendices.

Changes in station position, measuring procedures or observer may all significantly bias a time series of observations. For that reason metadata (“data on data”) are important. All available information on station positions and relocations are included in Appendix. Other metadata as descriptions of the construction of data sets and data series behind, rain gauge exposure, information concerning atmospheric pressure data from old manually operated climate stations, the introduction of the Hellmann rain gauge and the introduction of Stevenson screens (thermometer screen, notes on monthly values etc. can also be found in Appendices.

A compiled set of various metadata up to 1996, covering aspects such as station position and relocations, change of instrumentation and observation units etc., that is essential to know when homogenizing time series of climate data can be found in DMI Technical Report 03-24 [35]. This publication contains information concerning a major part of the stations included in this report.

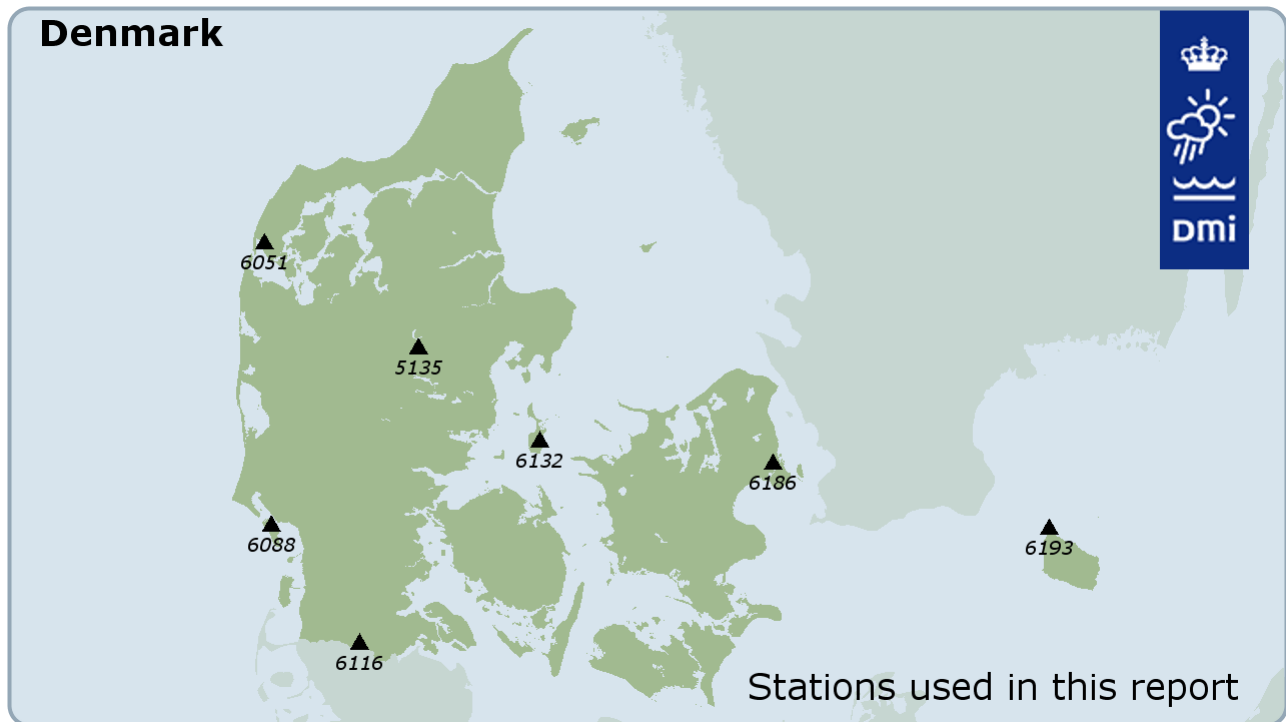
2. Overall data overview

Below is a quick overview of all the information from Denmark you can find in this report:

- A station map and -list showing weather stations (present name and location) from where the station based data sets presented in this report comes from.
- Description of the general weather and climate in Denmark.
- A survey and description of the different data collections.
- Detailed metadata (data about data).
- File formats describing the different data files included in this report.

Guidance: Find the data collection you are interested in the data collections overview. Read about it in the specific section and appendix. Find the data set among the data files, which can be downloaded from the publication part of DMI web pages together with this report.

2.1. Stations



Station based data sets referred to in the report. Only the latest positions are marked. The official WMO station identifiers for Denmark consist of 5 digits “06xxx”. However, in this report the in front “0” is omitted, giving 4 digits i.e. “6132” for Tranebjerg, which is also used on the map. The Danish national station identifiers describing climate/precipitation stations in Denmark consist of 5 digits, either the new format “05XXX” (the in front “0” is omitted, giving 4 digits i.e. “5135” for Grønbæk or a the old format, where the station number started with 20-32 dependent on the region i.e. “27080” for the old Tranebjerg station.

Data set id*	Station*	First year of appearance
6051	Vestervig	1874
5135	Grønbæk	1874
6088	Nordby	1872
6116	Store Jynde vad	1920
6132	Tranebjerg	1872
6186	København	1768
6193	Hammer Odde Fyr	1873

*latest station number and name



2.2. Data collections overview

Data types/parameters marked with “bold” in the “Data Collections” column represent a data set for every station/region mentioned. The data sets can be downloaded from the publication part of DMI web pages together with this report and are described in the sections and appendices specified.

Type	Data Collections	Section, Page, Appendix
Observation	<ul style="list-style-type: none"> Atmospheric pressure (msl) 3 data sets: 6051 Vestervig (1874-2014) 6088 Nordby (1874-2014) 6193 Hammer Odde Fyr (1874-2014) 	Sec 4.2.1., p 18, App 2
Daily	<ul style="list-style-type: none"> Accumulated precipitation 15 data sets: 6051 Vestervig (1874-2014) 5135 Grønbæk (1874-2014) 6088 Nordby/Fanø (1874-2014) 26410 Broderup (1920-1993) 26409 Tinglev (1995-2006) 6116/26400 Store Jyndevad (1987-2014) 27080 Tranebjerg (1872-2001) 6132/27082 Tranebjerg Øst (2001-2014) 30380 Landbohøjskolen (1874-1996) 30210 Meteorologisk Institut (1875-1922) 30210 Meteorologisk Institut (1961-1984) 5735/30370 Botanisk Have (1961-2014) 32030 Sandvig (1874-1970) 32020 Hammer Odde Fyr (1961-1987) 6193 Hammer Odde (1984-2014) Highest temperature Lowest temperature 11 data sets: 21100 Vestervig (1874-2003) 6051 Vestervig (2003-2014) 25140 Nordby/Fanø (1874-2003) 6088 Nordby/Fanø (2003-2014) 27080 Tranebjerg (1872-2003) 6132 Tranebjerg (2003-2014) 30380 Landbohøjskolen (1874-1997) 6186 København (1995-2014) 32030 Sandvig (1874-1970) 32020 Hammer Odde Fyr (1971-1987) 6193 Hammer Odde (1984-2014) Air temperature 14 UTC 1 data set: 6132 Tranebjerg (1872-2014) Cloud Cover 8, 14 and 21 UTC 1 dataset: 6132 Tranebjerg (1872-2000) Mean atmospheric pressure 5 data sets: 	<p>Sec 5.2.1, p 23, App 3</p> <p>Sec 5.2.2–5.2.3, p 23-24, App 3</p> <p>Sec 5.2.4, p 24, App 3</p> <p>Sec 5.2.5, p 25, App 3</p> <p>Sec 5.2.6, p 25, App 3</p>



	<p>21100 Vestervig (1874-1987) 6052 Thyborøn (1961-2014) 25140 Nordby/Fanø (1874-1987) 6080 Esbjerg Airport (1959-2014) 6193 Hammer Odde Fyr (1874-2014)</p>	
Monthly	<ul style="list-style-type: none"> • Mean air temperature • Mean daily minimum temperature • Mean daily maximum temperature • Highest temperature • Lowest temperature • Mean atmospheric pressure (msl) • Hours of bright sunshine • Accumulated precipitation • Highest 24-hour precipitation • No. of days with snow cover • Mean cloud cover <p>5 data sets: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranbjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p>	Sec 6.2.1-6.2.11, p 31-34, App 4
Annual	<ul style="list-style-type: none"> • Mean air temperature • Mean daily minimum temperature • Mean daily maximum temperature • Highest temperature • Lowest temperature • Mean atmospheric pressure (msl) • Hours of bright sunshine • Accumulated precipitation • Highest 24-hour precipitation • No. of days with snow cover • Mean cloud cover <p>5 data sets: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranbjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p> <ul style="list-style-type: none"> • Mean air temperature; graph and values with gauss filtered values <p>1 data set: 6186 København (1873-2014)</p>	<p>Sec 7.2.1., p 38, App 5</p> <p>Sec 7.2.2.-7.2.3, p 38, App 5</p>
Country-wise	<ul style="list-style-type: none"> • Country-wise monthly and annual climate data 1874-2014; mean temperature, mean of minimum and maximum temperatures, highest/lowest temperatures, accumulated precipitation, highest 24-hour precipitation and hours of bright sunshine; data set <p>All months/years 1891-2014 are characterised by</p>	Sec 8.2.1., p 43, App 6



	<p>a short text as well as the weather during Eastern, Christmas and Midsummer Day. Record breaking months and years are marked and normals 1961-90 and average 2001-2010 are included. The extremes are also isolated separately in a product</p> <ul style="list-style-type: none"> • Country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover 1873-2014; graphs and dataset with gauss filtered values 	<p>Sec 8.2.2.-8.2.3, p46-48, App 6</p>
Storm	<ul style="list-style-type: none"> • List of storms 1890-2014; data set <p>All strong gales to hurricanes registered in Denmark, have been ranked in terms of strength and wind direction and whether there has been snow-fall involved</p>	<p>Sec 9.2.1., p 55, App 7</p>



Denne rapport indeholder DMI historiske datasamlinger 1768-2014 for Danmark. Det drejer sig om tilgængelige lange serier af stationsbaserede data, herunder observationer af lufttryk samt daglige, månedlige og årlige værdier af udvalgte parametre. Endelig publiceres udvalgte danske landstal og en dansk stormliste. Beskrivelse af det generelle vejr og klima i Danmark [31] er medtaget.

Datasamlingerne er blevet offentliggjort tidligere i forskellige DMI rapporter [16], [17], [18], [19], [20] og [25]. Nu offentliggøres de i én rapport opdelt i sektioner, der dækker de forskellige datatyper.

Nedenfor er en oversigt over tilgængelige datasamlinger fra Danmark, du kan finde i denne rapport. Et kort og en liste over danske vejrstationer (nuværende navn og placering), hvorfra denne rapports stationsbaserede datasæt kommer fra kan ses i afsnit 2.1.

Detaljerede metadata (data om data) og filformater for de datafiler, der er inkluderet i denne rapport kan ses i Appendix.

Type	Datasamlinger	Sektion, Sidetal, Appendiks
Observation	<ul style="list-style-type: none"> • Atmosfærisk lufttryk (msl) <p>3 datasæt: 6051 Vestervig (1874-2014) 6088 Nordby (1874-2014) 6193 Hammer Odde Fyr (1874-2014)</p>	<p>Sektion 4.2.1., s 18, App 2</p>
Døgn	<ul style="list-style-type: none"> • Nedbørsum <p>15 datasæt: 6051 Vestervig (1874-2014) 5135 Grønbæk (1874-2014) 6088 Nordby/Fanø (1874-2014) 26410 Broderup (1920-1993) 26409 Tinglev (1995-2006) 6116/26400 Store Jyndevad (1987-2014) 27080 Tranebjerg (1872-2001)</p>	<p>Sektion 5.2.1, s 23, App 3</p>



	<p>6132/27082 <i>Tranebjerg Øst (2001-2014)</i> 30380 <i>Landbohøjskolen (1874-1996)</i> 30210 <i>Meteorologisk Institut (1875-1922)</i> 30210 <i>Meteorologisk Institut (1961-1984)</i> 5735/30370 <i>Botanisk Have (1961-2014)</i> 32030 <i>Sandvig (1874-1970)</i> 32020 <i>Hammer Odde Fyr (1961-1987)</i> 6193 <i>Hammer Odde (1984-2014)</i></p> <ul style="list-style-type: none">• Højeste lufttemperatur• Laveste lufttemperatur <p>11 datasæt: 21100 <i>Vestervig (1874-2003)</i> 6051 <i>Vestervig (2003-2014)</i> 25140 <i>Nordby/Fanø (1874-2003)</i> 6088 <i>Nordby/Fanø (2003-2014)</i> 27080 <i>Tranebjerg (1872-2003)</i> 6132 <i>Tranebjerg (2003-2014)</i> 30380 <i>Landbohøjskolen (1874-1997)</i> 6186 <i>København (1995-2014)</i> 32030 <i>Sandvig (1874-1970)</i> 32020 <i>Hammer Odde Fyr (1971-1987)</i> 6193 <i>Hammer Odde (1984-2014)</i></p> <ul style="list-style-type: none">• Lufttemperatur 14 UTC <p>1 datasæt: 6132 <i>Tranebjerg (1872-2014)</i></p> <ul style="list-style-type: none">• Skydække 8,14 og 21 UTC <p>1 datasæt: 6132 <i>Tranebjerg (1872-2014)</i></p> <ul style="list-style-type: none">• Middellufttryk <p>5 datasæt: 21100 <i>Vestervig (1874-1987)</i> 6052 <i>Thyborøn (1961-2014)</i> 25140 <i>Nordby/Fanø (1874-1987)</i> 6080 <i>Esbjerg Lufthavn (1959-2014)</i> 6193 <i>Hammer Odde Fyr (1874-2014)</i></p>	<p><i>Sektion 5.2.2-5.2.3, s 23-24, App 3</i></p> <p><i>Sektion 5.2.4, s 24, App 3</i></p> <p><i>Sektion 5.2.5, s 25, App 3</i></p> <p><i>Sektion 5.2.6, s 25, App 3</i></p>
Måned	<ul style="list-style-type: none">• Middel lufttemperatur• Middel maksimumtemperatur• Middel minimumtemperatur• Højeste temperatur• Laveste temperatur• Middellufttryk (msl)• Solskinstimer• Nedbørsum• Højeste 24 t nedbørsum• Antal snedækkedage• Middelskydække <p>5 datasæt: 6051 <i>Vestervig (1874-2014)</i> 6088 <i>Nordby (1872-2014)</i> 6132 <i>Tranebjerg (1873-2014)</i> 6186 <i>København (1768-2014)</i></p>	<p><i>Sektion 6.2.1-6.2.11, s 31-34, App 4</i></p>



	6193 Hammer Odde Fyr (1873-2014)	
År	<ul style="list-style-type: none">• <i>Middel lufttemperatur</i>• <i>Middel maksimumtemperatur</i>• <i>Middel minimumtemperatur</i>• <i>Højeste temperatur</i>• <i>Laveste temperatur</i>• <i>Middellufttryk (msl)</i>• <i>Solskinstimer</i>• <i>Nedbørsum</i>• <i>Højeste 24 t nedbørsum</i>• <i>Antal snedækkedage</i>• <i>Middelskydække</i> <p>5 datasæt: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranebjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p> <ul style="list-style-type: none">• <i>Middel lufttemperatur som data og grafik med gauss-filtrerede værdier</i> <p>1 datasæt: 6186 København (1873-2014)</p>	<p><i>Sektion 7.2.1., s 38, App 5</i></p> <p><i>Sektion 7.2.2-7.2.3., s 38, App 5</i></p>
Landstal	<ul style="list-style-type: none">• <i>Månedlige og årlige værdier af landstal af middel luft-, max- og min- temperatur samt højeste og laveste temperatur, nedbørsum, max 24 t nedbørsum og solskinstimer 1874-2014 som datasæt.</i> <p>Alle måneder og år samt Påske, Jul og Sankt Hans Aften 1891-2014 er desuden karakteriseret af en kort vejrbeskrivende tekst. Endelig er alle måned- og årsrekorder markeret og normaler 1961-90 samt gennemsnit 2001-2010 er inkluderet. Ekstremer fra materialet foreligger særskilt i et produkt</p> <ul style="list-style-type: none">• <i>Årlige landstal for middeltemperatur, nedbørsum, solskinstimer og middel skydække som datasæt og grafik 1873-2014 med gauss-filtrerede værdier</i>	<p><i>Sektion 8.2.1., p 43, App 6</i></p> <p><i>Sektion 8.2.2-8.2.3, p46-48, App 6</i></p>
Storm	<ul style="list-style-type: none">• <i>Stormliste 1890-2014 som datasæt</i> <p>Alle kraftige blæsevejr, der har ramt Danmark, klassificeret mht. styrke og vindretning, samt om der har været snefald indblandet</p>	<p><i>Sektion 9.2.1., p 55, App 7</i></p>

3. Climate and weather in general; Denmark

Between ocean and continent

Danish weather is extremely changeable. Denmark lies in the path of the westerlies, an area characterised by fronts, extratropical cyclones and unsettled weather. At the same time, the country is situated on the edge of the European Continent, where winters are cold and summers hot. Compared to other geographical areas on the same latitude, Denmark enjoys a relatively warm climate. This is due to the warm Gulf Stream that originates in the tropical ocean off the eastern coast of the USA. By way of comparison, Denmark is situated on the same latitude as Hudson Bay in Canada and Siberia in Russia, areas almost uninhabitable due to their short summers and harsh winters.

The weather changes according to the prevailing wind direction

Denmark has a typical coastal climate with mild, humid weather in winter and cool, changeable weather in summer, and mean temperatures do not vary greatly between the two seasons. However, the climate and weather in Denmark is strongly influenced by the country's proximity to both the sea and the European Continent. This means that the weather changes according to the prevailing wind direction. The westerly wind from the sea typically brings relatively homogeneous weather both summer and winter: mild in winter, cool during summer, always accompanied by clouds, often with rain or showers. If the wind comes from the east or south, the weather in Denmark tends to resemble the weather currently prevailing on the Continent: hot and sunny during summer, cold during winter. Thus, the wind direction and the season are key factors in describing Danish weather.

The westerly wind

As the wind in Denmark is predominantly westerly, depressions, with their windy and rainy weather, generally move along different tracks from the west in a direction north of Denmark. Summer and winter, such weather brings the depressions and their associated frontal systems close by Denmark - one after the other. This brings about the passage of fronts with continued rain, followed by areas with showers in the cold air behind the front. During winter, precipitation from the fronts will often commence as snow if the previous weather was cold with frost. As the depressions often succeed each other like pearls on a string or in 'clusters', the weather in these situations will often repeat itself at intervals of one or two days, and the weather type itself may last from a few days up to several weeks.

The passage of extratropical cyclones is accompanied by a wind - often a strong wind - on the south side of the low. This is normally strongest after the front passes, when the cold air has arrived. Most gales occur in autumn and early winter when the temperature difference between the still warm Southern Europe and rapidly cooling Scandinavia is greatest.

During summer, a change in the weather to a westerly wind will usually mean a drop in temperature during passage of the cold front, often followed by quite humid weather with rain or showers.

During winter, a change to a westerly wind will often be preceded by cold weather, perhaps, frost.

When the cold front passes, air from the ocean will, in fact, be warmer (being heated by the ocean) than the air over land. The temperature thus rises, even though a cold front is passing! Only if the air behind the front is really cold, such as when it comes from the north or north east, will the passage of a cold front during winter mean colder weather.

The calm anticyclones (highs)

If the extratropical cyclones from the west steer well clear of Denmark, periods of relatively settled anticyclone weather will ensue. During summer this means the ground will continue to be heated, resulting in increasingly hot temperatures. But with just a light breeze from the sea, a cover of very thin cloud - called stratocumulus - often forms at low altitude, blocking the sun and perhaps ruining an otherwise perfect day for the beach. For Denmark to experience hot and dry summer weather, the



air must preferably come from the continent, where it is usually hot and dry during the summer.

Highs during winter normally mean cold, clear and calm weather. However, because of the substantial radiation, especially at night, fog may easily form which is not readily dispersed during the day. Being very low during winter, the sun fails to heat the ground sufficiently during the short day to make the temperature rise. In fact, in clear weather during the months of December and January there will be a radiative deficit day and night, also at midday. This means that the temperature in clear weather will continually drop, in extreme situations falling to below -25°C inland away from coastal areas. This is rather unusual though and also requires that the air is deprived of any kind of heat from elsewhere. The presence of snow cover is of great importance in this connection, as this increases the albedo while also acting as insulation. Without snow cover the temperature will only rarely fall below -10°C , because of the heat supplied from the earth's surface. Finally, the weather must be totally calm to reach extremely low temperatures, as even a light breeze will bring in milder, more humid air from the sea surrounding Denmark. Should any clouds move in over land, they will act as a blanket, thus ending the cold spell/weather.

The easterly wind

In Denmark, the easterly wind is not as frequent as the westerly, as it is a sign of the inverse of the normal distribution of lows and highs, namely lows to the south and highs to the north. In this situation, the weather is subject to considerable continental influence, since the air originates from the great continental land mass to the east. This means cold weather during winter and warm weather during summer. The easterly wind is especially common during late winter or spring, at which time the cold continental winter-high over Europe has often been dissolved while the similar high over Scandinavia or Russia remains intact. This weather situation is quite stable and may produce cold and windy weather for days or weeks, thus prolonging the cold of winter far into the spring. Especially in early winter, however, the relatively warm waters of Baltic partly heat the cold easterly wind which may intensify precipitation and cause snow showers in the Baltic Sea, particularly on Bornholm and Lolland/Falster.

The southerly wind

As with air arriving from the east, air reaching Denmark from the south is of continental origin. This causes cold during winter and heat during summer. But air coming from the south will often be moist and accompanied by haze or fog. During summer, the moisture input may cause heavy showers, possibly with thunder. However, this is fairly rare, as thunder will most frequently be associated with fronts - especially cold ones. Moist air from the south preceding the passage of a cold front makes good conditions for thunderstorms. A prolonged heat wave is often terminated by just such a thunder cold front and followed by a change to cooler weather.

The northerly wind

North is the least frequent wind direction in Denmark. While air from the polar regions is generally cold and dry, it makes a great difference whether the air comes from the north west or from the north east. Since the north-westerly wind comes from the sea, it may be regarded as a colder and drier version of the westerly wind. The north-westerly wind will often only give rise to a few showers and little precipitation, and because of the effect of the Norwegian Mountains it brings dry and sunny weather, particularly to northern Jutland, although this effect may extend as far as Copenhagen. In these situations there will often be showers in south and west Jutland.

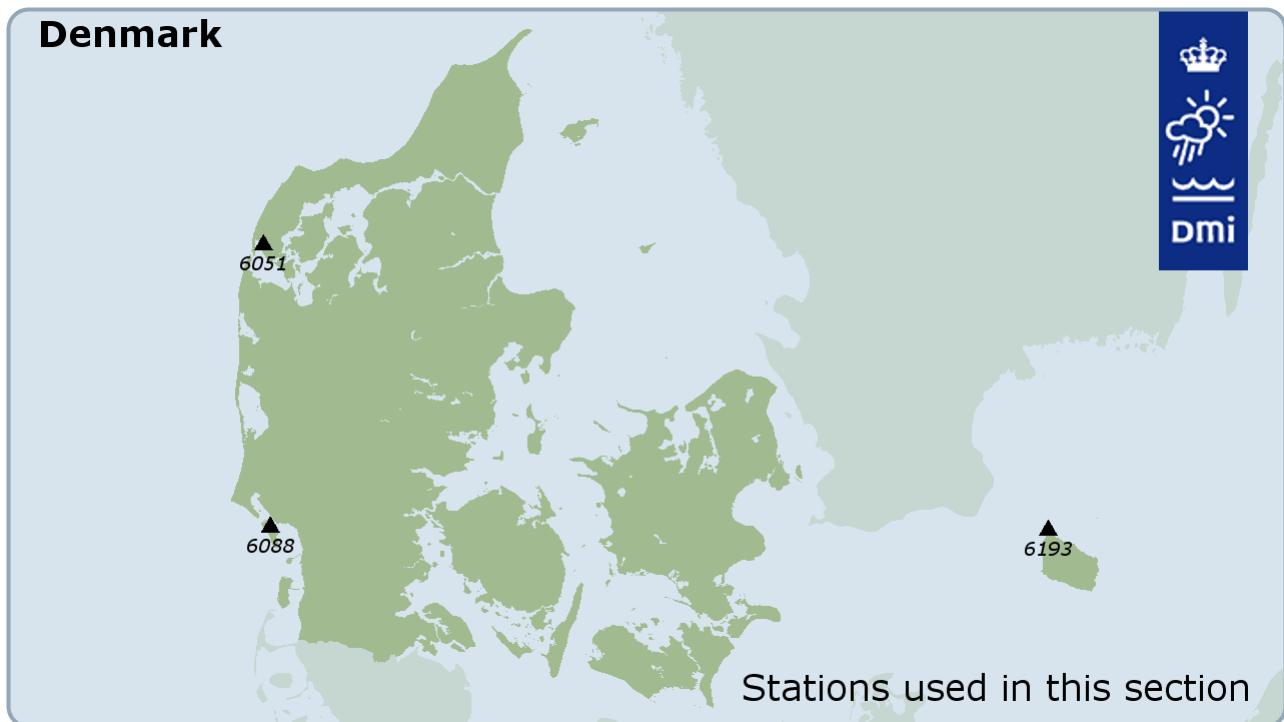
By comparison, air from the north and north east more closely resembles a cold and dry version of the typical easterly wind. North-easterly is thus the coldest wind direction in Denmark, and if very cold air from Sweden moves out over, say, the Kattegat, exceptionally heavy showers may form which can lead to prolonged local snowfall. These showers - often called "Kattegat showers" - become heavier the further the air moves over the comparatively warm water.

4. Observational Section: Historical DMI Data Collection

Type	Data Collections	Section, Page, Appendix
Observation	<ul style="list-style-type: none"> Atmospheric pressure (msl) 3 data sets: 6051 Vestervig (1874-2014) 6088 Nordby (1874-2014) 6193 Hammer Odde Fyr (1874-2014)	Sec 4.2.1., p 18, App 2



Type	Datasamlinger	Sektion, Sidetal, Appendiks
Observation	<ul style="list-style-type: none"> Atmosfærisk lufttryk (msl) 3 datasæt: 6051 Vestervig (1874-2014) 6088 Nordby (1874-2014) 6193 Hammer Odde Fyr (1874-2014)	Sektion 4.2.1., s 18, App 2



Data sets referred to in the observational section. Only the latest positions are marked. The official WMO station identifiers for Denmark consist of 5 digits "06xxx". However, in this report the in front "0" is omitted, giving 4 digits i.e. "6051" for Vestervig, which is also used on the map. The Danish national station identifiers describing climate stations in Denmark consist of 5 digits. In the old format the station number started with 20-32 dependent on the region i.e. "21100" for the old Vestervig station (see more details in Appendix 1.2 and 2.2).

Latest earlier report:

[21] Cappelen, J. (ed), 2014: Denmark -DMI Historical Climate Data Collection 1873-2013 - with Danish Abstracts. DMI Technical Report No. 14-02.

4.1. Introduction

The purpose of this chapter is to publish three Danish mean sea level atmospheric pressure data sets; Vestervig, Nordby and Hammer Odde Fyr (*observations*) covering the period 1874-2014.

According to the intentions to update regularly, preferably every year, this particular report contains an update (2014 data) of the Danish mean sea level atmospheric pressure series originally published in DMI Technical Report 97-3: North Atlantic-European pressure observations 1868-1995 - WASA dataset version 1.0 [43].

As part of a former project called WASA, selected DMI series of atmospheric pressure observations from Denmark, Greenland and the Faroes 1874-1970 on paper were digitised. The pressure observations were digitised from the meteorological yearbooks, which means that the observations were station level data corrected for index error, temperature and, since 1893, gravity. From 1971 the pressure data were taken from the DMI Climate Database. The WASA project was originally titled: “The impact of storms on waves and surges: Changing climate in the past 100 years and perspectives for the future” [44].

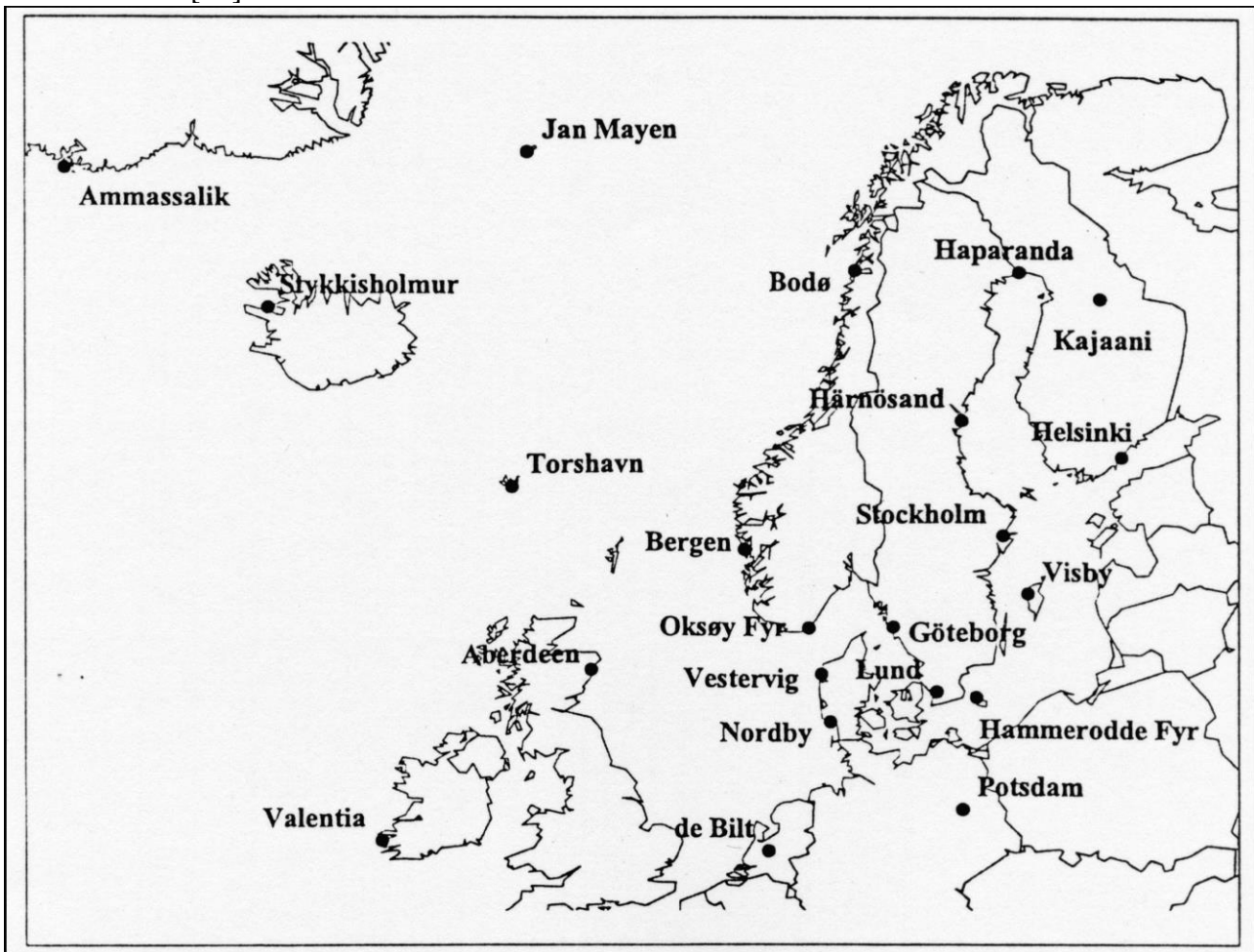


Figure 4.1.1. Location of the stations that originally provided atmospheric pressure observations to the WASA pressure data set [43]. In this report three updated Danish series Hammer Odde Fyr, Nordby and Vestervig are presented. The stations representing these sites are listed in the table 4.2.1. For station co-ordinates confer with the station position file in the data files included in this report (see Appendix 1). Pressure data sets from Tasiilaq/Ammassalik, Greenland and Tórshavn, The Faroe Islands are presented in the representative historical Climate Data Collection; DMI Technical Report 15-04 [23] and DMI Technical Report 15-05 [24].



Climate change studies and the related analysis of observed climatic data call for long time series of climate data on all scales, but please note that the digitisation of the observations of atmospheric pressure only can be considered as the first step towards sensible utilisation of the observations for climate change studies. Next follows testing for homogeneity of the series, ensuring that any discovered trend are natural.

During the WASA project the data have been homogenised. The updated series presented in this report have been tested and corrected carefully, mainly based on visual tests. Thus it must be stressed that the updated atmospheric pressure data after the WASA project consist of the values *as observed*, and that no final testing for homogeneity has been performed on these observations for the whole period up to now. They are therefore not necessarily homogenized as such and this should be considered before applying the data series for climate research purposes.

For the benefit of scientists that may wish to conduct such testing various results and remarks concerning observational atmospheric pressure data have been included in the report. For supplementary metadata, see also [43].

The mean sea level atmospheric pressure data sets can be downloaded from the publication part of DMI web pages. Details about the data sets and file formats can be seen in Appendix 2.



Formålet med denne sektion er at publicere tilgængelige dataserier af observationer af lufttryk fra Vestervig, Nordby og Hammer Odde Fyr 1874-2014. I afsnit 4.2 kan ses hvilke stationer, det drejer sig om. Stationshistorien kan ses i Appendix 1.2. Dataseriernes detaljer kan ses i Appendix 2.2 og filformat af de medfølgende filer kan ses i Appendix 2.1.

4.2. Data sets, station series and parameters

4.2.1. Atmospheric pressure

The Danish atmospheric pressure measurements started 1874 at national climate stations. Measurements of atmospheric pressure were stopped at this manually operated climate stations in 1987. Therefore the atmospheric pressure datasets in table 4.2.1 had to be continued from nearby synoptic stations measuring atmospheric pressure. In the WASA project the data were merged into long homogeneous series seen in table 4.2.1. Appendix 2.2 indicates how the stations were merged and how many observations the series contains in the different parts.

Important note: Please be aware that the daily series of atmospheric pressure presented in section 5.2.6 are constructed using the digitised material mentioned above only applying the formulas that can be seen in Appendix 3.3. Other adjustments (Appendix 3.4) have not been applied to the daily value dataset. This is the explanation for small differences between the daily series of atmospheric pressure presented in section 5.3.6 and the daily series that can be calculated using the homogenized atmospheric pressure observations presented here in this section. It is advised for the reader to take this probable need of adjustment into account when using the daily value data set.

Table 4.2.1. The three Danish datasets of atmospheric pressure observations (at MSL, mean sea level). See more details in Appendix 2.

Dataset*	Station series	Dataset id	Period	Parameter
Vestervig	Vestervig	6051	1874-1987	Atmospheric pressure (MSL)
	Thyborøn		1987-2014	Atmospheric pressure (MSL)
Nordby	Nordby	6088	1874-1987	Atmospheric pressure (MSL)
	Esbjerg Airport		1987-2014	Atmospheric pressure (MSL)
Hammer Odde Fyr	Sandvig or Hammer Odde Fyr	6193	1874-1987	Atmospheric pressure (MSL)
	Hammer Odde Fyr		1987-2014	Atmospheric pressure (MSL)

*Blended data sets, see details in Appendix 2.2.

Important note: During the WASA project the atmospheric pressure datasets 1874-1995 have been homogenised. Since then the updated series presented in this report have been tested and corrected carefully, mainly based on visual tests.

4.2.2. Data Dictionary

Table 4.2.2. Parameter used in the observational section. 'Method' specifies that the parameter is an observation. The units of the observation values in the data files are specified in 'Unit'.

Abbr.	Element	Method	Unit
pppp	Atmospheric pressure (MSL)	obs	0,1 hPa

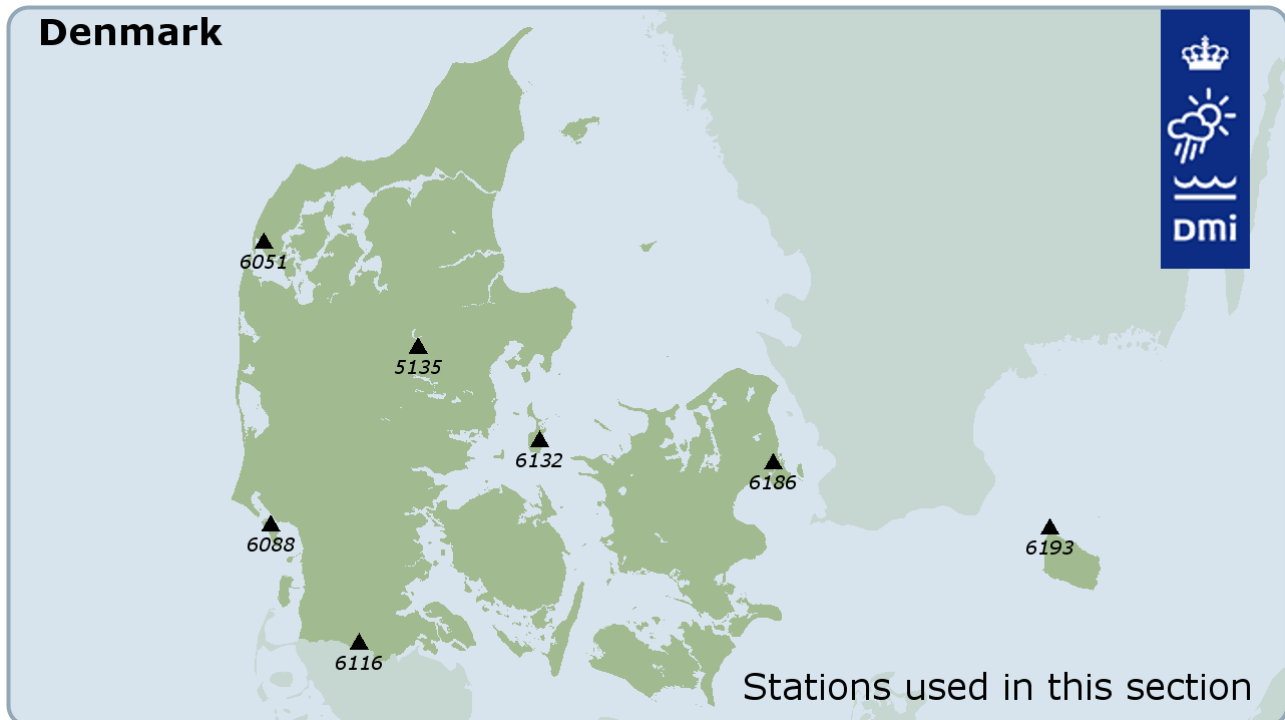


5. Daily Section: Historical DMI Data Collection

Type	Data Collections	Section, Page, Appendix
Daily	<ul style="list-style-type: none"> • Accumulated precipitation 15 data sets: 6051 Vestervig (1874-2014) 5135 Grønbæk (1874-2014) 6088 Nordby/Fanø (1874-2014) 26410 Broderup (1920-1993) 26409 Tinglev (1995-2006) 6116/26400 Store Jyndevad (1987-2014) 27080 Tranebjerg (1872-2001) 6132/27082 Tranebjerg Øst (2001-2014) 30380 Landbohøjskolen (1874-1996) 30210 Meteorologisk Institut (1875-1922) 30210 Meteorologisk Institut (1961-1984) 5735/30370 Botanisk Have (1961-2014) 32030 Sandvig (1874-1970) 32020 Hammer Odde Fyr (1961-1987) 6193 Hammer Odde (1984-2014) 	Sec 5.2.1, p 23, App 3
	<ul style="list-style-type: none"> • Highest temperature • Lowest temperature 11 data sets: 21100 Vestervig (1874-2003) 6051 Vestervig (2003-2014) 25140 Nordby/Fanø (1874-2003) 6088 Nordby/Fanø (2003-2014) 27080 Tranebjerg (1872-2003) 6132 Tranebjerg (2003-2014) 30380 Landbohøjskolen (1874-1997) 6186 København (1995-2014) 32030 Sandvig (1874-1970) 32020 Hammer Odde Fyr (1971-1987) 6193 Hammer Odde (1984-2014) 	Sec 5.2.2–5.2.3, p 23-24, App 3
	<ul style="list-style-type: none"> • Air temperature 14 UTC 1 data set: 6132 Tranebjerg (1872-2014) 	Sec 5.2.4, p 24, App 3
	<ul style="list-style-type: none"> • Cloud Cover 8, 14 and 21 UTC 1 dataset: 6132 Tranebjerg (1872-2000) 	Sec 5.2.5, p 25, App 3
	<ul style="list-style-type: none"> • Mean atmospheric pressure 5 data sets: 21100 Vestervig (1874-1987) 6052 Thyborøn (1961-2014) 25140 Nordby/Fanø (1874-1987) 6080 Esbjerg Airport (1959-2014) 6193 Hammer Odde Fyr (1874-2014) 	Sec 5.2.6, p 25, App 3



Type	Datasamlinger	Sektion, Sidetal, Appendiks
Døgn	<ul style="list-style-type: none"> • Nedbørsum 15 datasæt: 6051 Vestervig (1874-2014) 5135 Grønbæk (1874-2014) 6088 Nordby/Fanø (1874-2014) 26410 Broderup (1920-1993) 26409 Tinglev (1995-2006) 6116/26400 Store Jyndevad (1987-2014) 27080 Tranebjerg (1872-2001) 6132/27082 Tranebjerg Øst (2001-2014) 30380 Landbohøjskolen (1874-1996) 30210 Meteorologisk Institut (1875-1922) 30210 Meteorologisk Institut (1961-1984) 5735/30370 Botanisk Have (1961-2014) 32030 Sandvig (1874-1970) 32020 Hammer Odde Fyr (1961-1987) 6193 Hammer Odde (1984-2014) • Højeste lufttemperatur • Laveste lufttemperatur 11 datasæt: 21100 Vestervig (1874-2003) 6051 Vestervig (2003-2014) 25140 Nordby/Fanø (1874-2003) 6088 Nordby/Fanø (2003-2014) 27080 Tranebjerg (1872-2003) 6132 Tranebjerg (2003-2014) 30380 Landbohøjskolen (1874-1997) 6186 København (1995-2014) 32030 Sandvig (1874-1970) 32020 Hammer Odde Fyr (1971-1987) 6193 Hammer Odde (1984-2014) • Lufttemperatur 14 UTC 1 datasæt: 6132 Tranebjerg (1872-2014) • Skydække 8,14 og 21 UTC 1 datasæt: 6132 Tranebjerg (1872-2014) • Middellufttryk 5 datasæt: 21100 Vestervig (1874-1987) 6052 Thyborøn (1961-2014) 25140 Nordby/Fanø (1874-1987) 6080 Esbjerg Lufthavn (1959-2014) 6193 Hammer Odde Fyr (1874-2014) 	<p><i>Sektion 5.2.1, s 23, App 3</i></p> <p><i>Sektion 5.2.2-5.2.3, s 23-24, App 3</i></p> <p><i>Sektion 5.2.4, s 24, App 3</i></p> <p><i>Sektion 5.2.5, s 25, App 3</i></p> <p><i>Sektion 5.2.6, s 25, App 3</i></p>



Station based data sets referred to in the report. Only the latest positions are marked. The official WMO station identifiers for Denmark consist of 5 digits "06xxx". However, in this report the in front "0" is omitted, giving 4 digits i.e. "6132" for Tranebjerg, which is also used on the map. The Danish national station identifiers describing climate/precipitation stations in Denmark consist of 5 digits, either the new format "05XXX" (the in front "0" is omitted, giving 4 digits i.e. "5135" for Grønbæk or a the old format, where the station number started with 20-32 dependent on the region i.e. "27080" for the old Tranebjerg station (see more details in Appendix 1.2 and 3.2).

Latest earlier report:

[21] Cappelen, J. (ed), 2014: Denmark -DMI Historical Climate Data Collection 1873-2013- with Danish Abstracts. DMI Technical Report No. 14-02.



5.1. Introduction

The purpose of this chapter is to publish available long *daily* DMI data series 1873-2014 for Denmark. The data parameters include minimum and maximum temperature, mean sea level atmospheric pressure, accumulated precipitation and cloud cover.

According to the intentions to update regularly, preferably every year, this particular report contains an update (2014 data) of the “DMI Daily Climate Data Collection” for the first time published in that form in DMI Technical Report 04-03 [37]. A similar collection of long DMI *monthly* and *annual* Danish climate data series can be found in chapter 6 and 7 in this report.

The digitisation of a great part of the data presented in this chapter and also much of the station history presented are results of various projects. The WASA project¹, ACCORD² project, NACD³ project and the Danish CD-ROM “Vejr&Vind”⁴ have all contributed regarding the data from Denmark together with a digitisation during spring 1999 funded by the Danish Climate Centre⁵.

Climate change studies and the related analysis of observed climatic data call for long time series of daily climate data. In this context the report also serves as the DMI contribution of daily values to the European Climate Assessment & Dataset (ECA&D)⁶. ECA&D was initiated by the European Climate Support Network (ECSN⁷) which is a project within the Network of European Meteorological Services (EUMETNET⁸).

Please note that the digitisation of the observations only can be considered as the first step towards sensible utilisation of the observations for climate change studies. Next follows testing for homogeneity of the series, ensuring that any discovered trend are natural. Thus it must be stressed that the series presented here mostly consist of the values *as observed*, and that no testing for homogeneity has been performed on these daily observations. They are therefore not necessarily homogenized as such, and the report description of each series should therefore be read carefully before applying the data series for climate research purposes.

For the benefit of scientists that may wish to conduct such testing various metadata together with homogeneity test results on relevant series of *monthly* data have been included in the report (see Appendix 3.6). For supplementary metadata see also DMI Technical Report 03-24 [35].

The daily station data series can be downloaded from the publication part of DMI web pages. Details about the data sets and file formats can be seen in Appendix 3.



Formålet med denne sektion er at publicere tilgængelige lange daglige dataserier 1874-2014 fra Danmark. Det omfatter højeste og laveste temperaturer, atmosfærisk lufttryk, nedbørsum og skydække. I afsnit 5.2 kan ses hvilke stationer og parametre, det drejer sig om. Stationshistorien kan ses i Appendix 1.2. Dataseriernes detaljer kan ses i Appendix 3.2 og filformat af den medfølgende fil kan ses i Appendix 3.1. Appendix 3.3 – 3.6 omhandler flere metadata.

¹ WASA: 'The impact of storms on waves and surges: Changing climate in the past 100 years and perspectives for the future'. See [43,44].

² EU project number ENV-4-CT97-0530: Atmospheric Circulation Classification and Regional Downscaling. [1]

³ EU project number EV5V CT93-0277: North Atlantic Climatological Dataset. See [27].

⁴ Vejr & Vind. CD-ROM. Munksgaard Multimedia, Copenhagen 1997 [39].

⁵ The Danish Climate Centre (DKC) was established 1998 at DMI. DKC was closed 2014 in a reorganisation of DMI.

⁶ Project homepage: <http://www.ecad.eu/>

⁷ <http://www.eumetnet.eu/ecsn>

⁸ <http://www.eumetnet.eu/>

5.2. Data sets, station series and parameters

5.2.1. Accumulated precipitation

Fifteen Danish station series with a record of daily accumulated precipitation can be blended into seven long datasets. Table 5.2.1 presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Table 5.2.1. The Danish station series of daily accumulated precipitation. See more details in Appendix 3.

Dataset*	Station series	Dataset id	Period	Parameter
Vestervig 1874-2014	Vestervig	6051 (21100)	1874-2014	Accumulated precipitation
Grønbæk 1874-2014	Grønbæk	5135 (21430)	1874-2014	Accumulated precipitation
Nordby 1874-2014	Nordby/Fanø	6088 (25140)	1874-2014	Accumulated precipitation
Store Jynde vad 1920-2014	Broderup	26410	1920-1993	Accumulated precipitation
	Tinglev	26409	1995-2006	Accumulated precipitation
	Store Jynde vad	6116 (26400)	1987-2014	Accumulated precipitation
Tranebjerg 1872-2014	Tranebjerg	27080	1872-2001	Accumulated precipitation
	Tranebjerg Øst	5165 (27082)	2001-2014	Accumulated precipitation
København 1874-2014	Landbohøjskolen	30380	1874-1996	Accumulated precipitation
	Meteorologisk Institut	30210	1875-1922	Accumulated precipitation
	Meteorologisk Institut	30210	1961-1984	Accumulated precipitation
	Botanisk Have	5735 (30370)	1961-2014	Accumulated precipitation
Hammer Odde Fyr 1874-2014	Sandvig	32030	1874-1970	Accumulated precipitation
	Hammer Odde Fyr	32020	1961-1987	Accumulated precipitation
	Hammer Odde Fyr	6193	1984-2014	Accumulated precipitation

*Blended daily datasets using the daily station series are not a part of this report. See the European Climate Assessment & Dataset (ECA&D) project homepage: <http://www.ecad.eu/> for a possible blend and a homogeneity test. This site also contains the unblended Danish station series.

Important note: The daily station series mostly consist of the values as observed. No DMI testing for homogeneity has been performed on these daily observations. They have however been tested and corrected carefully, mainly based on visual tests.

5.2.2. Lowest temperature

Eleven Danish station series with a record of daily lowest temperatures can be blended into five long datasets. Table 5.2.2 presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Table 5.2.2. The Danish station series of daily lowest temperature. See more details in Appendix 3.

Dataset*	Station series	Dataset id	Period	Parameter
Vestervig	Vestervig	21100	1874-2003	Lowest temperature
	Vestervig	6051	2003-2014	Lowest temperature
Nordby/Fanø	Nordby	25140	1874-2003	Lowest temperature
	Nordby	6088	2003-2014	Lowest temperature
Tranebjerg	Tranebjerg	27080	1872-2003	Lowest temperature

	Tranebjerg Øst	6132	2003-2014	Lowest temperature
København	Landbohøjskolen	30380	1874-1997	Lowest temperature
	Landbohøjskolen	6186	1995-2014	Lowest temperature
Hammer Odde Fyr	Sandvig	32030	1874-1970	Lowest temperature
	Hammer Odde Fyr	32020	1971-1987	Lowest temperature
	Hammer Odde Fyr	6193	1984-2014	Lowest temperature

**Blended datasets using the station series are not a part of this report. See the European Climate Assessment & Dataset (ECA&D) project homepage: <http://www.ecad.eu/> for a possible blend and a homogeneity test. This site also contains the unblended Danish station series.*

Important note: The daily station series mostly consist of the values as observed. No DMI testing for homogeneity has been performed on these daily observations. They have however been tested and corrected carefully, mainly based on visual tests.

5.2.3. Highest temperature

Eleven Danish station series with a record of daily highest temperatures can be blended into five long datasets. Table 5.2.3 presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Table 5.2.3. The Danish station series of daily highest temperature. See more details in Appendix 3.

Dataset*	Station series	Dataset id	Period	Parameter
Vestervig	Vestervig	21100	1874-2003	Highest temperature
	Vestervig	6051	2003-2014	Highest temperature
Nordby/Fanø	Nordby	25140	1874-2003	Highest temperature
	Nordby	6088	2003-2014	Highest temperature
Tranebjerg	Tranebjerg	27080	1873-2003	Highest temperature
	Tranebjerg Øst	6132	2003-2014	Highest temperature
København	Landbohøjskolen	30380	1874-1997	Highest temperature
	Landbohøjskolen	6186	1995-2014	Highest temperature
Hammer Odde Fyr	Sandvig	32030	1874-1970	Highest temperature
	Hammer Odde Fyr	32020	1971-1987	Highest temperature
	Hammer Odde Fyr	6193	1984-2014	Highest temperature

**Blended datasets using the station series are not a part of this report. See the European Climate Assessment & Dataset (ECA&D) project homepage: <http://www.ecad.eu/> for a possible blend and a homogeneity test. This site also contains the unblended Danish station series.*

Important note: The daily station series mostly consist of the values as observed. No DMI testing for homogeneity has been performed on these daily observations. They have however been tested and corrected carefully, mainly based on visual tests.

5.2.4. Air temperature at 14 hours DNT or 12 UTC

Two Danish station series with a record of air temperatures measured at 14 hours DNT (old part of the series) or 12 UTC (= 13 hours DNT, newer part of the series) can be blended into one long dataset. Table 5.2.4 presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Table 5.2.4. The Danish station series of air temperature at 14 hours DNT/12 UTC. DNT refers to Danish normal time, which is the time in a given time zone in contrast to summer time, where 1 hour is added. In Denmark the normal time is UTC+1. UTC is "Universal Time Coordinated" - a global indication of time, which refers to the mean solar time on the meridian of Greenwich, England, which is the conventional 0-meridian for geographic longitude. See more details in Appendix 3.

Dataset*	Station series	Dataset id	Period	Parameter
Tranebjerg	Tranebjerg	27080	1872-2003	Air temperature 14DNT/12UTC
	Tranebjerg Øst	6132	2003-2014	Air temperature 14DNT/12UTC

*Blended datasets using the station series are not a part of this report. See the European Climate Assessment & Dataset (ECA&D) project homepage: <http://www.ecad.eu/> for a possible blend and a homogeneity test. This site also contains the unblended Danish station series.

Important note: The daily station series mostly consist of the values as observed. No DMI testing for homogeneity has been performed on these daily observations. They have however been tested and corrected carefully, mainly based on visual tests.

5.2.5. Cloud cover at 8, 14 and 21 hours DNT

One Danish station series with a long record of cloud cover at 8, 14 and 21 hours DNT exists. Table 5.3.5 presents an overview of this station data series (identified by the station name and number).

Table 5.2.4. The Danish station series of cloud cover at 8, 14 and 21 hours DNT. DNT refers to Danish normal time, which is the time in a given time zone in contrast to summer time, where 1 hour is added. In Denmark the normal time is UTC+1. See more details in Appendix 3.

Dataset	Station series	Dataset id	Period	Parameter
Tranebjerg	Tranebjerg	27080	1872-2000	Cloud cover 8,14,21DNT

* See the European Climate Assessment & Dataset (ECA&D) project homepage: <http://www.ecad.eu/> for the station series and a homogeneity test.

Important note: The daily station series mostly consist of the values as observed. No DMI testing for homogeneity has been performed on these daily observations. They have however been tested and corrected carefully, mainly based on visual tests.

5.2.6. Atmospheric pressure

Five Danish station series with a record of mean daily atmospheric pressure data can be blended into three long datasets. Table 5.2.6 presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report except the Hammer Odde series). Overlap periods have been included when available.

It is common for all three sites that the atmospheric pressure measurements started 1874 at national climate stations. In Denmark measurements of atmospheric pressure was stopped at these manually operated climate stations in 1987. Therefore the atmospheric pressure series had to be continued from nearby synoptic stations measuring atmospheric pressure. One of the series, that of '6193 Hammer Odde Lighthouse', consists of data from stations sufficiently close that it was straightforward to present the data in one series, 1874-2014.

For the other two sites, the synoptic stations are a little further apart from the old climate stations and therefore these two synoptic stations are presented as independent series. In both cases there should nonetheless be sufficient overlap for it to be fairly straightforward for the reader to merge

the data into long series for the old Vestervig and Nordby sites also, just as it was done for the pressure observations of the WASA project [43], see also chapter 4.

Table 5.2.6. The Danish station series of daily atmospheric pressure (at MSL, mean sea level). In the data files the Hammer Odde series is presented with the station number 6193, 1874-2014. See more details in Appendix 3.

Dataset*	Station series	Dataset id	Period	Parameter
Vestervig	Vestervig	21100	1874-1987	Mean atm. pressure (MSL)
	Thyborøn	6052	1962-2014	Mean atm. pressure (MSL)
Nordby/Fanø	Nordby	25140	1874-1987	Mean atm. pressure (MSL)
	Esbjerg Airport	6088	1959-2014	Mean atm. pressure (MSL)
Hammer Odde Fyr	Sandvig or	32030	1874-1987	Mean atm. pressure (MSL)
	Hammer Odde Fyr	32020		Mean atm. pressure (MSL)
	Hammer Odde Fyr	6193	1987-2014	Mean atm. pressure (MSL)

*Blended datasets using the station series are not a part of this report except the Hammer Odde series. See the European Climate Assessment & Dataset (ECA&D) project homepage: <http://www.ecad.eu/> for a possible blend and a homogeneity test. This site also contains the unblended Danish station series.

Important note: The daily station series mostly consist of the values as observed. No DMI testing for homogeneity has been performed on these daily observations. They have however been tested and corrected carefully, mainly based on visual tests.

5.2.7. Data Dictionary

Table 5.2.7. Parameters used in the daily section. 'Method' specifies whether the parameter is an observation, sum, mean or an extreme. The units of the daily values in the data files are specified in 'Unit'.

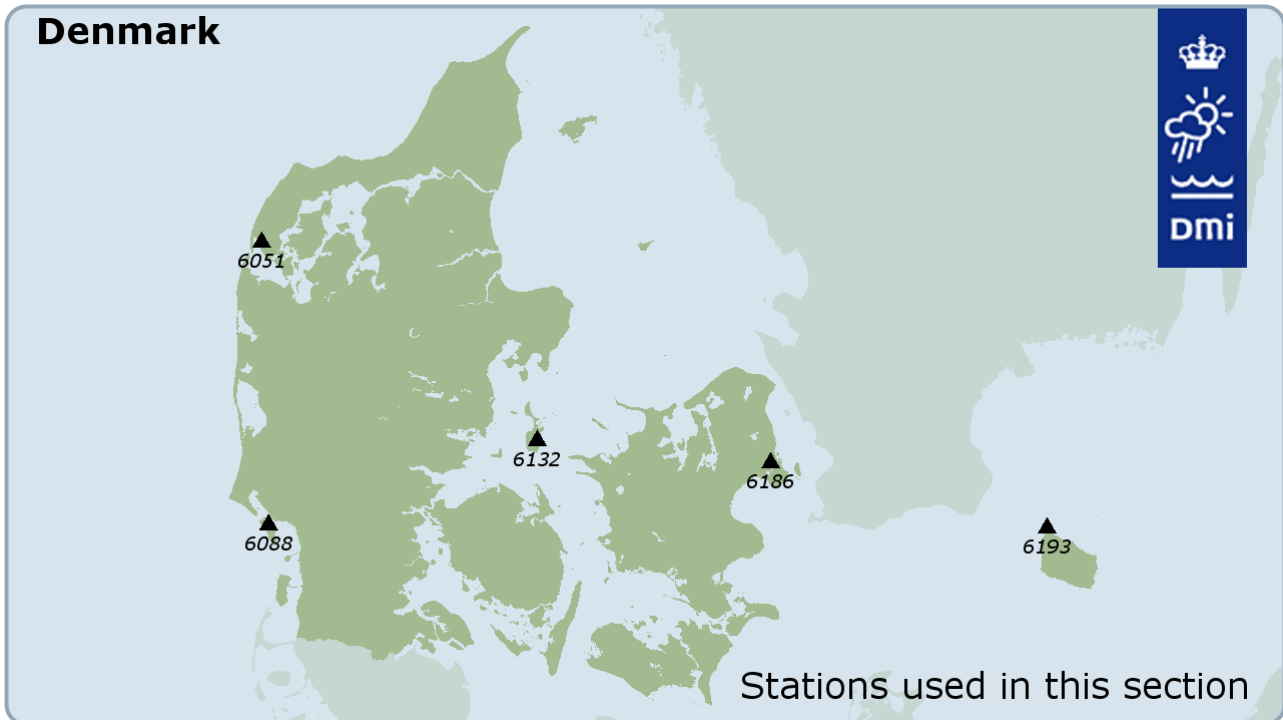
Abbr.	Parameter	Method	Unit
t	Temperature measured at a certain time	obs	0,1°C
tx	Highest temperature	max	0,1°C
tn	Lowest temperature	min	0,1°C
pppp	Mean atmospheric pressure (MSL)	mean	0,1 hPa
p	Accumulated precipitation	sum	0,1 mm
n	Cloud cover measured at a certain time	obs	various

6. Monthly Section: Historical DMI Data Collection

Type	Data Collections	Section, Page, Appendix
Monthly	<ul style="list-style-type: none"> • Mean air temperature • Mean daily minimum temperature • Mean daily maximum temperature • Highest temperature • Lowest temperature • Mean atmospheric pressure (msl) • Hours of bright sunshine • Accumulated precipitation • Highest 24-hour precipitation • No. of days with snow cover • Mean cloud cover <p>5 data sets: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranebjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p>	Sec 6.2.1-6.2.11, p 31-34, App 4



Type	Datasamlinger	Sektion, Sidetal, Appendiks
Måned	<ul style="list-style-type: none"> • <i>Middel lufttemperatur</i> • <i>Middel maksimumtemperatur</i> • <i>Middel minimumtemperatur</i> • <i>Højeste temperatur</i> • <i>Laveste temperatur</i> • <i>Middellufttryk (msl)</i> • <i>Solskinstimer</i> • <i>Nedbørsum</i> • <i>Højeste 24 t nedbørsum</i> • <i>Antal snedækkedage</i> • <i>Middelskydække</i> <p>5 datasæt: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranebjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p>	<i>Sektion 6.2.1-6.2.11, s 31-34, App 4</i>



Station based data sets referred to in the report. Only the latest positions are marked. The official WMO station identifiers for Denmark consist of 5 digits "06xxx". However, in this report the in front "0" is omitted, giving 4 digits i.e. "6132" for Tranebjerg, which is also used on the map. The Danish national station identifiers describing climate/precipitation stations in Denmark consist of 5 digits, either the new format "05XXX" (the in front "0" is omitted, giving 4 digits i.e. "5165" for Tranebjerg or a the old format, where the station number started with 20-32 dependent on the region i.e. "27080" for the old Tranebjerg station (see more in Appendix 1.2 and 4.2).

Latest earlier report:

[21] Cappelen, J. (ed), 2014: Denmark -DMI Historical Climate Data Collection 1873-2013- with Danish Abstracts. DMI Technical Report No. 14-02.



6.1. Introduction

The purpose of this chapter is to publish available long *monthly* DMI data series 1768-2014 for Denmark. The data parameters include mean temperature, minimum temperature, maximum temperature, atmospheric pressure, accumulated precipitation, highest 24-hour precipitation, hours of bright sunshine, number of days with snow and cloud cover. Only one data set has data before the 1870s – Copenhagen.

According to the intentions to update regularly, preferably every year, this particular report contains an update (2014 data) of the “DMI Monthly Climate Data Collection” published for the first time in that form in DMI Technical Report 03-26: DMI Monthly Climate Data Collection 1860-2002, Denmark, The Faroe Island and Greenland. An update of: NACD, REWARD, NORDKLIM and NARP datasets, Version 1, Copenhagen 2003 [29]. A similar collection of long DMI *daily* and *annual* Danish climate data series can be found in chapter 5 and 7 in this report.

Some of the monthly data have over the years been published in connection with different Nordic climate projects like NACD (North Atlantic Climatological Dataset [27]), REWARD (Relating Extreme Weather to Atmospheric circulation using a Regionalised Dataset [26]), NORDKLIM (Nordic Co-operation within Climate activities, see NORDKLIM project homepage: http://www.smhi.se/hfa_coord/nordklim/) and NARP (Nordic Arctic Research Programme).

The original DMI Monthly Climate Data Collection published in DMI Technical Report 03-26 [29] was for that reason, besides a publication of a collection of recommended DMI long monthly data series 1860-2002, also an revision/update of the NACD, REWARD, NORDKLIM and NARP datasets with a clarification on what has been done with the data previously. The method used in this clarification was based on 3 different datasets:

- 1) **Recommended** - a collection of DMI recommended well-documented data series.
- 2) **Observed** - based strictly on raw observations, which have to fulfil certain criteria in terms of frequency etc., in order for arithmetic means, maximums, minimums etc. to be calculated depending on the parameter. These dataset acts as a baseline, since many of the time-series previously published represent adjusted data, which are not very well documented.
- 3) **Previous** - represents the time-series generated earlier primarily in connection with NACD and REWARD. These time-series are quite complete for the period 1890 – 1995 and many holes have been filled compared to the observed dataset.

The revision/update of those datasets is considered done with the DMI Technical Report 03-26 [29].

Therefore only already published recommended DMI monthly data series with relevant updates/corrections have been included since and will be included in this and the coming reports comprising DMI Monthly Data Collections.

During some of the former data projects (i.e. NACD) the data have been homogenised based on tests against neighbouring stations.

The updated series presented in this report have been tested and corrected carefully, mainly based on visual tests. Otherwise it is clearly indicated in Appendix 4.2, if care should be taken when using the series.



Special care should be taken concerning the series with mean cloud cover. There are still problems to be solved in the data sets mainly due to the difficult character of the observation – visual back in time and the shift to automatic detection with a ceilometer starting approximately in the beginning of the new millennium. Another visual parameter is observations of snow - the number of days with snow cover. It is however still observed manually in the same manner as all ways. Finally please notice that the recently introduction of automatic rain gauges can have caused small inhomogeneities, not to be discovered in the visual check.

The monthly data sets can be downloaded from the publication part of DMI web pages. Details about the data sets and file formats can be seen in Appendix 4.



Formålet med denne sektion er at publicere tilgængelige lange månedlige DMI dataserier 1768-2014 fra Danmark. Det omfatter middeltemperatur, minimumtemperatur, maksimumtemperatur, atmosfærisk tryk, solskinstimer, nedbørsum, maksimal daglig nedbør, antallet af dage med sne og skydække. I afsnit 6.2 kan ses hvilke stationer og parametre, det drejer sig. Stationshistorien kan ses i Appendix 1.2. I Appendix 4.1 er filformatet af de medfølgende filer beskrevet og de enkelte seriers sammensætning kan ses i Appendix 4.2.

6.2. Data sets, station series and parameters

6.2.1. Accumulated precipitation

Table 6.2.1. Data sets and station series; monthly accumulated precipitation. See details in Appendix 4. This counts for all the following tables.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1874-2014	Vestervig	vest_6051_601	1874-2014	Accumulated precipitation
Nordby/Fanø 1872-2014	Nordby/Fanø	nord_6088_601	1872-2014	Accumulated precipitation
Tranebjerg 1873-2014	Tranebjerg	tran_6132_601	1873-2001	Accumulated precipitation
	Tranebjerg Øst		2001-2014	
København 1821-2014	Gl. Botanisk Have	koeb_6186_601	1821-1859	Accumulated precipitation
	Landbohøjskolen		1860-1995	
	Botanisk Have		1996-2014	
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_601	1873-1971	Accumulated precipitation
	Hammer Odde Fyr		1971-2014	

*Blended monthly data sets part of the monthly section. Count also for the following tables.

**Not a part of the monthly section. Count also for the following tables.

6.2.2. Highest 24-hour precipitation

Table 6.2.2. Data sets and station series; highest monthly 24-hour precipitation.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1874-2014	Vestervig	vest_6051_602	1874-2014	Highest 24-hour precipitation
Nordby/Fanø 1872-2014	Nordby/Fanø	nord_6088_602	1872-2014	Highest 24-hour precipitation
Tranebjerg 1873-2014	Tranebjerg	tran_6132_602	1873-2001	Highest 24-hour precipitation
	Tranebjerg Øst		2001-2014	
København 1843-2014	Gl. Botanisk Have	koeb_6186_602	1843-1859	Highest 24-hour precipitation
	Landbohøjskolen		1860-1995	
	Botanisk Have		1996-2014	
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_602	1873-1971	Highest 24-hour precipitation
	Hammer Odde Fyr		1971-2014	

6.2.3. Mean temperature

Table 6.2.3. Data sets and station series; monthly mean temperature.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1874-2014	Vestervig	vest_6051_101	1874-2014	Mean temperature
Nordby/Fanø 1872-2014	Nordby/Fanø	nord_6088_101	1872-2014	Mean temperature
Tranebjerg 1873-2014	Tranebjerg	tran_6132_101	1873-2003	Mean temperature
	Tranebjerg Øst		2003-2014	
København 1768-2014	Rundetårn	koeb_6186_101	1768-1819	Mean temperature
	Gl. Botanisk Have		1820-1859	
	Landbohøjskolen		1860-2014	
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_101	1873-1953	Mean temperature
	Sandvig/Hammer Odde		1953-1960	
	Hammer Odde Fyr		1961-2014	

6.2.4. Mean daily maximum temperature

Table 6.2.4. Data sets and station series; monthly mean daily maximum temperature.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1875-2014	Vestervig	vest_6051_111	1875-2014	Mean daily max temperature
Nordby/Fanø 1875-2014	Nordby/Fanø	nord_6088_111	1875-2014	Mean daily max temperature
Tranebjerg 1873-2014	Tranebjerg	tran_6132_111	1873-2003	Mean daily max temperature
	Tranebjerg Øst		2003-2014	
København 1861-2014	Landbohøjskolen	Koeb_6186_111	1861-2014	Mean daily max temperature
Hammer Odde Fyr 1875-2014	Sandvig	hamm_6193_111	1875-1953	Mean daily max temperature
	Sandvig/Hammer Odde		1953-1960	
	Hammer Odde Fyr		1961-2014	

6.2.5. Highest temperature

Table 6.2.5. Data sets and station series; monthly highest temperature.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1875-2014	Vestervig	vest_6051_112	1875-2014	Highest temperature
Nordby/Fanø 1874-2014	Nordby/Fanø	nord_6088_112	1874-2014	Highest temperature
Tranebjerg 1874-2014	Tranebjerg	tran_6132_112	1874-2003	Highest temperature
	Tranebjerg Øst		2003-2014	
København 1861-2014	Landbohøjskolen	Koeb_6186_112	1861-2014	Highest temperature
Hammer Odde Fyr 1874-2014	Sandvig	hamm_6193_112	1874-1953	Highest temperature
	Sandvig/Hammer Odde		1953-1960	
	Hammer Odde Fyr		1961-2014	

6.2.6. Mean daily minimum temperature

Table 6.2.6. Data sets and station series; monthly mean daily minimum temperature.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1875-2014	Vestervig	vest_6051_112	1875-2014	Mean daily min temperature
Nordby/Fanø 1875-2014	Nordby/Fanø	nord_6088_112	1875-2014	Mean daily min temperature
Tranebjerg 1873-2014	Tranebjerg	tran_6132_112	1873-2003	Mean daily min temperature
	Tranebjerg Øst		2003-2014	
København 1861-2014	Landbohøjskolen	Koeb_6186_112	1861-2014	Mean daily min temperature
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_112	1873-1953	Mean daily min temperature
	Sandvig/Hammer Odde		1953-1960	
	Hammer Odde Fyr		1961-2014	

6.2.7. Lowest temperature

Table 6.2.7. Data sets and station series; monthly lowest temperature.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1875-2014	Vestervig	vest_6051_112	1875-2014	Lowest temperature
Nordby/Fanø 1875-2014	Nordby/Fanø	nord_6088_112	1875-2014	Lowest temperature
Tranebjerg 1873-2014	Tranebjerg	tran_6132_112	1873-2003	Lowest temperature
	Tranebjerg Øst		2003-2014	
København 1861-2014	Landbohøjskolen	Koeb_6186_112	1861-2014	Lowest temperature
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_112	1873-1953	Lowest temperature
	Sandvig/Hammer Odde		1953-1960	
	Hammer Odde Fyr		1961-2014	

6.2.8. Mean atmospheric pressure

Table 6.2.8 Data sets and station series; monthly mean atmospheric pressure.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1874-2014	Vestervig	vest_6051_401	1874-1987	Mean atmospheric pressure
	Thyborøn		1987-2014	
Nordby/Fanø 1874-2014	Nordby/Fanø	nord_6088_401	1874-1987	Mean atmospheric pressure
	Esbjerg/Blåvand/Rømø		1987-2014	
Tranebjerg 1872-2014	Tranebjerg	tran_6132_401	1872-1987	Mean atmospheric pressure
	Røsnæs Fyr		1987-2014	
København 1923-2014	Landbohøjskolen	Koeb_6186_401	1923-1987	Mean atmospheric pressure
	Københavns Lufthavn		1987-2014	
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_401	1873-1970	Mean atmospheric pressure
	Hammer Odde Fyr		1971-1987	
	Hammer Odde Fyr		1987-2014	

6.2.9. Hours of bright sunshine (Star level)

Table 6.2.9 Data sets and station series; Hours of bright sunshine (Star level).

Dataset*	Station series**	Dataset id	Period	Parameter
København 1876-2014	Landbohøjskolen (visual obs)	Koeb_6186_504	1876-1887	Hours of bright sunshine
	Københavns Toldbod (Campbell-Stokes sunrecorder)		1887-2004	
	Københavns Toldbod (Star pyranometer)		2005-2014	

6.2.10. Number of days with snow cover

Table 6.2.10. Data sets and station series; monthly number of days with snow cover.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1939-2014	Vestervig	vest_6051_701	1939-2014	No. of days with snow cover
Nordby/Fanø 1957-2014	Nordby/Fanø	nord_6088_701	1857-2001	No. of days with snow cover
	Esbjerg Lufthavn		2001-2006	
	Outrup		2007-2014	
Tranebjerg 1949-2014	Tranebjerg	tran_6132_701	1949-2000	No. of days with snow cover
	Tranebjerg Øst		2004-2014	
København 1938-2014	Landbohøjskolen	koeb_6186_701	1938-1996	No. of days with snow cover
	Københavns Lufthavn		1997-2009	
	Botanisk Have		2010-2014	
Hammer Odde Fyr 1939-2014	Sandvig/Hammer Odde	hamm_6193_701	1939-2002	No. of days with snow cover
	Klemensker		2002-2010	
	Østerlars		2010-2014	

6.2.11. Cloud cover

Table 6.2.11. Data sets and station series; monthly mean cloud cover.

Dataset*	Station series**	Dataset id	Period	Parameter
Vestervig 1874-2014	Vestervig	vest_6051_801	1874-1995	Mean cloud cover
	Thyborøn		1996-2014	
Nordby/Fanø 1872-2014	Nordby/Fanø	nord_6088_801	1872-1999	Mean cloud cover
	Esbjerg Lufthavn		2000	
	Rømø		2000-2014	
Tranebjerg 1874-2001	Tranebjerg	tran_6132_801	1872-2000	Mean cloud cover
	Røsnæs Fyr		2000-2001	
København 1876-2014	Landbohøjskolen	Koeb_6186_801	1923-1995	Mean cloud cover
	Københavns Lufthavn		1996-2014	
Hammer Odde Fyr 1873-2014	Sandvig	hamm_6193_801	1873-1889	Mean cloud cover
	Sandvig/Hammer Odde		1890-1995	
	Hammer Odde Fyr		1996-2014	

6.2.12. Data Dictionary

Table 6.2.12. Parameters used in this report. 'Method' specifies whether the element is a sum, a mean or an extreme. The units of the monthly values in the data files are specified in 'Unit'. The DMI system of element numbers contains much more than the shown elements.

Number	Abbr.	Parameter	Method	Unit
101	T	Mean temperature	mean	0,1°C
111	Tx	Mean of daily maximum temperature	mean	0,1°C
112	Th	Highest temperature	Max	0,1°C
121	Tn	Mean of daily minimum temperature	mean	0,1°C
122	Tl	Lowest temperature	Min	0,1°C
401	P	Mean atmospheric pressure	mean	0,1 hPa
504	S	Hours of bright sunshine (Star level)	Sum	0,1 hours
601	R	Accumulated precipitation	sum	0,1 mm
602	Rx	Highest 24-hour precipitation	max	0,1 mm
701	DSC	No. of days with snow cover (> 50 % covered)	sum	days
801	N	Mean cloud cover	mean	%

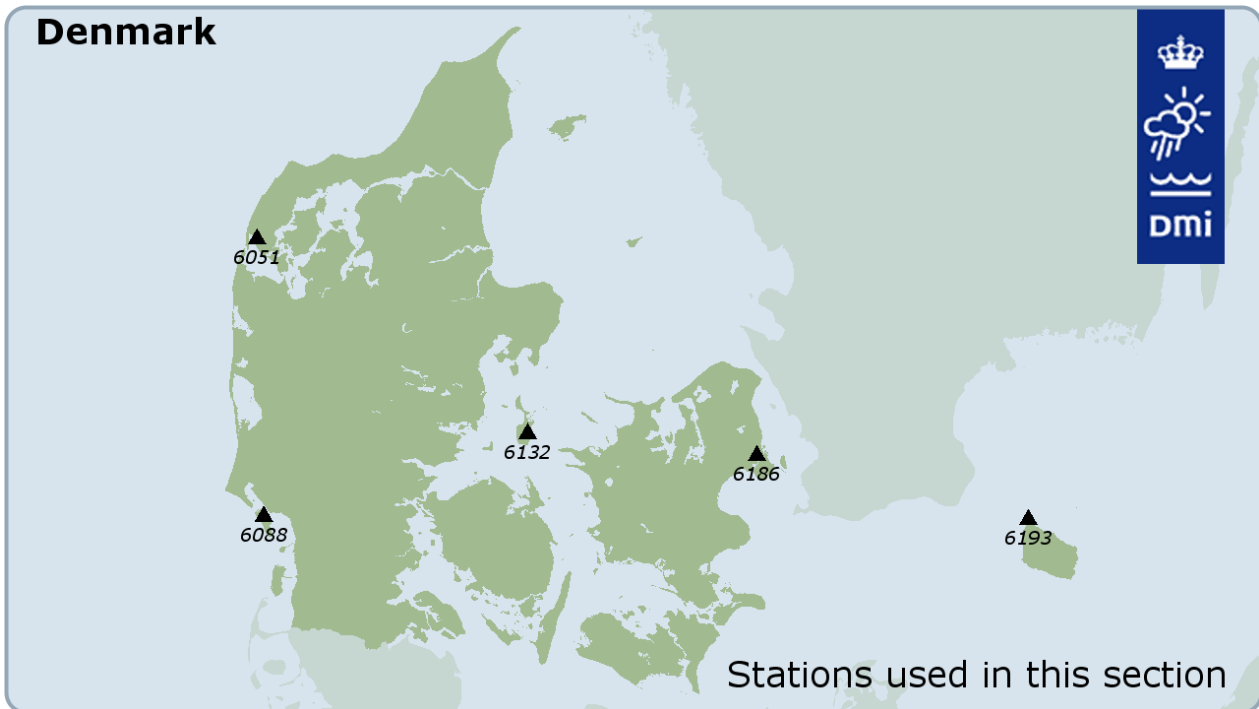


7. Annual Section: Historical DMI Data Collection

Type	Data Collections	Section, Page, Appendix
Annual	<ul style="list-style-type: none"> • Mean air temperature • Mean daily minimum temperature • Mean daily maximum temperature • Highest temperature • Lowest temperature • Mean atmospheric pressure (msl) • Hours of bright sunshine • Accumulated precipitation • Highest 24-hour precipitation • No. of days with snow cover • Mean cloud cover <p>5 data sets: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranebjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p> <ul style="list-style-type: none"> • Mean air temperature; graph and values with gauss filtered values <p>1 data set: 6186 København (1873-2014)</p>	<p>Sec 7.2.1., p 38, App 5</p> <p>Sec 7.2.2.-7.2.3, p 38, App 5</p>



Type	Datasamlinger	Sektion, Sidetal, Appendiks
År	<ul style="list-style-type: none"> • Middel lufttemperatur • Middel maksimumtemperatur • Middel minimumtemperatur • Højeste temperatur • Laveste temperatur • Middellufttryk (msl) • Solskinstimer • Nedbørsum • Højeste 24 t nedbørsum • Antal snedækkedage • Middelskydække <p>5 datasæt: 6051 Vestervig (1874-2014) 6088 Nordby (1872-2014) 6132 Tranebjerg (1873-2014) 6186 København (1768-2014) 6193 Hammer Odde Fyr (1873-2014)</p> <ul style="list-style-type: none"> • Middel lufttemperatur som data og grafik med gauss-filtrerede værdier <p>1 datasæt: 6186 København (1873-2014)</p>	<p>Sektion 7.2.1., s 38, App 5</p> <p>Sektion 7.2.2-7.2.3., s 38, App 5</p>



Station based data sets referred to in the report. Only the latest positions are marked. The official WMO station identifiers for Denmark consist of 5 digits “06xxx”. However, in this report the in front “0” is omitted, giving 4 digits i.e. “6132” for Tranebjerg, which is also used on the map. The Danish national station identifiers describing climate/precipitation stations in Denmark consist of 5 digits, either the new format “05XXX” (the in front “0” is omitted, giving 4 digits i.e. “5165” for Tranebjerg or a the old format, where the station number started with 20-32 dependent on the region i.e. “27080” for the old Tranebjerg station (see more in Appendix 1.2 and 4.2).

Latest earlier report:

[21] Cappelen, J. (ed), 2014: Denmark -DMI Historical Climate Data Collection 1873-2013- with Danish Abstracts. DMI Technical Report No. 14-02.



7.1. Introduction

The purpose of this section is to publish different *annual* data series together with relevant graphics. That is:

- Annual data sets within the period 1768-2014 for Denmark. The data parameters include mean temperature, minimum temperature, maximum temperature, atmospheric pressure, accumulated precipitation, highest 24-hour precipitation, hours of bright sunshine, number of days with snow and mean cloud cover. Only one data set has data before the 1870s – København.
- Annual mean temperatures and filtered values for one data set (København) in Denmark; 1873-2014, both as data and graphics.

According to the intentions to update regularly, preferably every year, this particular report contains an update (2014 data) of the “DMI Monthly Climate Data Collection” published for the first time in that form in DMI Technical Report 05-06: DMI Annual Climate Data Collection 1873-2004, Denmark, The Faroe Islands and Greenland - with Graphics and Danish Abstracts. Copenhagen 2005 [12]. A similar collection of long DMI *daily* and *monthly* Danish climate data series can be found in section 5 and 6 in this report. Annual values of Danish mean temperatures also regularly forms part of other similar publications [23,24].

Five meteorological stations with a long record have been operated in Denmark, four of them since the 19th century, one of them since the 18th century. Their longest series have digitised records back to 1768 (the Danish Meteorological Institute (DMI) was established 1872).

It is obvious that the quality and homogeneity of the series have been affected in various degrees. The series have been corrected in the best possible way i.e. in connection with:

- The development of the North Atlantic Climatological Dataset: DMI Scientific Report 96-1: North Atlantic Climatological Dataset (NACD Version 1) - Final report. Copenhagen 1996 [27],
- and the regularly publication of the DMI historical monthly data collection in section 6.

The annual data sets can be downloaded from the publication part of DMI web pages. Details about the data sets and file formats can be seen in Appendix 5.



Formålet med denne sektion er at publicere forskellige årlige dataserier indenfor perioden 1768-2014 samt tilhørende grafik. Det drejer sig om henholdsvis:

- *Årsmiddeltemperaturer for udvalgte meteorologiske datasæt i Danmark. Det omfatter middeltemperatur, minimumtemperatur, maksimumtemperatur, atmosfærisk tryk, solskinstimer, nedbørsum, maksimal 24t nedbørsum, antallet af dage med sne og skydække.*
- *Årsmiddeltemperaturer og gauss filtrerede værdier for ét datasæt i Danmark (København), 1873-2014, både som data og grafik.*

I afsnit 7.2 kan ses hvilke datasæt og parametre, det drejer sig om. Årsmiddelværdierne af de forskellige parametre kan findes sammen med de månedlige data, se sektion 6. I afsnit 7.2.2 er København's årsmiddeltemperatur grafisk vist sammen med Tórshavn, Færøerne og forskellige stationer i Vest- og Østgrønland. Stationshistorien kan ses i Appendix 1.2. Endelig er filformatet af de medfølgende filer og grafik beskrevet i Appendix 5.

7.2. Data sets, station series, parameters and graphics

7.2.1. Annual values 1768-2014; Denmark

The calculated annual values (5 stations) are a part of the monthly data sets (see section 6; file formats in Appendix 4.1).

7.2.2. Annual mean temperatures and filtered values, København; 1873-2014

Annual mean temperatures 1873-2014 and filtered values for 6186 København; Denmark are available as a data set together with selected meteorological data sets from the Faroe Islands and Greenland.

Table 7.2.2. Data set and station series; annual mean temperatures. See details in Appendix 5.

Dataset*	Station series	Dataset id	Period	Parameter
København 1873-2014	Landbohøjskolen	dk_annual_temper ature_dkfrgr	1873-2014	Mean temperature °C

* *The annual mean temperature data are the same as the calculated annual values for parameter 101 Mean Temperature mentioned in section 6.2.3.*

7.2.3. Graphics; annual mean temperatures and filtered values, København; 1873-2014

The annual mean temperatures 1873-2014 for 6186 København are also available as a graph.

Table 7.2.3. Graphical products; annual mean temperatures. See details in Appendix 5.

Product*	Station series	Graph id	Period	Parameter
Graph; København 1873-2014	Landbohøjskolen	dk_annual_temper ature_page	1873-2014	Mean temperature °C

* *Graph (Danish and English version).*

The graphs are shown on the next pages. They show annual mean temperatures for København together with selected data sets from the Faroe Islands and West/East Greenland. See [24] for details concerning the annual temperature series from The Faroe Islands and [23] for the Greenlandic series.

A Gauss filter with filter width (standard deviation) 9 years has been used to create the “bold” smooth curves. A Gauss filter with standard deviation 9 years is comparable to a 30-years running mean. However, the filter gives a smoother curve than a running mean, as temperatures from central years are given larger weight than temperatures from periferal years. Filter values are also calculated for the years at either end of the series. It should be noted that these values are computed from one-sided Gauss filters, and that values from later years will change, when the series is updated.

Important note concerning the graphs: 2010 in West Greenland was extremely record breaking warm many places and the graphical presentation are not ideal to deal with such extreme values (see figure 7.2.3.1).

A better graphic presentation can be seen in a poster included in another report [23] showing “Annual mean temperatures 1873-2014, Greenland” (Tr15-04_gr_temperatur_1873_2014_plakat.pdf). The following record breaking annual 2010 average temperatures can also help in the interpretation: Pituffik -7.9°C, Upernavik -3.1°C, Ilulissat -0.1°C, Nuuk 2.6°C, Narsarsuaq 5.4°C. Tasiilaq 1.1°C was second warmest (2003 warmest; 1.2°C). Danmarkshavn with -11.3°C in northeast Greenland was in the warm end of the scale, but not near the record (-9,5°C in 2005).

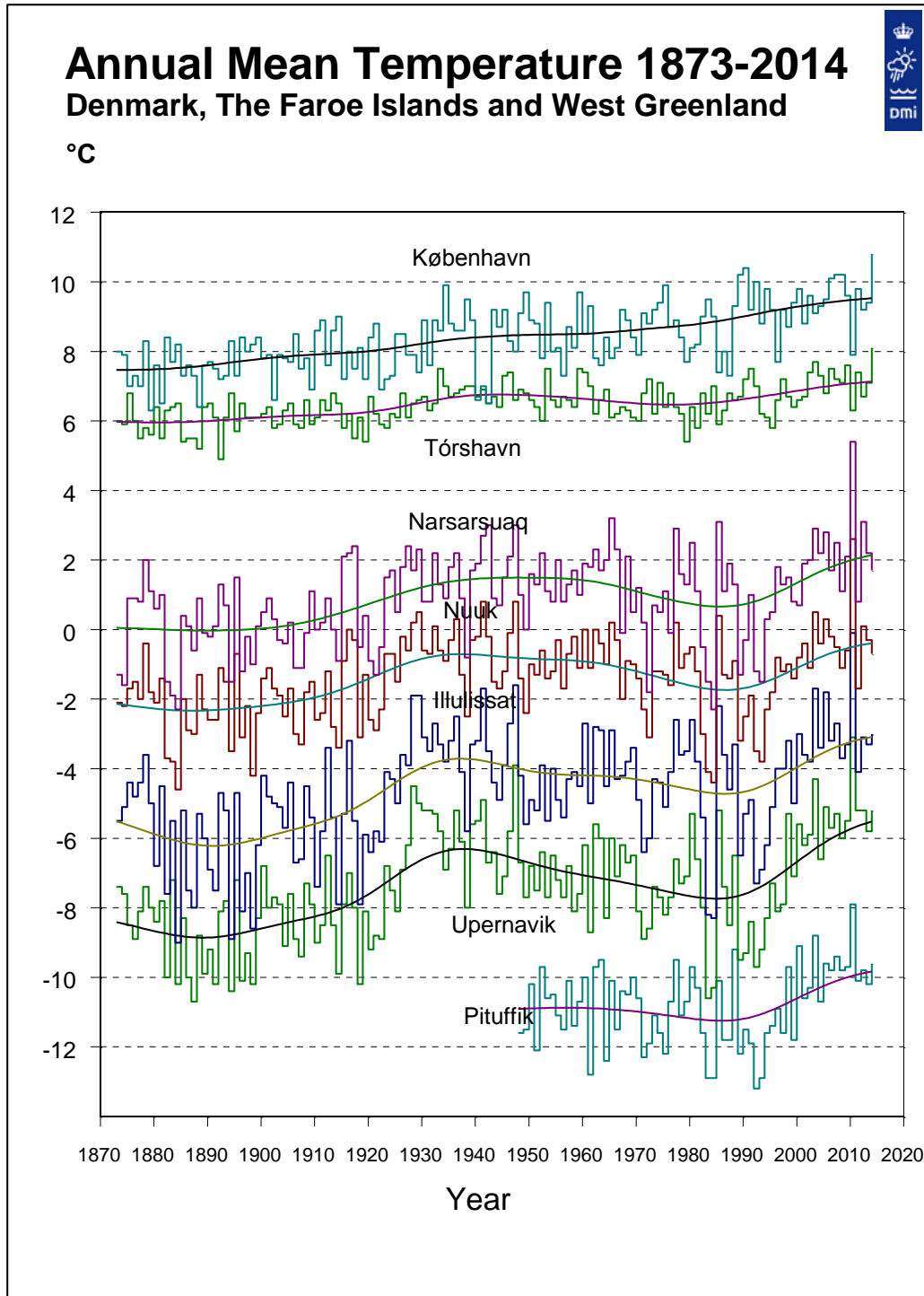


Figure 7.2.3.1. Annual mean temperatures 1873-2014, Denmark, The Faroes and West Greenland.

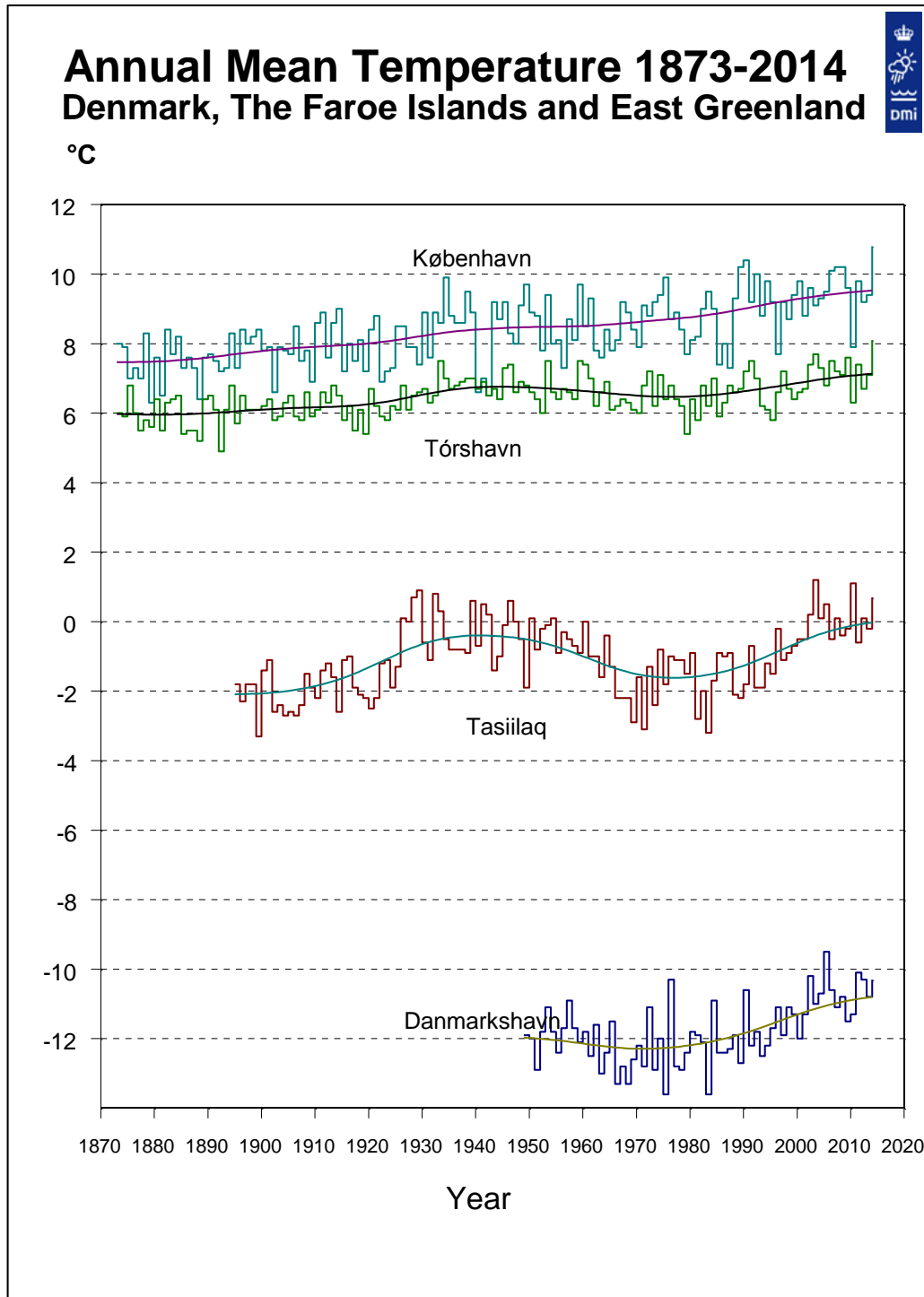


Figure 7.2.3.2. Annual mean temperatures 1873-2014, Denmark, The Faroes and East Greenland.



8. Country-wise Section: Historical DMI Data Collection

Type	Data Collections	Section, Page, Appendix
Country-wise	<ul style="list-style-type: none"> Country-wise monthly and annual climate data 1874-2014; mean temperature, mean of minimum and maximum temperatures, highest/lowest temperatures, accumulated precipitation, highest 24-hour precipitation and hours of bright sunshine; data set <p>All months/years 1891-2014 are characterised by a short text as well as the weather during Eastern, Christmas and Midsummer Day. Record breaking months and years are marked and normals 1961-90 and average 2001-2010 are included. The extremes are also isolated separately in a product</p> <ul style="list-style-type: none"> Country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover 1873-2014; graphs and dataset with gauss filtered values 	<p>Sec 8.2.1., p 43, App 6</p> <p>Sec 8.2.2.-8.2.3, p 46-48, App 6</p>



Type	Datasamlinger	Sektion, Sidetal, Appendiks
Landstal	<ul style="list-style-type: none"> Månedlige og årlige værdier af landstal af middel luft-, max- og min- temperatur samt højeste og laveste temperatur, nedbørsum, max 24 t nedbørsum og solskinstimer 1874-2014 som datasæt. <p>Alle måneder og år samt Påske, Jul og Sankt Hans Aften 1891-2014 er desuden karakteriseret af en kort vejrbeskrivende tekst. Endelig er alle måned- og årsrekorder markeret og normaler 1961-90 samt gennemsnit 2001-2010 er inkluderet. Ekstremer fra materialet foreligger særskilt i et produkt</p> <ul style="list-style-type: none"> Årlige landstal for middeltemperatur, nedbørsum, solskinstimer og middel skydække som datasæt og grafik 1873-2014 med gauss-filtrerede værdier 	<p>Sektion 8.2.1., p 43, App 6</p> <p>Sektion 8.2.2-8.2.3, p 46-48, App 6</p>

Latest earlier report:

[21] Cappelen, J. (ed), 2014: Denmark - DMI Historical Climate Data Collection 1873-2013- with Danish Abstracts. DMI Technical Report No. 14-02.

8.1. Introduction

The purpose of this section is to publish different country-wise monthly and annual climate data together with relevant graphics. That is:

- Monthly and annual country-wise values of mean temperature, mean of minimum and maximum temperatures, highest/lowest temperatures, accumulated precipitation, highest 24-hour precipitation and hours of bright sunshine from Denmark since 1874. In addition every month and year in the period 1891-2014 are characterised by a short text as well as the weather during Eastern, Christmas and Midsummer Day. The different record breaking months and years are also marked. Finally the figures can be compared with the Standard Normal values from the period 1961-90 (latest WMO recommended) and the average 2001-2010.
- Climate extremes from the above material separately.
- Annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover and gauss-filtered values for Denmark as a whole; 1873-2014, both as data and graphics.

These country-wise values also regularly forms part (graphical) of the yearly publication “Danmarks Klima”. The newest one published in 2015 is DMI Teknisk Rapport 15-01: Danmarks klima 2014 – with English Summary. København 2015 [22].

According to the intentions to update regularly, preferably every year, this particular section contains an annual update (2014 data) of the monthly and annual selected country-wise values published for the first time in that form in DMI Teknisk Rapport 06-02: Dansk vejr siden 1874 – måned for måned med temperatur, nedbør og soltimer samt beskrivelser af vejret - with English translations. København 2006 [13].

The annual country-wise data both as data and graphics from Denmark are partly an annual update (with 2014 data) of the “DMI Annual Climate Data Collection” published for the first time in that form in DMI Technical Report 05-06: DMI Annual Climate Data Collection 1873-2004, Denmark, The Faroe Islands and Greenland - with Graphics and Danish Abstracts. Copenhagen 2005 [12].

The country-wise data sets and graphics can be downloaded from the publication part of DMI web pages. Details about the data sets, file formats and graphics can be seen in Appendix 6.



Formålet med denne sektion er at publicere forskellige danske landstal indenfor perioden 1873-2014 samt tilhørende grafik. Det drejer sig om henholdsvis:

- *Månedlige og årlige værdier af landstal af middel luft-, max- og min- temperatur samt højeste og laveste temperatur, nedbørsum, max 24 t nedbørsum og solskinstimer siden 1874. Alle måneder og år samt Påske, Jul og Sankt Hans Aften 1891-2014 er desuden karakteriseret af en kort vejrbeskrivende tekst. Endelig er alle måned- og årsrekorder markeret og normal 1961-90 samt gennemsnit 2001-2010 er inkluderet.*
- *En samling af ekstremer fra ovenstående materiale.*
- *Årlige landstal for middeltemperatur, nedbørsum, solskinstimer og middelskydække for Danmark som helhed som data og grafik.*

I afsnit 8.2 kan ses hvilke datasæt, grafik og parametre, det drejer sig om. Endelig er filformatet af de medfølgende filer og grafik beskrevet i Appendix 6.

8.2. Data sets, parameters and graphics

8.2.1. Country-wise monthly and annual climate data 1874-2014

Meteorological parameters for Denmark as a whole have been published on a monthly and annual basis since the start of the Danish Meteorological Institute in 1872. Every year since 1874 meteorological country-wise values (means) for Denmark as a whole have been calculated using a selection of stations. In this chapter country-wise monthly and annual values for Denmark for the period 1874–2014 and for the parameters mentioned in table 8.2.1.2 and 8.2.1.4 are described.

Table 8.2.1.1. Data set; country-wise monthly and annual climate data. See details in Appendix 6.

Dataset*	Dataset id	Period	Parameters
Country-wise climate data 1874-2014	dk_country	1874-2014	See table 8.2.1.2

Table 8.2.1.2. Parameters and units used in this section in connection with monthly/annual country-wise climate data and year of first appearance.

Parameter	Unit	First year
Daily mean temperature	°C	1874
Daily mean maximum temperature	°C	1953
Daily mean minimum temperature	°C	1973
Highest temperature	°C	1874
Lowest temperature	°C	1874
Accumulated precipitation	mm	1874
Highest 24-hour precipitation at a single station	mm	1874
Accumulated hours of bright sunshine	hours	1920

Figure 8.2.1.1. Example (2011 data) of the country-wise monthly and annual climate data 1874-2014 which contain values of temperature, precipitation and hours of bright sunshine, weather describing text, weather records and standard normal values 1961-90 from Denmark as a whole. The figures can be compared with the Standard Normal values from the period 1961-90 (latest WMO recommended) and the average 2001-10 by moving the cursor to the figure. Every month and year in the period 1891-2014 are characterised by a short text as well as the weather during Eastern, Christmas and Midsummer Day. The different record breaking months and years are also marked. (only Danish)

Year	Month	Description	Temp	Precip	Sunshine	Wind	Pressure	Humidity	Cloud	Other			
2011	Året	Varmt og solrigt med overskud af nedbør. Rekordvarm april og rekordhøj maksimum temperatur i oktober. Tør april og november og andenvådeste sommer.	9,0	28,2	-16,5	12,1	5,8	779	135,4	1683			
2011	Januar	Solrig med underskud af nedbør og lidt over normal temperatur.	0,3	9,8	-12,4	2,4	-2,1	46	16,8	72			
2011	Februar	Solunderskud, ellers normal.	-0,1	9,6	-16,5	1,6	-2,2	40	20,2	52			
2011	Marts	Varm, tør og solrig.	3,1	15,3	-7,6	6,1	0,2	31	16,4	143			
2011	April	R Rekordvarm, meget solrig og tør.	▲9,9	22,5	-1,6	14,5	5,5	16	25,8	253	Påske	21.-25.	Solrig, varm og tør. Middeltemp.: 13,6 °C. Soltimer: 63.
2011	Maj	Frost, sommer og sol.	11,4	26,2	-3,2	15,6	7,3	54	26,9	239			
2011	Juni	Varm med overskud af nedbør og sol.	15,1	28,2	2,6	19,2	11,1	76	89,6	252	Sct. Hans		Svag til let vind, for det meste tørt, få spredte småbyger, 10-15°C
2011	Juli	Syvende vådeste med overskud af varme og underskud af sol.	16,4	27,1	6,2	20,1	13,0	113	135,4	171			
2011	August	Meget våd og solfattig med overskud af varme.	16,1	27,6	4,9	19,8	12,9	132	74,8	150			
2011	September	Lun og våd.	14,1	25,9	3,8	17,5	10,8	92	54,2	135			
2011	Oktober	R Varm og meget solrig med underskud af nedbør.	9,8	▲26,9	-2,6	13,0	6,2	61	29,4	130			Rekord den 1. i Sl. Jydeved
2011	November	Meget tør, mild og grå.	6,7	14,6	-3,9	8,5	4,6	18	13,8	37			
2011	December	Varm og våd.	4,2	11,3	-5,1	6,1	1,9	99	32,4	50	Julen		Meget lunt ca. 5-10°C, blæsende fra sydvest med lidt sol og nedbør

The country-wise climate extremes from the above material are published separately. See table 8.2.1.3 for the data set and table 8.2.1.4 for the parameters.

Table 8.2.1.3. Data set; country-wise monthly/annual climate extremes. See details in Appendix 6.

Dataset*	Dataset id	Period	Parameters
Country-wise climate extremes 1874-2014	dk_country	1874-2014	See table 8.2.1.4

Table 8.2.1.4. Parameters and units used in this section in connection with country-wise climate extremes and year of first appearance.

Parameter	Unit	First year
Highest temperature	°C	1874
Lowest temperature	°C	1874
Highest mean temperature	°C	1874
Lowest mean temperature	°C	1874
Highest accumulated hours of bright sunshine	hours	1920
Lowest accumulated hours of bright sunshine	hours	1920
Highest accumulated precipitation	mm	1874
Lowest accumulated precipitation	mm	1874
Highest 24-hour precipitation at a single station	mm	1874

The Danish Meteorological Institute (DMI) has since the beginning in 1872 observed various weather elements at different observation sites in Denmark. These observations have over the years been the basis for the calculation of different country-wise values as i.e. temperature, precipitation and hours of bright sunshine.

DMI has continuously published country-wise values. In 1991 monthly and annual country-wise values of temperature, precipitation and hours of bright sunshine supplemented by a short description of the weather were published in the book “Dansk Vejr i 100 år” [41]. The period covered was 1891-1990. The latest 6th edition of the book was published in 2000, covering the period 1891-August 2000.

This climate information from this latest 6th edition has been the data source for this report supplemented with information covering the period 1874 - 1890 and September 2000 – December 2014. Those the whole period from 1874 – 2014 are covered.

The latest version of the book “Dansk Vejr i 100 år” [42] was published 2007, covering the period 1907- 2007. Minor insignificant differences, compared to the information in this DMI publication, can be found in this new version of the book.

Looking back in history the calculations of the different parameters always have been based upon the existing station- and data availability at that specific time. Furthermore different methods of data weighting have been used. The selection of stations back in time and the different methods of the calculations have never been published and for that reason the exact details concerning the meteorological parameters for the country as a whole partly are unknown. Since 1950s and up till 2006 (inclusive) it is however known, that methods and data more or less look like today what concerns the area weighting – data from Jutland are weighted with 7/10 and data from the islands with 3/10 (see section 8.2.2 for more information).

Figure 8.2.1.2. Country-wise climate extremes 1874-2014. (only Danish)

Rekorder siden 1874 (solskinstimer siden 1920).													
	Jan	Feb	Mar	Apr	Maj	Jun	Jul	Aug	Sep	Okt	Nov	Dec	År
Absolut højeste temperatur													
°C	12,4	15,8	22,2	28,6	32,8	35,5	35,3	36,4	32,3	26,9	18,5	14,5	
år	2005	1990	1990	1993	1892	1947	1941	1975	1906	2011	1968	1953	
sted	Sønderborg	København	Karup	Holbæk	Herning	Hillerød	Erslev (Mors) Studsgård v/Herning	Holstebro	Randers	St. Jydevad	Faksinge v/Præstø	Nordby	
Absolut laveste temperatur													
°C	-31,2	-29,0	-27,0	-19,0	-8,0	-3,5	-0,9	-2,0	-5,6	-11,9	-21,3	-25,6	
år	1982	1942	1888	1922	1900	1936	1903	1885	1886	1880	1973	1981	
sted	Hørsted i Thy	Brande	Søndersted v/Holbæk	St. Vildmose	Gludsted Plantage	Klosterhede Plantage	Gludsted Plantage	Varde	Aalborg	Torstedlund v/Rold Skov	Egvad v/Tarm	Døvling	
Højeste middeltemperatur måned/år													
°C	5,0	5,5	6,1	9,9	13,8	18,2	19,8	20,4	16,2	12,2	8,1	7,0	10,0
år	2007	1990	1990/2007	2011	1889	1889	2006	1997	1999/2006	2006	2006	2006	2014
Laveste middeltemperatur måned/år													
°C	-6,6	-7,1	-3,5	2,5	8,1	10,7	13,6	12,8	10,0	5,2	0,7	-4,0	5,9
år	1942	1947	1942	1888	1902	1923	1979	1902	1877	1905	1919	1981	1879
Flest solskinstimer måned/år													
timer	100	140	200	272	347	303	321	291	201	162	88	81	1878
år	1963	1932	1943	2009	2008	1940	2006	1947	2002	2005	1989	2010	1947
Færrest solskinstimer måned/år													
timer	14	12	50	84	103	107	137	113	74	26	19	8	1287
år	1969	1926	1963	1937	1983	1987	1922	1980	1998	1976	1993	1959	1987
Største nedbørmængde måned/år													
mm	123	109	100	98	138	124	140	167	162	177	155	140	905
år	2007	2002	1978	1936	1983	2007	1931	1891	1994	1967	1969	1985	1999
Mindste nedbørmængde måned/år													
mm	6	2	7	3	9	1	15	10	18	12	13	7	466
år	1996/1997	1932	1918/1969	1893/1974	1959	1992	1904/1983 1994	1947	1933	1922	1902	1890	1947
Største 24 timers nedbør på én lokalitet													
mm	50,0	61,8	54,8	66,5	94,0	153,1	168,9	151,2	132,7	100,8	62,3	74,6	
år	1886	1881	1970	1969	2007	1880	1931	1959	1968	1982	1981	2010	

Samtlige rekorder er relateret til DMI målestationer.

Opdateret 5.januar 2015. © DMI, Danmarks Meteorologiske Institut.



From 2007 the country-wise mean values of temperature, precipitation and hours of bright sunshine are based on interpolation of station data in a fine-meshed grid covering Denmark. The highest and lowest temperatures are off course still directly measured values.

Temperature is measured in louvered screens at 2m above ground level. Precipitation is measured at 1.5m above ground level and hours of bright sunshine in such a way that the horizon is visible 360 degrees. Hours of bright sunshine are only measured, when the Sun are at least 3 degrees above the horizon.

When compared to earlier published key country-wise values minor changes can be found. This can be related to an ongoing quality control of data.

The sunshine country-wise values have been corrected compared to earlier published material. The instruments for registration of hours of bright sunshine have been changed several times since 1920. In 2002 DMI converted to a new, automatic and more precise measuring method. That introduced a very large gap between old and new measurements. At the same time the opportunity to correct all the “old” sunshine values also was exploited in such a way so the time series of hours of bright sunshine now can be compared from 1920 to now. This report contains this new data set of hours of bright sunshine. The correction of hours of bright sunshine is also described in details in DMI Technical Report 03-19 [34].

It should also be mentioned that both corrected and uncorrected country-wise temperature values exist as two separate published series. By comparing the figures before and after 1956/1957, correction factors (in degrees Celsius) have been found, which can be added to mean temperatures for Denmark in the period 1874-1956, when comparing over time (see the table 8.2.1.5).

Table 8.2.1.5. Correction factors (in degrees Celsius), which can be added to the mean temperatures for Denmark in the period 1873-1956.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
-0,06	-0,01	-0,04	-0,07	-0,09	-0,20	-0,21	-0,18	-0,14	-0,15	-0,14	-0,15	-0,12

The correction factors have been added to the temperature series in some cases, but not all. In general corrected data have been used in all presentations of the temperature series on a time scale, while the uncorrected data have been used in all the cases, where it was important to compare the values with already published data in yearbooks back in time.

In this section only the published uncorrected country-wise temperature values have been included.

8.2.2. Country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover and filtered values 1873-2014

Meteorological parameters for Denmark as a whole have been published on a monthly basis since the start of the Danish Meteorological Institute in 1872. Every year since 1873 meteorological country-wise values (means) for Denmark as a whole have been calculated using a selection of stations. In this section country-wise annual values for Denmark as a whole for the period 1873–2014 and for the parameters mentioned in table 8.2.2.2 are described.

Table 8.2.2.1. Data set; country-wise monthly and annual climate data. See details in Appendix 6.

Dataset*	Dataset id	Period	Parameters
Country-wise climate data 1873-2014	dk_country_tpssc	1873-2014	See table 8.2.2.2

Table 8.2.2.2. Parameters, abbreviations, units and year of first appearance.

Parameter	Abbr.	Units	First year
Mean temperature (Uncorrected)	T	°C	1873
Mean temperature (Corrected)	TK	°C	1873
Accumulated precipitation	P	mm	1874
Hours of bright sunshine	S	hours	1920
Mean cloud cover	C	%	1874

Looking back in history the calculations of the different parameters always have been based upon the existing station- and data availability at that specific time. Furthermore different methods of data weighting have been used.

The selection of stations back in time and the different methods of the calculations have never been published and for that reason the exact details concerning the meteorological parameters for the country as a whole partly are unknown.

Since 1950s it is however known, that methods and data more or less look like in recent times what concerns the area weighting – data from Jutland are weighted with 7/10 and data from the islands with 3/10.

From 2007 the country-wise mean values of temperature, precipitation and hours of bright sunshine among others are based on interpolation of station data in a fine-meshed grid covering Denmark.

The last 10-15 years the methods and data are well known and described in details.

In the report “Danmarks Klima 1991” [10], an examination of temperature for Denmark as a whole is described on page 40 in the chapter “Danmarks middeltemperatur i perspektiv”.

The examination pointed out, that in order to compare values of that parameter on a time scale, it would be necessary to correct the values in periods where a different area weighting has been used.

In the period 1873-1956 the mean temperatures for Denmark as a whole have been calculated using 25 well distributed stations, one half in Jutland and the rest on the Islands.

Thus the area weighting at that time was 5/10 for both Jutland and the Islands. In 1957 there was a change. From that year and until 1975; 20 stations was used in Jutland and 10 from the Islands.

In the period 1976-1986 the basis was about 100 stations, where Jutland was weighted with 7/10 and the Islands 3/10. This area weighting reflects that the area of Jutland accounts for about 7/10 of Denmark.

Since 1987 an area weighting using about 20 stations in Jutland and 10 stations on the Islands once more have been used. From 2007 a change for some parameters have been introduced, see above.

Nevertheless the examination described above concluded that only the change in 1957 requires a correction.

By comparing the figures before and after 1956/1957, correction factors (in degrees Celsius) were given, which can be added to mean temperatures for Denmark in the period 1873-1956 (see the table 8.2.2.3).

The correction factors have been added to the temperature series in some cases, but not all. Consequently the Danish temperature series from 1873 since the beginning of the 1990s have existed in 2 versions – one with correction and one without.

In general corrected data have been used in all presentations of the temperature series on a time scale, while the uncorrected data have been used in all the cases, where it was important to compare the values with already published data in yearbooks back in time.

In this section both the corrected and the uncorrected temperature series have been included. In the future it is strongly recommended that it is clearly marked, which data set has been used.

Besides the temperature series also the sunshine series have been corrected compared to earlier published material. The instruments for registration of hours of bright sunshine have been changed several times since 1920. In 2002 DMI converted to a new, automatic and more precise measuring method. That introduced a very large gap between old and new measurements. At the same time the opportunity to correct all the “old” sunshine values also was exploited in such a way so the time series of hours of bright sunshine now can be compared from 1920 to now.

This report contains this new data set of hours of bright sunshine. The correction of hours of bright sunshine is also described in details in DMI Technical Report 03-19, 2003 [34].

Table 8.2.2.3. Correction factors (in degrees Celsius), which can be added to the mean temperatures for Denmark in the period 1873-1956.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
-0,06	-0,01	-0,04	-0,07	-0,09	-0,20	-0,21	-0,18	-0,14	-0,15	-0,14	-0,15	-0,12

8.2.3. Graphics; Country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover and filtered values 1873-2014

The country-wise annual values and filtered values are also showed as graphics for Denmark as a whole for the period 1873–2014 and for the parameters mentioned in table 8.2.3.2. The graphs are shown on the next pages.

Table 8.2.3.1. Graphical products; country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover and filtered values. See details in Appendix 6.

Product*	Graph id	Period	Parameter
Graph; country-wise annual climate data 1873-2014	dk_country_<parameter>	1873-2014	See table 8.2.3.2

*Graph (Danish and English version).

Table 8.2.3.2. Parameters, abbreviations, units and year of first appearance.

Parameter	Abbr.	Units	First year
Mean temperature (Uncorrected)	T	°C	1873
Mean temperature (Corrected)	TK	°C	1873
Accumulated precipitation	P	mm	1874
Hours of bright sunshine	S	hours	1920
Mean cloud cover	C	%	1874

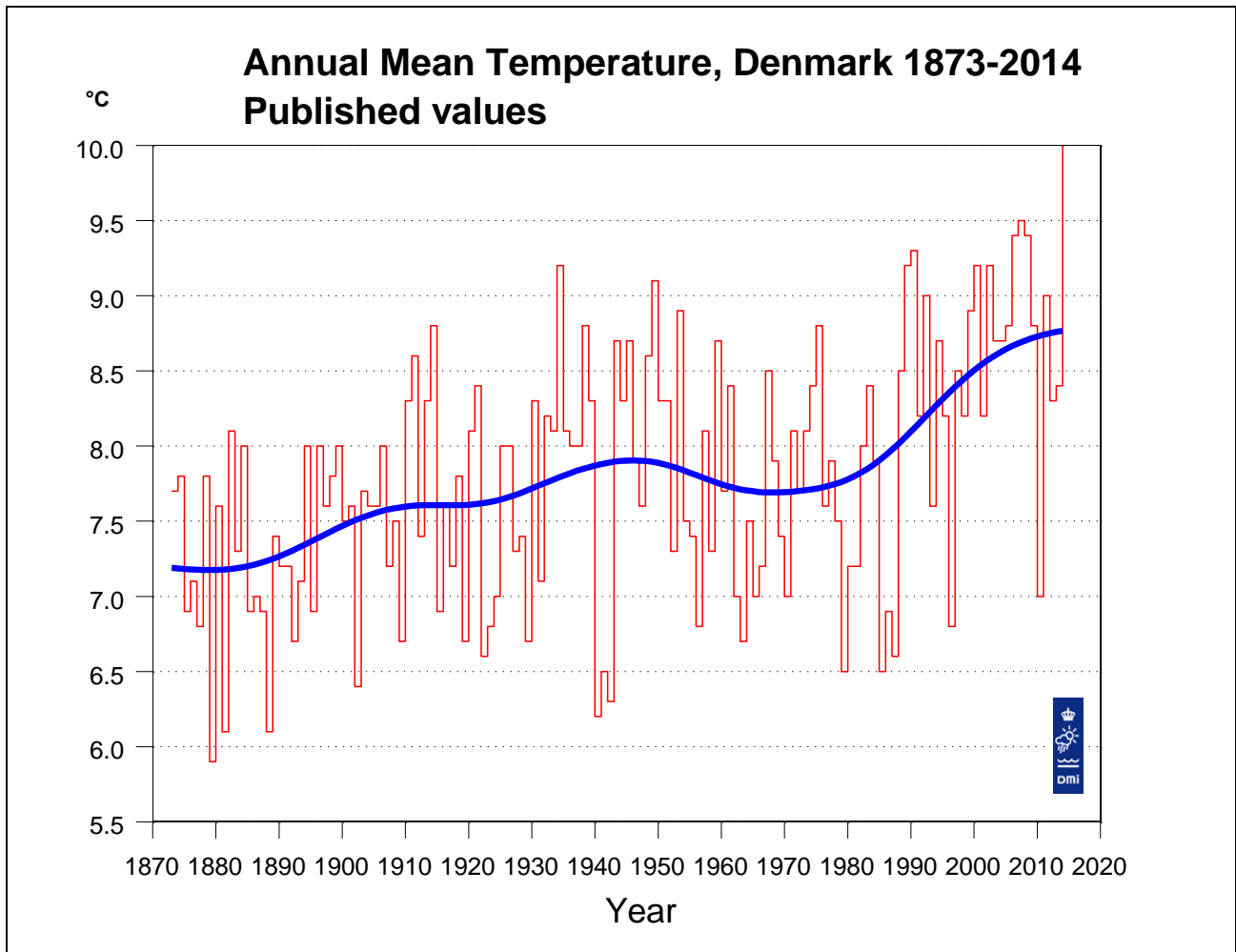


Figure 8.2.3.1. Annual mean temperature, Denmark 1873-2014, published values. A Gauss filter with filter width (standard deviation) 9 years has been used to create the “bold” smooth curve. A Gauss filter with standard deviation 9 years is comparable to a 30-years running mean. However, the filter gives a smoother curve than a running mean, as temperature values from central years are given larger weight than temperature values from peripheral years. Filter values are also calculated for the years at either end of the series. It should be noted that these values are computed from one-sided Gauss filters, and that values from later years will change when the series is updated.

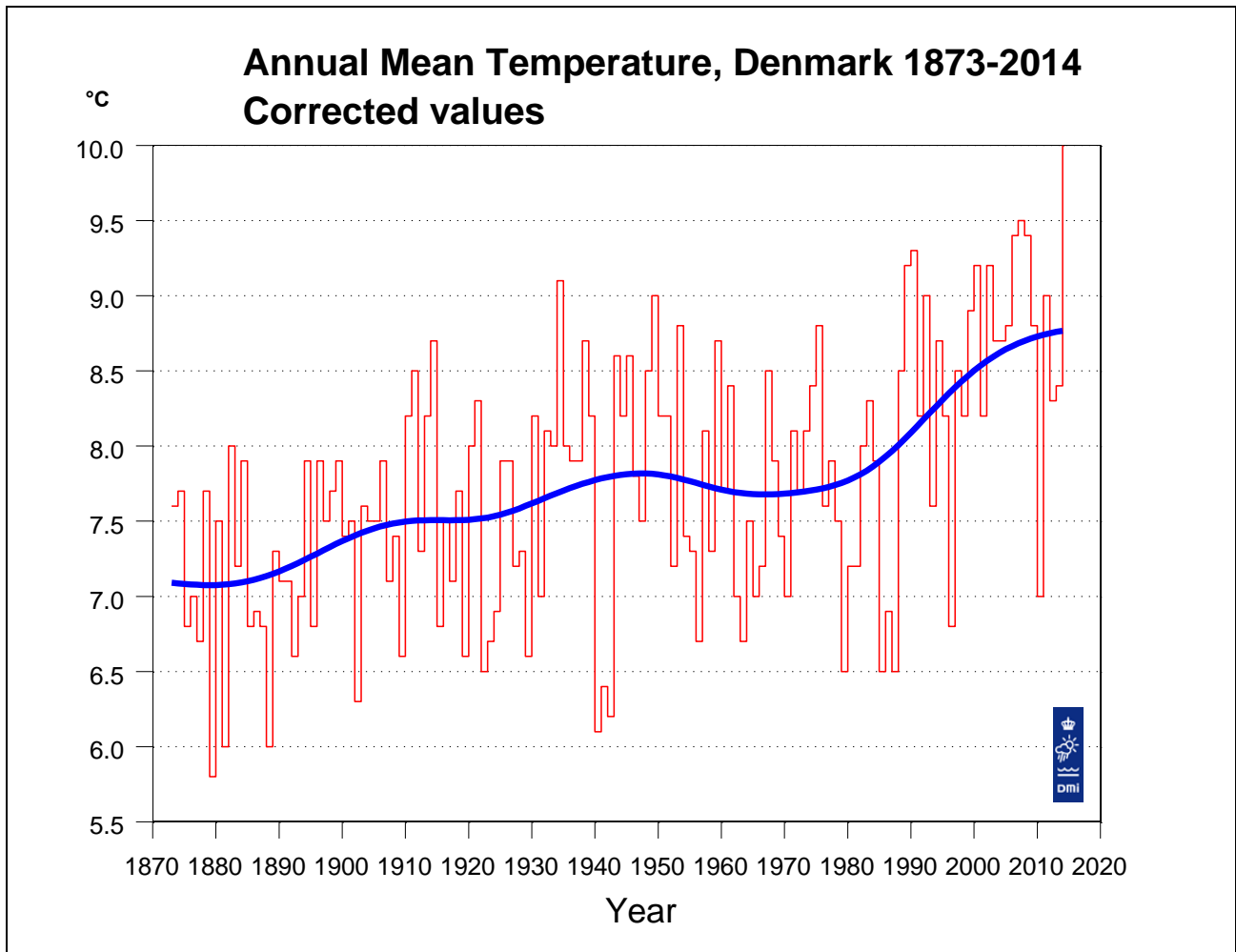


Figure 8.2.3.2. Annual mean temperature, Denmark 1873-2014, corrected values. A Gauss filter with filter width (standard deviation) 9 years has been used to create the “bold” smooth curve. A Gauss filter with standard deviation 9 years is comparable to a 30-years running mean. However, the filter gives a smoother curve than a running mean, as temperature values from central years are given larger weight than temperature values from periferal years. Filter values are also calculated for the years at either end of the series. It should be noted that these values are computed from one-sided Gauss filters, and that values from later years will change when the series is updated.

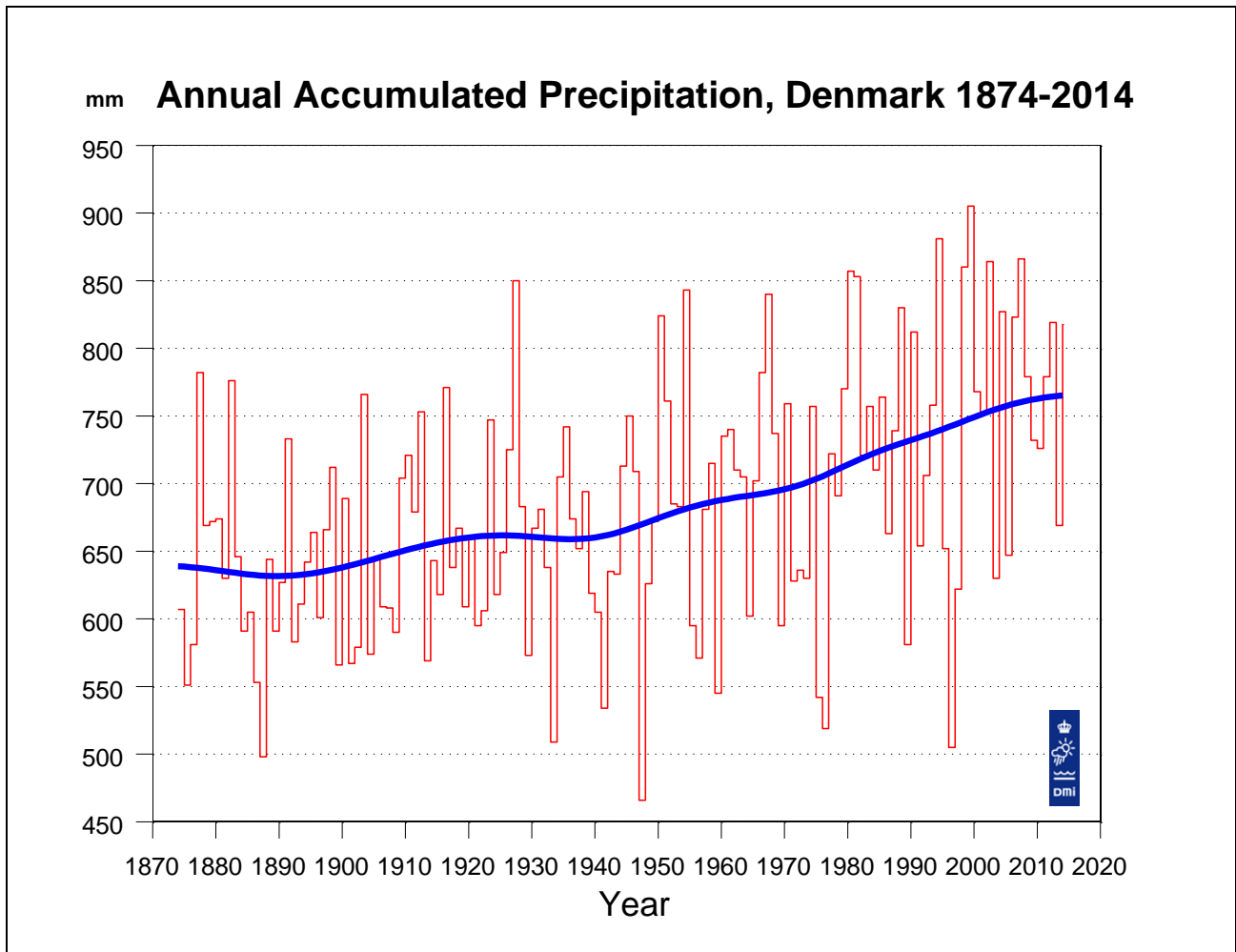


Figure 8.2.3.3. Annual accumulated precipitation, Denmark 1873-2014. A Gauss filter with filter width (standard deviation) 9 years has been used to create the “bold” smooth curve. A Gauss filter with standard deviation 9 years is comparable to a 30-years running mean. However, the filter gives a smoother curve than a running mean, as precipitation values from central years are given larger weight than precipitation values from periferal years. Filter values are also calculated for the years at either end of the series. It should be noted that these values are computed from one-sided Gauss filters, and that values from later years will change when the series is updated.

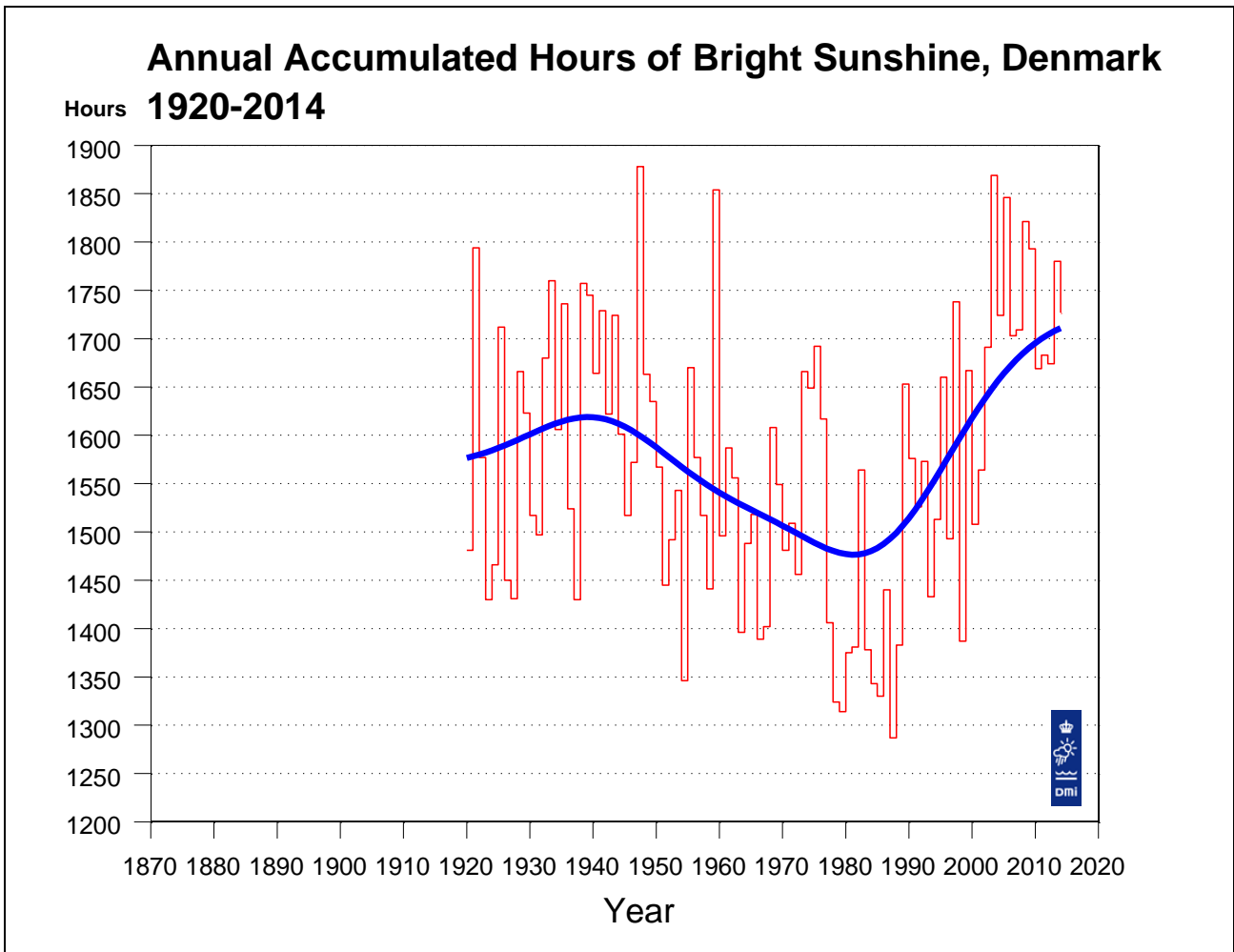


Figure 8.2.3.4. Annual accumulated hours of bright sunshine, Denmark 1920-2014. A Gauss filter with filter width (standard deviation) 9 years has been used to create the “bold” smooth curve. A Gauss filter with standard deviation 9 years is comparable to a 30-years running mean. However, the filter gives a smoother curve than a running mean, as sunshine values from central years are given larger weight than sunshine values from periferal years. Filter values are also calculated for the years at either end of the series. It should be noted that these values are computed from one-sided Gauss filters, and that values from later years will change when the series is updated.

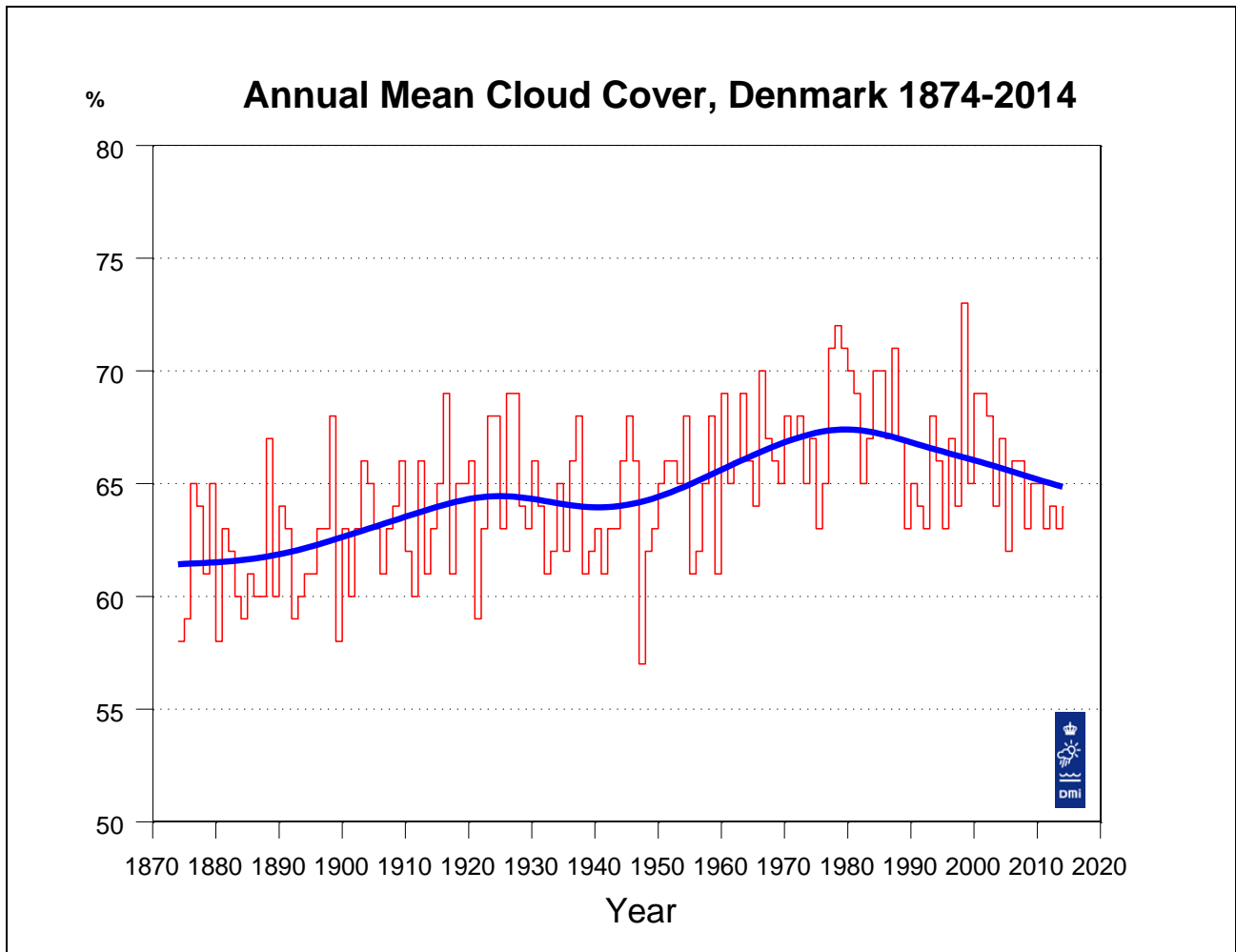


Figure 8.2.3.5. Annual mean cloud cover, Denmark 1874-2014. The annual value is calculated using manually observed cloud cover data from seven manned stations at airports. A Gauss filter with filter width (standard deviation) 9 years has been used to create the “bold” smooth curve. A Gauss filter with standard deviation 9 years is comparable to a 30-years running mean. However, the filter gives a smoother curve than a running mean, as cloud cover values from central years are given larger weight than cloud cover values from periferal years. Filter values are also calculated for the years at either end of the series. It should be noted that these values are computed from one-sided Gauss filters, and that values from later years will change when the series is updated.



9. Storm Section: Historical DMI Data Collection

Type	Data Collections	Section, Page, Appendix
Storm	<ul style="list-style-type: none">List of storms 1890-2014; data set All strong gales to hurricanes registered in Denmark, have been ranked in terms of strength and wind direction and whether there has been snow-fall involved	Sec 9.2.1., p 55, App 7



Type	Datasamlinger	Sektion, Sidetal, Appendiks
Storm	<ul style="list-style-type: none">Stormliste 1890-2014 som datasæt Alle kraftige blæsevejr, der har ramt Danmark, klassificeret mht. styrke og vindretning, samt om der har været snefald indblandet	Sektion 9.2.1., p 55, App 7

Latest earlier report:

[21] Cappelen, J. (ed), 2014: Denmark - DMI Historical Climate Data Collection 1873-2013- with Danish Abstracts. DMI Technical Report No. 14-02.

9.1. Introduction

Since 1891, all strong gales to hurricanes, registered in Denmark, have been ranked in terms of strength and wind direction and whether there has been snowfall involved. They are all shown in the table 9.2.1.2 and the four major events are marked in grey.



Siden 1891 er alle kraftige blæsevejr, der har ramt Danmark, klassificeret mht. styrke og vindretning, samt om der har været snefald indblandet. De er alle vist i tabellen 9.2.1.2 og de fire største storme er markeret i gråt.

9.2. Data sets, parameters and table

9.2.1. Table; the list of storms 1891-2014

Table 9.2.1.1. Table product; list of Danish storms. See details in Appendix 7.

Product*	Graph id	Period	Parameter
Table; list of storms 1891-2014	dk_storm	1891-2014	Classification, see table 9.2.1.2

*Graph (Danish and English version).

The table are shown on the next pages, but can also be found on dmi.dk (continuously updated): Storms in Denmark since 1891 (English only):

http://www.dmi.dk/fileadmin/user_upload/Stormlisten/storme-2.pdf [25].

Table 9.2.1.2. The list of classified storms in Denmark 1890-2014.

STORMS IN DENMARK SINCE 1891

Classification

Classification of storms are based on a climatological valuation, based on 10 minutes average wind speed

N or n - wind from north

E or e - wind from east

S or s - wind from south

W or w - wind from west

X or x - variable wind direction

* or * - snow storm (no wind direction indicated in most cases)

Class 4		Class 3		Class 2		Class 1	
Capital	Small	Capital	Small	Capital	Small	Capital	Small
Strong storm to hurricane, > 28,5 m/s	Strong storm to hurricane, > 28,5 m/s	Strong storm, (hurricane-like) > 26,5 m/s	Strong storm (hurricane-like) > 26,5 m/s	Storm, > 24,5 m/s	Storm, > 24,5 m/s	Stormy, > 21 m/s	Stormy, > 21 m/s
National > 30%	Regional 10-30%	National > 30%	Regional 10-30%	National > 30%	Regional 10-30%	National > 30%	Regional 10-30%



Period		Remarks	Classification	
Days	Year		Date	Index
4-5/1	1891	Snow storm	5/1-1891	*2
10-11/12	1891		11/12-1891	SW2
24-25/6	1892		25/6-1892	W1
12/2	1894		12/2-1894	W2
25-25/3	1895	Strong storm	25/3-1895	W3
6-7/12	1895		7/12-1895	W2
30-31/1	1898		31/1-1898	W2
24-25/3	1898		25/3-1898	E2
11-12/5	1898		12/5-1898	W1
14/7	1898	Jylland	14/7-1898	NW2
24-25/7	1898		25/7-1898	NW1
31/8	1898		31/8-1898	W1
17/10	1898		17/10-1898	E1
18/10	1898		18/10-1898	E1
19/10	1898		19/10-1898	E1
2-3/12	1898		3/12-1898	SW1
10-11/12	1898		11/12-1898	W1
27/12	1898		27/12-1898	SW1
17/8	1899		17/8-1899	W1
22-23/9	1899		23/9-1899	W1
24/11	1899		24/11-1899	W1
16-17/2	1900	Snow storm	17/2-1900	*1
17-18/2	1900	Snow storm	18/2-1900	*1
25-26/12	1902	Hurricane-like (The "1902 Christmas" Storm)	26/12-1902	w4
17/1	1905		17/1-1905	SE1
31/1	1905		31/1-1905	W1
27-28/11	1905	Nordjylland	28/11-1905	w2
13/3	1906		13/3-1906	W1
25/3	1906	Snow storm	25/3-1906	*1
28/3	1906		28/3-1906	W1
13/1	1907		13/1-1907	W1
21/2	1907		21/2-1907	W1
16/8	1907	Nordjylland	16/8-1907	W1
8/1	1908	Snow storm, Nordjylland	8/1-1908	*1
8/2	1908		8/2-1908	NW1
13/11	1909	Snow storm	13/11-1909	*1
3-4/12	1909	Snow storm	3/12-1909	*se1
20/12	1909		20/12-1909	W2
24-25/1	1910	Snow storm	25/1-1910	*1
25-26/1	1910	Snow storm	26/1-1910	*1
24-25/2	1911		25/2-1911	W2
5-6/11	1911	Strong storm	6/11-1911	W3
14/12	1912		14/12-1912	W2
31/1	1913		31/1-1913	S2
19/11	1913		19/11-1913	W2
4/12	1913		4/12-1913	SW2
28/9	1914		28/9-1914	W2
24/12	1915	Snow storm, Jylland	24/12-1915	*1



15/1	1916		15/1-1916	W1
16/2	1916	Strong storm, Sydvestjylland	16/2-1916	w3
24/12	1916		24/12-1916	X1
8/3	1917		8/3-1917	E2
14/9	1917		14/9-1917	W1
21/9	1917		21/9-1917	W1
13/10	1917		13/10-1917	W1
25/10	1917		25/10-1917	W1
27/11	1917		27/11-1917	W1
23/8	1918	Nordjylland	23/8-1918	w1
29/1	1920		29/1-1920	SE1
19/1	1921		19/1-1921	NW1
22/1	1921		22/1-1921	W1
18/6	1921		18/6-1921	NW1
23-24/10	1921	Hurricane-like, The "Ulvsund" storm	24/10-1921	n4
1-2/11	1921		2/11-1921	W1
17-18/12	1921		18/12-1921	W2
31/12	1921	Strong storm	31/12-1921	W3
20/9	1922		20/9-1922	W1
30/8	1923		30/8-1923	w1
9-10/10	1923		10/10-1923	W1
16/12	1923		16/12-1923	W2
24/12	1923	Snow storm, The "Christmas" snow storm	24/12-1923	*1
10/9	1924		10/9-1924	W2
2-3/1	1925		3/1-1925	W1
14/6	1925		14/6-1925	W1
4/11	1925	The southern parts of Denmark	4/11-1925	w2
10/10	1926	The southern parts of Denmark	10/10-1926	w2
2-3/10	1927	Strong storm	3/10-1927	W3
24/11	1928		24/11-1928	W1
11-12/10	1929	The southern parts of Denmark	12/10-1929	w2
9/10	1930		9/10-1930	W1
8-9/7	1931	Strong storm, the southeastern parts of Denmark	9/7-1931	sw3
11/10	1933	Strong storm, Jylland	11/10-1933	SW3
8/2	1934	Strong storm, Jylland	8/2-1934	NW3
27/10	1936		27/10-1936	SW1
19/1	1937		19/1-1937	E2
24/11	1938		24/11-1938	SW2
23-24/8	1940		24/8-1940	NW1
3/5	1944		3/5-1944	W1
24/2	1946	Snow storm	24/2-1946	*1
1/3	1947	Snow storm	1/3-1947	*1
7/3	1947	Snow storm	7/3-1947	*1
13/3	1947	Snow storm	13/3-1947	*1
1/3	1949	Snow storm	1/3-1949	*1
24/10	1949	Strong storm	24/10-1949	W3
26/10	1949	Strong storm	26/10-1949	W3
6/1	1950	Snow storm	6/1-1950	*1
28/5	1951	The eastern parts of Denmark	28/5-1951	ne1
1/12	1951	Nordjylland	1/12-1951	w2

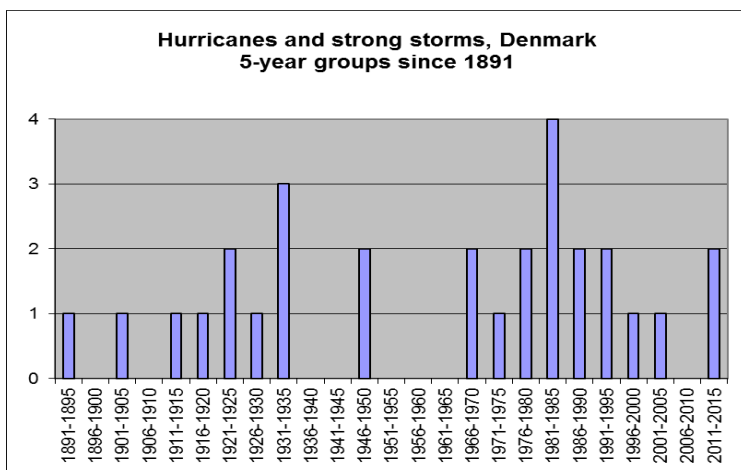


28/1	1953	The "Holland" storm	28/1-1953	W1
11/2	1953	Snow storm	11/2-1953	*1
21/2	1953		21/2-1953	W2
16/1	1954		16/1-1954	W1
20/1	1954		20/1-1954	W1
21/1	1956		21/1-1956	W2
7-8/12	1959		8/12-1959	E1
26-27/3	1961		27/3-1961	NW1
12/2	1962		12/2-1962	W1
16-17/2	1962	The "Hamborg" storm	17/2-1962	NW2
25/6	1962		25/6-1962	NW1
23/2	1967		23/2-1967	W1
17-18/10	1967	Hurricane-like	18/10-1967	w4
15-16/1	1968	Strong storm	16/1-1968	W3
22/9	1969		22/9-1969	W2
21/11	1971	Snow storm	21/11-1971	*2
19/11	1973	Strong storm	19/11-1973	NW3
26/1	1975		26/1-1975	w2
3/1	1976	Hurricane-like, Sydvestjylland	3/1-1976	w4
24/12	1977	The southern parts of Denmark	24/12-1977	w2
28/12	1978	Snow storm, the southern parts of Denmark	28/12-1978	*1
29/12	1978	Snow storm, the southern parts of Denmark	29/12-1978	*2
30/12	1978	Snow storm, strong, the southern parts of Denmark	30/12-1978	*3
31/12	1978	Snow storm, the southern parts of Denmark	31/12-1978	*2
1/1	1979	Snow storm, the southern parts of Denmark	1/1-1979	*2
2/1	1979	Snow storm, the southern parts of Denmark	2/1-1979	*2
3/1	1979	Snow storm, the southern parts of Denmark	3/1-1979	*1
4/1	1979	Snow storm, the southern parts of Denmark	4/1-1979	*1
21/8	1980		21/8-1980	W1
8/2	1981		8/2-1981	W2
2/11	1981		2/11-1981	W2
20-21/11	1981		21/11-1981	W1
24-25/11	1981	Hurricane	25/11-1981	W4
18/1	1983	Hurricane-like	18/1-1983	w4
13/1	1984	Hurricane-like	13/1-1984	w4
23/6	1984	The southern parts of Denmark	23/6-1984	w2
16-17/11	1984		17/11-1984	E1
6/9	1985		6/9-1985	W2
6/11	1985	Strong storm	6/11-1985	W3
2/12	1986		2/12-1986	W2
24/9	1988	The southern parts of Denmark	24/9-1988	w2
29/11	1988		29/11-1988	W2
14/2	1989	Vestjylland	14/2-1989	w2
25-26/1	1990	Hurricane-like	26/1-1990	sw4
26/2	1990	Hurricane-like	26/2-1990	w4
20/8	1990	The southwestern parts of Denmark	20/8-1990	w1
21/9	1990	The southwestern parts of Denmark	21/9-1990	w2
9/1	1991	Hurricane-like	9/1-1991	w4
22/5	1991		22/5-1991	W1
14/1	1993	Hurricane-like, the southern parts and Bornholm	14/1-1993	w3



22/1	1993		22/1-1993	W2
3/12	1999	Hurricane, mostly the southern parts of Denmark	3/12-1999	W4
17/12	1999		17/12-1999	sw1
29-30/1	2000	Strong storm	30/1-2000	W2
28-29/1	2002	The southernmost parts of Denmark	29/1-2002	W2
27-28/10	2002	The southern parts of Denmark	28/10-2002	nw1
6/12	2003	Storm, Kattegat and coastal areas of Nordsjælland	6/12-2003	n1
18/11	2004	Storm, few coastal areas	18/11-2004	w1
8/1	2005	Strong storm, Hurricane mostly the northern part of Jutland and the coastal western Jutland	8/1-2005	W3
27/10	2006	Storm, few coastal areas	27/10-2006	w1
1/11	2006	Storm, few coastal areas	1/11-2006	*n1
1/1	2007	Storm, few coastal areas	1/1-2007	w1
11-12/1	2007	Storm, few coastal areas	12/1-2007	w1
14/1	2007	Storm, few coastal areas	14/1-2007	w1
27/6	2007	The southernmost parts of Denmark	27/6-2007	w1
31/1-1/2	2008	Storm, few coastal areas	31/1-2008	sw1
22/2	2008	Storm, few coastal areas	22/2-2008	w1
1/3	2008	Storm, few coastal areas	1/3-2008	nw1
18/11	2009	Storm, few coastal areas	18/11-2009	w1
7-8/2	2011	Storm, coastal areas	8/2-2011	w1
27-28/11	2011	Storm, most significant in the northern and eastern parts of Denmark	28/11-2011	W2
8-9/12	2011	Storm, most significant in the western and northern parts of Denmark	9/12-2011	W1
3-4/1	2012	Storm, most significant in the western and northern parts of Denmark	4/1-2012	w2
28/10	2013	Hurricane, southern parts of Denmark, record breaking in average wind speed and gust, named Allan	28/10-2013	sw4
5-6/12	2013	Hurricane-like, named Bodil	6/12-2013	nw4
14-15/3	2014	The northern parts of Jutland, Kattegat and Bornholm, named Carl	15/3-2014	nw1

Class 4	13
Class 3	16
Class 2	50
Class 1	95
Total	174



Class 3 and 4 storms in 5-year groups since 1891.

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Previous reports

Previous reports from the Danish Meteorological Institute can be found on:

<http://www.dmi.dk/laer-om/generelt/dmi-publikationer/>



Appendices - File formats and metadata

Appendix 1 Station history

Appendix 2 Observational section

Appendix 3 Daily section

Appendix 4 Monthly section

Appendix 5 Annual section

Appendix 6 Country-wise section

Appendix 7 Storm section



Appendix 1. Station history - File Formats and metadata

Appendix 1.1. File formats; Station position file

A station file included in this report contains the digitised information on the station positions and thereby on any removals of the stations during the operation period. The same metadata can also be seen in tables in Appendix 1.2.

dk_station_position

More specifically a fixed format text file and an Excel file in this report:

dk_station_position.dat

dk_station_position.xlsx

Format of the station position fixed format text file:

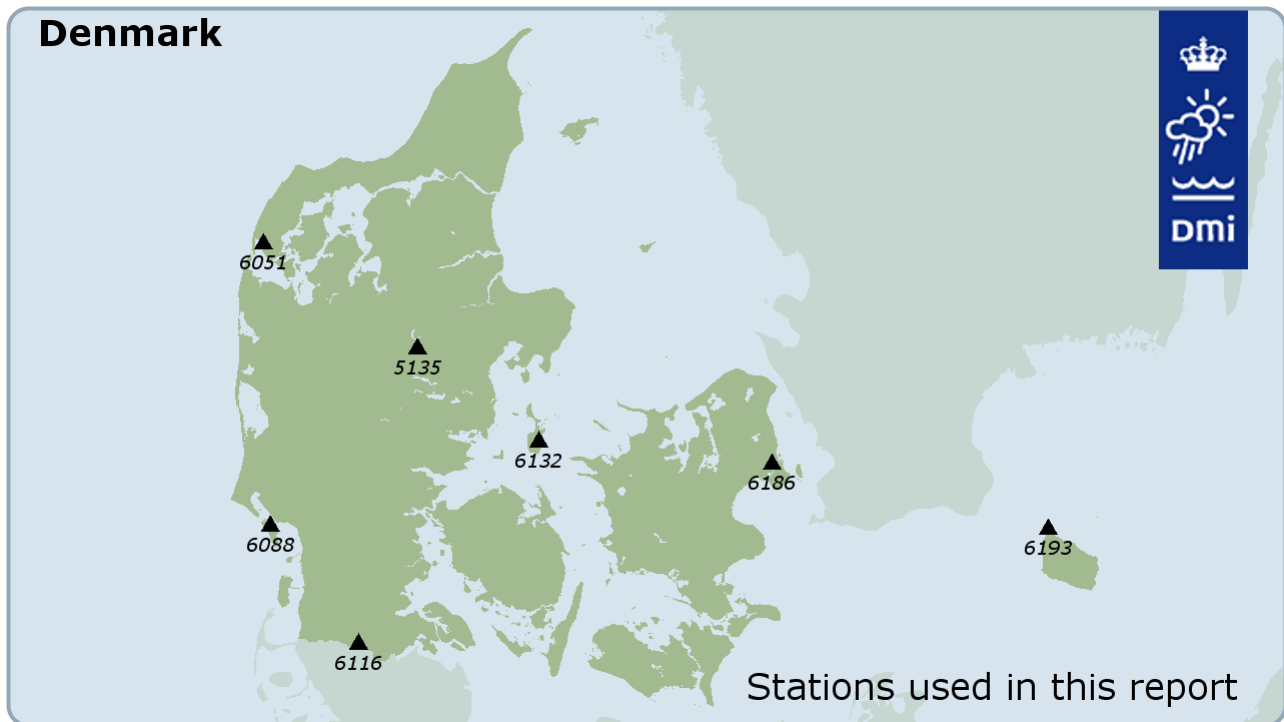
Position	Format	Description
1-5	F5.0	Station number
6-35	A30	Station name
36-45	A10	Station type (synop_dk = part of WMO synoptic net, clima_man = manual climate station, clima_aut = automatic climate station, precip_man = manual precipitation station, snow_man = manual snow observing station)
46-56	Date11	Start date (dd-mmm-yyyy)
57-67	Date11	End date (dd-mmm-yyyy)
68-70	A3	UTM zone
71-81	F11.0	Eastings
82-92	F11.0	Northings
93-98	F6.0	Elevation (metres above mean sea level)
99-109	F11.0	Latitude, degrees N (dddmmss)
110-120	F11.0	Longitude, degrees E (dddmmss)

Data are only to be used with proper reference to the accompanying report:

Cappelen, J. (ed) (2015): Denmark - DMI Historical Climate Data Collection 1768-2014 - with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.

Appendix 1.2. Metadata - Station history

By convention a time series is named after the most recent primary station delivering the data. Here is presented an overview back in time of the positions and relocations and starting and (if any) closing dates of the stations used in this report. Also presented are any positions or relocations and starting and closing dates of other stations forming part of the series and therefore referred to in the description of the data series in the next section. More metadata on the series/station may be found in [35]. The information can also be found in a text file attached to this report, see Appendix 1.1.



Station based data sets referred to in the report. Only the latest positions are marked. The official WMO station identifiers for Denmark consist of 5 digits "06xxx". However, in this report the in front "0" is omitted, giving 4 digits i.e. "6132" for Tranebjerg, which is also used on the map. The Danish national station identifiers describing climate/precipitation stations in Denmark consist of 5 digits, either the new format "05XXX" (the in front "0" is omitted, giving 4 digits i.e. "5135" for Grønåbæk or the old format, where the station number started with 20-32 dependent on the region i.e. "27080" for the old Tranebjerg station.

6051 Vestervig

No.	Name	Start	End	Type	UTM	Northings	Eastings	Longitude	Latitude	Elev.
21100	Vestervig	01-JUN-1873	30-JUN-1879	clima_man	32V	6291160	459820	82100	564600	47
21100	Vestervig	01-JUL-1879	18-SEP-1883	clima_man	32V	6292610	458640	81900	564600	25
21100	Vestervig	19-SEP-1883	16-AUG-1892	clima_man	32V	6291380	458510	81900	564600	18
21100	Vestervig	17-AUG-1892	30-JUN-1924	clima_man	32V	6291395	458670	81900	564600	22
21100	Vestervig	01-JUL-1924	12-APR-1937	clima_man	32V	6291410	458210	81900	564600	17
21100	Vestervig	13-APR-1937	31-MAR-1946	clima_man	32V	6291225	458420	81900	564600	27
21100	Vestervig	01-APR-1946	01-JAN-2000	clima_man	32V	6291492	458551	81919	564551	18
21100	Vestervig	02-JAN-2000	10-SEP-2003	precip_man	32V	6291492	458551	81919	564551	18
21100	Vestervig	11-SEP-2003	01-APR-2011	precip_man	32V	6291492	458551	81919	564551	18
21100	Vestervig	01-JAN-2000	10-SEP-2003	snow_man	32V	6291492	458551	81919	564551	18
21100	Vestervig	11-SEP-2003		snow_man	32V	6291492	458551	81919	564551	18
21100	Vestervig	17-FEB-2000	10-SEP-2003	clima_aut	32V	6291492	458551	81919	564551	18
21100	Vestervig	11-SEP-2003		clima_aut	32V	6291492	458551	81919	564551	18
21120	Tødsø	05-JUN-1881	30-JUN-1903	clima_man	32V	6298350	488600	84900	565000	33
21120	Erslev	01-NOV-1927	31-DEC-1949	clima_man	32V	6298850	484730	84500	565000	14
21120	Erslev	01-JAN-1950	31-MAY-1961	clima_man	32V	6298820	483850	84400	565000	20
21120	Erslev	01-NOV-1961	31-MAY-1974	clima_man	32V	6299080	483560	84400	565000	25
21120	Erslev	01-JUN-1974	30-JUN-1987	clima_man	32V	6299350	483300	84400	565000	19
21120	Erslev	01-JUL-1987	30-JUN-1993	precip_man	32V	6299280	483340	84400	565000	20
21120	Erslev	01-JUL-1993	01-APR-2011	precip_man	32V	6299080	483585	84400	565000	26
24020	Bovbjerg Fyr	01-MAR-1876	24-MAR-1944	clima_man	32V	6263750	445920	80700	563100	41



6120	H.C. Andersen Airport	01-OCT-2013		synop_dk	32U	6148648	584180	102000	552900	15
6169	Gniben	01-JAN-1961	31-JUL-1974	synop_dk	32V	6209380	642270	111700	560000	4
6169	Gniben	01-AUG-1974	31-MAR-1979	synop_dk	32V	6209340	642190	111700	560000	10
6169	Gniben	01-APR-1979	14-FEB-1983	synop_dk	32V	6209560	642140	111700	560100	13
6169	Gniben	15-FEB-1983		synop_dk	32V	6209553	642156	111648	560032	14

6186 Københavns Landbohøjskole

This station has been subject to urban change. Back in time the surroundings were rural whereas today the park of Landbohøjskolen with the synoptic station is surrounded by the city of Copenhagen. Observations in Copenhagen started 1751 in the tower “Rundetårn”, but the first 16 years the thermometer was situated inside a room in a little observatory near the top of the tower. In the beginning of 1767 the thermometer was situated outside the observatory facing north and from 1768 the observations were taken 4 times a day. Therefore the series presented in this report starts 1768.

No.	Name	Start	End	Type	UTM	Northings	Eastings	Longitude	Latitude	Elev.
30380	Landbohøjskolen	01-JAN-1860	01-JUL-1997	clima_man	33U	6173560	345420	123200	554100	9
6186	Landbohøjskolen	29-NOV-1995	12-JUN-1997	synop_dk	33U	6173560	345420	123200	554100	9
6186	Landbohøjskolen	13-JUN-1997	01-JUL-1997	synop_dk	33U	6174083	345667	123242	554112	7
6186	Landbohøjskolen	02-JUL-1997		synop_dk	33U	6174083	345667	123242	554112	7
6180	Københavns Lufthavn	01-JAN-1953	30-JUN-1955	synop_dk	33U	6167070	352740	124000	553800	2
6180	Københavns Lufthavn	01-JUL-1955	30-JUN-1959	synop_dk	33U	6167170	352110	123900	553800	3
6180	Københavns Lufthavn	01-JUL-1959	13-JUL-1971	synop_dk	33U	6166370	352440	123900	553700	3
6180	Københavns Lufthavn	14-JUL-1971	15-JUN-1983	synop_dk	33U	6165550	351570	123900	553700	4
6180	Københavns Lufthavn	16-JUN-1983		synop_dk	33U	6165840	351770	123900	553700	5
6183	Drogden Fyr	01-JAN-1961		synop_dk	33U	6157060	355647	124245	553213	5
30340	Københavns Toldbod	01-JAN-1886	31-DEC-1949	fuess	33U	6174250	349070	123600	554100	20
30340	Københavns Toldbod	01-JAN-1950	30-JUN-1976	fuess	33U	6174240	349110	123600	554100	20
30340	Københavns Toldbod	01-JAN-1978	30-JUN-1997	fuess	33U	6174240	349110	123600	554100	20
30340	Københavns Toldbod	01-MAY-1968	03-APR-2005	casella	33U	6174240	349110	123600	554100	20
30341	Københavns Toldbod	20-FEB-2004		clima_aut	33U	6174236	349105	123559	554121	20
30370	Botanisk Have	01-OCT-1955	31-DEC-1970	clima_man	33U	6174193	347579	123500	554100	6
30370	Botanisk Have	01-NOV-1945	30-SEP-1955	precip_man	33U	6174193	347579	123500	554100	6
30370	Botanisk Have	01-JAN-1971	01-APR-2011	precip_man	33U	6174193	347579	123500	554100	6
5735	Botanisk Have	14-JAN-2010	28-NOV-2011	synop_dk	33U	6174196	347575	123431	554118	6
5735	Botanisk Have	29-NOV-2011	23-JUL-2012	synop_dk	33U	6174199	347574	123431	554118	6
5735	Botanisk Have	24-JUL-2012		synop_dk	33U	6174194	347557	123430	554118	6
30370	Botanisk Have	01-OCT-2004		snow_man	33U	6174193	347579	123500	554100	6
30372	Rundetårn	01-JAN-1751	31-DEC-1817	clima_man	33U	6173480	347655	123437	554055	7 ^{*)}
30371	Gl. Botanisk Have	01-JAN-1818	31-DEC-1859	clima_man	33U	6173160	348485	123525	554045	3

*) The ground level of the tower is 7 m above MSL. The thermometer was situated app. 43 m above MSL.

6193 Hammer Odde Fyr/Lighthouse

No.	Name	Start	End	Type	UTM	Northings	Eastings	Longitude	Latitude	Elev.
32030	Sandvig	11-NOV-1872	31-AUG-1953	clima_man	33U	6127090	486180	144700	551700	13
32030	Sandvig	01-SEP-1953	30-JUN-1966	clima_man	33U	6127105	486140	144700	551700	13
32030	Sandvig	01-AUG-1966	30-NOV-1972	clima_man	33U	6127010	485840	144700	551700	12
32025	Hammeren Fyr	01-JAN-1880	31-JUL-1962	clima_man	33U	6126930	484770	144600	551700	77
32020	Hammer Odde Fyr	01-MAR-1953	30-JUN-1974	clima_man	33U	6128190	485630	144600	551800	7
32020	Hammer Odde Fyr	01-JUL-1974	30-JUN-1987	clima_man	33U	6128170	485710	144700	551800	11
6191	Christiansø Fyr	01-JAN-1961	31-MAR-2000	synop_dk	33U	6130820	511970	151100	551900	13
32080	Klemensker	01-OCT-1954	30-NOV-1971	clima_man	33U	6114630	487970	144900	551100	110
32080	Klemensker	01-SEP-1953	30-SEP-1954	precip_man	33U	6114630	487970	144900	551100	110
32080	Klemensker	01-OCT-1994	21-SEP-1998	precip_man	33U	6114674	488059	144900	551100	111
32080	Klemensker	22-SEP-1998	01-DEC-2004	precip_man	33U	6114671	488062	144900	551100	111
32080	Klemensker	02-DEC-2004	01-AUG-2010	precip_man	33U	6114234	488024	144900	551000	108
32080	Klemensker	01-DEC-2002	01-DEC-2004	snow_man	33U	6114671	488062	144900	551100	111
32080	Klemensker	02-DEC-2004	31-MAY-2010	snow_man	33U	6114234	488024	144900	551000	108
32175	Østerlars	15-MAY-1998	20-MAY-2008	precip_man	33U	6113107	498094	145800	551000	94
32175	Østerlars	21-MAY-2008	01-APR-2011	precip_man	33U	6113129	498051	145800	551000	94
32175	Østerlars	20-JAN-2005	20-MAY-2008	snow_man	33U	6113107	498094	145800	551000	94
32175	Østerlars	21-MAY-2008		snow_man	33U	6113129	498051	145800	551000	94
6193	Hammer Odde Fyr	05-OCT-1977	29-AUG-2001	synop_dk	33U	6128170	485710	144700	551800	11
6193	Hammer Odde Fyr	30-AUG-2001		synop_dk	33U	6128170	485579	144622	551755	8
6190	Bornholms Lufthavn	01-JAN-1959	31-MAY-1977	synop_dk	33U	6102830	483820	144500	550400	13
6190	Bornholms Lufthavn	01-JUN-1977		synop_dk	33U	6102556	484066	144500	550400	15
6199	Dueodde N Fyr	01-JAN-1959	30-SEP-1962	synop_dk	33U	6095230	504720	150400	550000	16
6199	Dueodde S Fyr	01-OCT-1962	30-JUN-1977	synop_dk	33U	6094150	504810	150500	550000	6



Appendix 2. Observational section - File Formats and metadata

Appendix 2.1. File Formats; Observation data files

The observation files included in this report contains mean sea level (MSL) atmospheric pressure observations in three data sets.

The file names are determined as follows:

dk_obs_<station number>_pppp_<period>.dat

More specifically in this report:

dk_obs_pppp_6051_1874_2014.dat

dk_obs_pppp_6088_1874_2014.dat

dk_obs_pppp_6193_1874_2014.dat

There **can** be missing dates/records/values between the start and the end date.

Format and units of mean sea level atmospheric pressure observation files:

Position	Format	Description
1-5	F5.0	Station id (= most recent station number)
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-15	F2.0	Hour (UTC)
16-20	F5.0	Atmospheric pressure reduced to MSL (0.1 hPa)

Data are only to be used with proper reference to the accompanying report:

Cappelen, J. (ed) (2015): Denmark - DMI Historical Climate Data Collection 1768-2014 - with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.

Appendix 2.2. Metadata - Description of observational atmospheric pressure datasets

Three Danish data sets have long series of atmospheric pressure observations (at MSL, mean sea level). The table presents an overview of the blended station data series (identified by the station name and station id) resulting in the long data sets and how many observations the series contains in the different parts.

Additional metadata can be seen in DMI Technical Report 97-3: North Atlantic-European pressure observations 1868-1995 - WASA dataset version 1.0 [43].

Dataset/period	Station	Start	End	Obs. hours (utc)
Vestervig 1874-2014	21100 Vestervig	01 January 1874	31 July 1987	7,13,20
	6052 Thyborøn	01 August 1987	22 November 2000	0,3,6,9,12,15,18,21
	6052 Thyborøn	22 November 2000	31 December 2014	0 – 23 every hour
Nordby/Fanø 1874-2014	25140 Nordby	01 January 1874	31 July 1987	7,13,20
	6080 Esbjerg Airport	01 August 1987	10 September 2003	0,3,6,9,12,15,18,21
	6080 Esbjerg Airport	10 September 2003	31 December 2014	0 – 23 every hour
Hammer Odde 1874-2014	32030 Sandvig or	01 January 1874	31 May 1987	7,13,20
	32020 Hammer Odde Fyr	01 June 1987	30 August 2001	0,3,6,9,12,15,18,21
	6193 Hammer Odde Fyr	30 August 2001	31 December 2014	0 – 23 every hour



Appendix 3. Daily section – File formats and metadata

Appendix 3.1. File formats; Daily data files

The daily files included in this report contain daily DMI data series 1872 - 2014 comprising different parameters for selected meteorological stations in Denmark.

The file names are determined as follows:

dk_daily_<element abbr><station number>_<period>

More specifically following fixed format text files in this report:

15 fixed format text files named dk_daily_p<station number_<period>.dat
11 fixed format text files named dk_daily_tn<station number_<period >.dat
11 fixed format text files named dk_daily_tx<station number_<period >.dat
2 fixed format text files named dk_daily_t<station number_<period >.dat
1 fixed format text file named dk_daily_n27080_period.dat
5 fixed format text files named dk_daily_pppp<station number_<period >.dat
1 fixed format text files: dk_station_ang.dat

Formats and units can be seen in the following.

From 2011 and forward interpolated values can be included in the data series.

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: DMI Historical Climate Data Collection 1768-2014, Denmark – with Danish Abstracts. DMI Technical Report 15-02. Copenhagen.

Daily accumulated precipitation files

dk_daily_p<station number_<period>.dat

The files contain daily accumulated precipitation. There are no missing dates between the start and the end date. Any missing observations are filled in by -9999.

dk_daily_p6193_1984_2014.dat
dk_daily_p6051_1874_2014.dat
dk_daily_p5135_1874_2014.dat
dk_daily_p6088_1874_2014.dat
dk_daily_p6116_1987_2014.dat
dk_daily_p26409_1995_2006.dat
dk_daily_p26410_1920_1993.dat
dk_daily_p27080_1872_2001.dat
dk_daily_p5165_2001_2014.dat
dk_daily_p30210_1875_1922.dat
dk_daily_p30210_1961_1984.dat
dk_daily_p5735_1961_2014.dat



dk_daily_p30380_1874_1996.dat
dk_daily_p32020_1961_1987.dat
dk_daily_p32030_1874_1970.dat

Format and units of daily precipitation files:

Position	Format	Description
1-5	F5.0	Station number
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-15	F2.0	Hour (Local time or UTC (since 2001 or if station number starts with 6 (station 6193, whole period))
16-20	F5.0	Accumulated Precipitation previous 24 hours (0.1 mm) -1 means more than 0 mm, but less than 0.1 mm, -2 means accumulation for several days up to the day where precipitation differs from 0, -9999 means missing value. Please note: Before 1931 the 'daily precipitation' for station 21430 may in some cases be the precipitation accumulated for several days or for the whole month.

Daily lowest temperature files

dk_daily_tn<station number>_<period>.dat

The files contain daily lowest temperatures. There are no missing dates between the start and the end date. Any missing observations are filled in by -9999.

dk_daily_tn6193_1984_2014.dat
dk_daily_tn21100_1874_2003.dat
dk_daily_tn25140_1874_2003.dat
dk_daily_tn27080_1872_2003.dat
dk_daily_tn30380_1874_1997.dat
dk_daily_tn6051_2003_2014.dat
dk_daily_tn6088_2003_2014.dat
dk_daily_tn6132_2003_2014.dat
dk_daily_tn6186_1995_2014.dat
dk_daily_tn32020_1971_1987.dat
dk_daily_tn32030_1874_1970.dat

Format and units of lowest temperature files:

Position	Format	Description
1-5	F5.0	Station number
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-15	F2.0	Hour DNT or UTC (since 2001 or if station number starts with 6)
16-20	F5.0	Lowest temperature previous 24 hours (0.1°C).



Daily highest temperature files

dk_daily_tx<station number_<period>.dat

The files contain daily highest temperatures. There are no missing dates between the start and the end date. Any missing observations are filled in by -9999.

dk_daily_tx6193_1984_2014.dat
dk_daily_tx21100_1874_2003.dat
dk_daily_tx25140_1874_2003.dat
dk_daily_tx27080_1873_2003.dat
dk_daily_tx30380_1874_1997.dat
dk_daily_tx6051_2003_2014.dat
dk_daily_tx6088_2003_2014.dat
dk_daily_tx6132_2003_2014.dat
dk_daily_tx6186_1995_2014.dat
dk_daily_tx32020_1971_1987.dat
dk_daily_tx32030_1874_1970.dat

Format and units of highest temperature files:

Position	Format	Description
1-5	F5.0	Station number
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-15	F2.0	Hour DNT or UTC (since 2001 or if station number starts with 6)
16-20	F5.0	Highest temperature (0.1°C). The highest temperature, covering the previous 24 hours, is read in the morning (the same as the lowest temperature). For the manual climate stations (21100, 25140, 27080, 30380, 32020 and 32030) please note: During the periods 1 Jan 1874 - 31 Dec 1912 and 2 Jan 1971 - 31 Dec 2000 the highest temperature is listed on the date it has been read. During the period 1 Jan 1913 - 1 Jan 1971 the highest temperature is listed on the previous day (where it most often occurs). This change in practice was only regarding the highest temperature, not the lowest temperature. The result is repeated here in the data files as listed above. Because of the change back and forth in practise the data files (and DMI annals) hold no highest temperature for the 24-hours period starting in the morning 31 Dec 1912 and ending in the morning 1 Jan 1913. And conversely the highest temperature of the 24-hours that starts in the morning 1 Jan 1971 and ends in the morning 2 Jan 1971 is listed TWO times in the data files: With time stamp 1 Jan 1971 at 8 hours AND with time stamp 2 Jan 1971 at 8 hours, just as the change of practice dictates for those dates.



Air temperature at 14 hours DNT or 12 UTC files

dk_daily_t<station number_<period>.dat

The files contain air temperature observed daily at 14 hours DNT or 12 UTC. There are no missing dates between the start and the end date. Any missing observations are filled in by -9999.

dk_daily_t27080_1872_2003.dat

dk_daily_t6132_2003_2014.dat

Format and units of the air temperature 1400 hours files:

Position	Format	Description
1-5	F5.0	Station number
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-15	F2.0	Hour (until and including January 2000: DNT: Danish Normal Time. Starting 1 February 2000: UTC)
16-20	F5.0	Air temperature (0.1°C).

Cloud cover at 8, 14 and 21 hours DNT file

dk_daily_n<station number_<period>.dat

The file contains cloud cover observed daily at 8, 14 and 21 hours DNT. There are no missing dates between the start and the end date. Any missing observations are filled in by -9999.

dk_daily_n27080_1872_2000.dat

Format and units of the cloud cover file:

Position	Format	Description
1-5	F5.0	Station number
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-18	F5.0	Cloud cover at 8 (Please note change in units listed below)
9-23	F5.0	Cloud cover at 14 (Please note change in units listed below)
24-28	F5.0	Cloud cover at 21 (Please note change in units listed below)

Cloud cover units:

1872-1873:	0-4	(0= cloudless, 1= 1/4 part clouded, ..., 4= overcast)
1874-1952:	0-10	(0= cloudless, 1= 1/10 part clouded, ..., 10= overcast)
Since 1953:	0-8	(0= cloudless, 1= 1/8 part clouded, ..., 8 = overcast)

Daily atmospheric pressure files

dk_daily_pppp<station number><period>.dat

The files contain observed daily average atmospheric pressure (MSL). There are no missing dates



between the start and the end date. Any missing observations are filled in by -9999.

dk_daily_pppp21100_1874_1987.dat
 dk_daily_pppp25140_1874_1987.dat
 dk_daily_pppp6052_1962_2014.dat
 dk_daily_pppp6080_1959_2014.dat
 dk_daily_pppp6193_1874_2014.dat

Format and units of atmospheric pressure observation files:

Position	Format	Description
1-5	F5.0	Station number
6-9	F4.0	Year
10-11	F2.0	Month
12-13	F2.0	Day
14-15	F2.0	Hour (UTC)
16-20	F5.0	Atmospheric pressure reduced to MSL (0.1 hPa)
21-25	F5.0	No. of observations in daily average (-9999: Not available. Usually 8, at least 4 observations per day as concerns the newest part of the series)

Station angles file

The file contains the digitised information on the rain gauge exposure. The information is expressed as the angle to the horizon in eight directions, as the summarising angle index and the exposure class. The information is only available for some of the stations and only through the recent years.

The file name is:

dk_station_ang.dat

The file has the following format:

Position	Format	Description
1-5	F5.0	Station number
6-25	Datetime20	Start date (DD-MMM-YYYY HH:MM:SS)
26-45	Datetime20	End date (DD-MMM-YYYY HH:MM:SS)
46-51	F6.0	Angle towards N
52-57	F6.0	Angle towards NE
58-63	F6.0	Angle towards E
64-69	F6.0	Angle towards SE
70-75	F6.0	Angle towards S
76-81	F6.0	Angle towards SW
82-87	F6.0	Angle towards W
88-93	F6.0	Angle towards NW
94-99	F6.0	Angle index
100-177	A78	Remarks
178-178	A1	Exposure class

The following dependence of exposure class on angle index are used:

Exposure class	Description	Min. index	Max. index
A	Well sheltered	20	30
B	Moderately sheltered	6	19
C	Freely exposed, unsheltered	0	5
D	Overprotected, too well sheltered	>=31	

Appendix 3.2. Metadata - Description of daily station data series

Accumulated precipitation

Fifteen Danish station series with a record of daily accumulated precipitation can be blended into seven long data sets. The table presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Dataset/period	Station	Start	End
Vestervig 1874-2014	6051/21100 Vestervig	1 January 1874	31 December 2014
Grønbæk 1874-2014	5135/21430 Grønbæk/ Allingskovgård	1 September 1874	31 December 2014
Nordby/Fanø 1874-2014	6088/25140 Nordby	1 January 1874	31 December 2014
Store Jyndeved 1920-2014	26410 Broderup/Bajstrup/ Gårdeby/Rødebæk/ Broderup Mark	1 July 1920	30 June 1993
	26409 Tinglev	1 June 1995	31 December 2006
	6116/26400 Store Jyndeved	1 July 1987	31 December 2014
Tranebjerg 1872-2014	27080 Tranebjerg	1 December 1872	01 August 2001
	5165/27082 Tranebjerg Øst	02 August 2001	31 December 2014
København 1874-2014	30380 Landbohøjskolen	1 January 1874	1 October 1996
	30210 Meteorologisk Institut	1 January 1875	30 June 1922
	30210 Meteorologisk Institut	1 January 1961	31 December 1984
	5735/30370 Botanisk Have	1 January 1961	31 December 2014
Hammer Odde 1874-2014	32030 Sandvig	1 January 1874	31 December 1970
	32020 Hammer Odde Fyr	1 January 1961	30 June 1987
	6193 Hammer Odde Fyr	1 January 1984	31 December 2014

Lowest temperature

Eleven Danish station series with a record of daily lowest temperatures can be blended into five long data sets. The table presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Site and period	Station	Start	End
Vestervig 1874-2014	21100 Vestervig	19 June 1874	10 September 2003
	6051 Vestervig	02 October 2003	31 December 2014
Nordby/Fanø 1874-2014	25140 Nordby	1 May 1874	18 July 2003
	6088 Nordby	25 July 2003	31 December 2014
Tranebjerg 1872-2014	27080 Tranebjerg	1 December 1872	10 August 2003
	6132 Tranebjerg	21 August 2003	31 December 2014
København 1874-2014	30380 Landbohøjskolen	1 January 1874	30 June 1997
	6186 Landbohøjskolen	1 December 1995	31 December 2014
Hammer Odde	32030 Sandvig	1 January 1874	31 December 1970

1874-2014	32020 Hammer Odde Fyr 6193 Hammer Odde Fyr	1 January 1971 1 January 1984	24 June 1987 31 December 2014
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Highest temperature

Eleven Danish station series with a record of daily highest temperatures can be blended into five long data sets. The table presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Site and period	Station	Start	End
Vestervig 1874-2014	21100 Vestervig 6051 Vestervig	2 August 1874 02 October 2003	10 September 2003 31 December 2014
Nordby/Fanø 1874-2014	25140 Nordby 6088 Nordby	2 May 1874 25 July 2003	18 July 2003 31 December 2014
Tranebjerg 1873-2014	27080 Tranebjerg 6132 Tranebjerg	1 January 1873 21 August 2003	10 August 2003 31 December 2014
København 1874-2014	30380 Landbohøjskolen 6186 Landbohøjskolen	1 January 1874 1 December 1995	30 June 1997 31 December 2014
Hammer Odde 1874-2014	32030 Sandvig 32020 Hammer Odde Fyr 6193 Hammer Odde Fyr	2 April 1874 1 January 1971 1 January 1984	31 December 1970 24 June 1987 31 December 2014

Air temperature at 14 hours DNT or 12 UTC

Two Danish station series with a record of air temperatures measured at 14 hours DNT (old part of the series) or 12 UTC (= 13 hours DNT, newer part of the series) can be blended into one long data set. The table presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report). Overlap periods have been included when available.

Site and period	Station	Start	End
Tranebjerg 1872-2014	27080 Tranebjerg 6132 Tranebjerg	1 December 1872 21 August 2003	20 August 2003 31 December 2014

Cloud cover at 8, 14 and 21 hours DNT

One Danish station series with a long record of cloud cover at 8, 14 and 21 hours DNT exists. The table presents an overview of this station data series (identified by the station name and number).

Site and period	Station	Start	End
Tranebjerg 1872-2000	27080 Tranebjerg	1 December 1872	31 January 2000

Atmospheric pressure

Five Danish station series with a record of mean daily atmospheric pressure data can be blended into three long data sets. The table presents an overview of these station data series (identified by the station name and number) and the possible blended datasets making up the long series (not in this report except the Hammer Odde series). Overlap periods have been included when available.



Site and period	Station	Start	End
Vestervig 1874-2014	21100 Vestervig 6052 Thyborøn	01 January 1874 02 March 1962	01 August 1987 31 December 2014
Nordby/Fanø 1874-2014	25140 Nordby 6080 Esbjerg Airport	01 January 1874 29 March 1959	01 August 1987 31 December 2014
Hammer Odde 1874-2014	32030 Sandvig or 32020 Hammer Odde Fyr 6193 Hammer Odde Fyr	01 January 1874 - 02 June 1987	- 1 June 1987 31 December 2014

Additional information concerning daily averages and atmospheric pressure:

At DMI daily averages on observations are made (as a principle) for the meteorological day from (but not including) the previous day at 6 hours UTC until and including the actual day at 6 hours UTC and the meteorological day is given the date of the day it ends. The observation hours and observation frequencies varies for the station types used, therefore details on the number of observations forming part of the daily values are included below.

21100 Vestervig and 25140 Nordby (manually operated climate station, observing 8, 14 and 21 hours DNT):

The daily average (approximating the '6 hours UTC to 6 hours UTC' definition) is made from three measurements: 14 and 21 hours DNT the previous day and 8 hours DNT on the actual day (or at least two observations). The date of the daily value is the date of the day it ends. The observations were station level data and were reduced to MSL following the formulas described in the subsection 'Concerning reduction to MSL' below.

DNT refers to Danish normal time, which is the time in a given time zone in contrast to summer time, where 1 hour is added. In Denmark the normal time is UTC+1. UTC is "Universal Time Coordinated" - a global indication of time, which refers to the mean solar time on the meridian of Greenwich, England, which is the conventional 0-meridian for geographic longitude.

6052 Thyborøn (synoptical station at least observing 0,3,6,9,12,15,18 and 21 hours UTC):

The data are averaged over the meteorological day (6 to 6 hours UTC). The average was made from the available measurements at 9, 12, 15, 18, 21, 0, 3 and 6 hours UTC if at least four of these measurements were available. The data are MSL pressure.

6080 Esbjerg Airport (synoptical station at least observing 0,3,6,9,12,15,18 and 21 hours UTC):

The data are averaged over the meteorological day (6 to 6 hours UTC). The average was made from the available measurements at 9, 12, 15, 18, 21, 0, 3 and 6 hours UTC if at least four of these measurements were available. The data are MSL pressure. During the period 1964-1971 the station in the winter only has measurements during daytime and consequently many daily averages are missing during that period.

6193 Hammer Odde Fyr (synoptical station at least observing 0,3,6,9,12,15,18 and 21 hours UTC) and 32030 Sandvig/ 32020 Hammer Odde Fyr (manually operated climate station, observing 8, 14 and 21 hours DNT):

1 January 1874 – 1 June 1987 the data are from the climate stations 32030 Sandvig and 32020 Hammer Odde Fyr and the averaging follows that of 21100 Vestervig and 25140 Nordby (see above). The observations were station level data and were reduced to MSL following the formulas described in the subsection 'reduction to MSL' below. 2 June 1987 – 31 December 2014 the data are from 6193 Hammer Odde Fyr and the averaging follows that of 6052 Thyborøn.



Concerning reduction to MSL

As part of the WASA project [43], selected DMI series of pressure observations 1874-1970 were digitised. The pressure observations were digitised from the meteorological yearbooks, which means that the observations were station level data corrected for index error, temperature and, since 1893, gravity.

Important note: For the present data set, the pressure data from these “old” manually operated climate stations were reduced to mean sea level applying the formulas that can be seen in Appendix 3.3. Other adjustments (Appendix 3.3) have not been applied to the daily value dataset. This is the explanation for small differences between the daily series presented in section 5.2.6 and the daily series that can be calculated using the homogenized atmospheric pressure observations presented in section 4.2.1. It is advised for the reader to take this probable need of adjustment into account when using the daily value data set.

Appendix 3.3. Information concerning atmospheric pressure data

The pressure data from the old manually operated climate stations were reduced to mean sea level by applying the formulas that can be seen in tables A3.3.1, A3.3.2, A3.3.3 and A3.3.4, see [9], [43].

Station 21100 Vestervig Reduction to mean sea level		
First (yyyy.mm)	Last (yyyy.mm)	Pressure reduced to mean sea level (0.1 hPa) =
.	1879.06	$P * (1 - 0.00259 * \cos(2 * 56.75 * 3.14/180)) * (1 + 9.82/287.04 * 47.4/(T/10+273.15))$
1879.07	1883.09	$P * (1 - 0.00259 * \cos(2 * 56.75 * 3.14/180)) * (1 + 9.82/287.04 * 25.7/(T/10+273.15))$
1883.10	1892.12	$P * (1 - 0.00259 * \cos(2 * 56.75 * 3.14/180)) * (1 + 9.82/287.04 * 25.0/(T/10+273.15))$
1893.01	1924.06	$P * (1 + 9.82/287.04 * 25.0/(T/10+273.15))$
1924.07	1937.03	$P * (1 + 9.82/287.04 * 19.3/(T/10+273.15))$
1937.04	1946.03	$P * (1 + 9.82/287.04 * 27.0/(T/10+273.15))$
1946.04	1946.04	$P * (1 + 9.82/287.04 * 19.0/(T/10+273.15))$
1946.05	.	$P * (1 + 9.82/287.04 * 19.6/(T/10+273.15))$

Table A3.3.1. Formulas to obtain mean sea level pressure for station 21100 Vestervig from the data in the internal DMI database 'wasa' (1874-1970) and 'clima_man' (1971-1987). Until and including 1892 the formulas are also correcting the pressure for gravity. The formulas are stored in the database 'wasa_formula'. 'P' is the station level pressure (0.1 hPa) and 'T' is the temperature at station level (0.1°C).

Station 25140 Nordby Reduction to mean sea level		
First (yyyy.mm)	Last (yyyy.mm)	Pressure reduced to mean sea level (0.1 hPa) =
.	1892.04	$P * (1 - 0.00259 * \cos(2 * 55.5 * 3.14/180)) * (1 + 9.82/287.04 * 5.5/(T/10+273.15))$
1892.05	1892.12	$P * (1 - 0.00259 * \cos(2 * 55.5 * 3.14/180)) * (1 + 9.82/287.04 * 8.0/(T/10+273.15))$
1893.01	1899.11	$P * (1 + 9.82/287.04 * 8.0/(T/10+273.15))$
1899.12	1928.07	$P * (1 + 9.82/287.04 * 5.5/(T/10+273.15))$
1928.08	1936.03	$P * (1 + 9.82/287.04 * 10.5/(T/10+273.15))$
1936.04	1944.11	$P * (1 + 9.82/287.04 * 6.9/(T/10+273.15))$
1944.12	1945.05	$P * (1 + 9.82/287.04 * 7.0/(T/10+273.15))$
1945.06	1955.11	$P * (1 + 9.82/287.04 * 3.0/(T/10+273.15))$
1955.12	1960.08	$P * (1 + 9.82/287.04 * 9.7/(T/10+273.15))$
1960.09	.	$P * (1 + 9.82/287.04 * 6.7/(T/10+273.15))$

Table A3.3.2. Formulas to obtain mean sea level pressure for station 25140 Nordby, Fanø from the data in the internal DMI database 'wasa' (1874-1970) and 'clima_man' (1971-1987). Until and including 1892 the formulas are also correcting the pressure for gravity. The formulas are stored in the database 'wasa_formula'. 'P' is the station level pressure (0.1 hPa) and 'T' is the temperature at station level (0.1°C).

Station 32030 Sandvig Reduction of atmospheric pressure to mean sea level		
First (yyyy.mm)	Last (yyyy.mm)	Pressure reduced to mean sea level (0.1 hPa) =
-	1892.12	$P * (1 - 0.00259 * \cos(2 * 55.25 * 3.14/180)) * (1 + 9.82/287.04 * 15.1/(T/10+273.15))$
1893.01	1942.08	$P * (1 + 9.82/287.04 * 15.1/(T/10+273.15))$
1942.09	1966.08	$P * (1 + 9.82/287.04 * 11.0/(T/10+273.15))$
1966.09	1969.12	$P * (1 + 9.82/287.04 * 21.7/(T/10+273.15))$

Table A3.3.3. Formulas to obtain mean sea level pressure for station 32030 Sandvig, Bornholm from the data in the internal DMI database 'wasa' (1874-1970) listed as '6193'. Until and including 1892 the formulas are also correcting the pressure for gravity. The formulas are stored in the database 'wasa_formula'. 'P' is the station level pressure (0.1 hPa) and 'T' is the temperature at station level (0.1°C). The data from 1970 was already reduced to MSL.

Station 32020 Hammer Odde Fyr/Lighthouse Reduction of atmospheric pressure to mean sea level		
First (yyyy.mm)	Last (yyyy.mm)	Pressure reduced to mean sea level (0.1 hPa) =
1971.01	-	$P * (1 + 9.82/287.04 * 10.9/(T/10+273.15))$

Table A3.3.4. Formulas to obtain mean sea level pressure for station 32020 Hammer Odde Fyr, Bornholm from the data in the internal DMI database 'wasa' (1970) listed as '6193' and 'clima_man' (1971-1987). The formulas are stored in the database 'wasa_formula'. 'P' is the station level pressure (0.1 hPa) and 'T' is the temperature at station level (0.1°C). The data from 1970 was already reduced to MSL.

Appendix 3.4. More information concerning the series of atmospheric pressure

The reduction formulas of tables A3.3.1 to A3.3.4 in Appendix 3.3 make use of the barometer heights listed in tables A3.4.1 to A3.4.5 below.

To homogenize the 21100 Vestervig atmospheric pressure and the 25140 Nordby atmospheric pressure observation series of the WASA dataset were additionally added the adjustments (units 0.1 hPa) listed in tables A3.4.4 and A3.4.5 (look for type '11' and '12'). **These adjustments have not been applied to the present daily value dataset, but available information on the adjustments is included in tables A3.4.4 and A3.4.5. It is advised for the reader to take this probable need of adjustment into account when using the data.**

Station 32030 Sandvig metadata			
Start	End	Type	Description
18721111	19660901	1	55 17'N 14 47'E
19660901	-	1	15 17'N 14 46'E (Strandgade 17)
18721111	19660901	2	H = 14 m
19660901	19660901	2	Hs = 12 m
19110112	19110112	2	Hb = 15.1 m
19420824	19420824	2	Hb = 15.1 m
19420825	19560101	2	Hb = 11 m
19560101	19620101	2	Hb = 22.0 m (but same observer)
19620101	19660914	2	Hb = 21.7 m (but same observer)
19660914	-	2	Hb = 11.7 m (Strandgade 17)
18721204	18880817	5	Kapplersk barometer no. 9
18880817	18971106	5	Bar. no. 2094
18971106	-	5	Bar. no. 1381
18730101	-	6	0.1 mm Hg – 7000
18730101	18930101	7	$P = (p8+p14+p21)/3$
18930101	19550601	7	$P = (p8+p14+p21)/3 + \text{corr. } 45 \text{ N}$
19550601	-	7	$P = (p8+p14+p21)/3 + \text{corr. } 45 \text{ N} + \text{red. sea level}$
18730101	18930101	10	$P = 4/3 * (7000 + p) * (1 - k1 * \cos(2 * \emptyset)) * (1 + Hb/k2/(k3+t))$
18930101	19560101	10	$P = 4/3 * (7000 + p) * (1 + Hb/k2/(k3+t))$ in 0.1 hPa
19560101	-	10	$P = 4/3 * (7000 + p)$ in 0.1 hPa
-	18921200	10	$P * (1 - 0.00259 * \cos(2 * 55.25 * 3.14/180)) * (1 + 9.82/287.04 * 15.1/(T/10+273.15))$
18930100	19420800	10	$P * (1 + 9.82/287.04 * 15.1/(T/10+273.15))$
19420900	19530800	10	$P * (1 + 9.82/287.04 * 11.0/(T/10+273.15))$
19530900	19550500	10	$P * (1 + 9.82/287.04 * 21.7/(T/10+273.15))$

Table A3.4.1. Meta data regarding pressure measurements at station 32030 Sandvig, Bornholm (used in the 6193 Hammer Odde pressure series) (from NACD and WASA projects, see list of references). Description type number: 2=regarding vertical position. 5=regarding the instrument. 6=units of original measurements and later changes. 7=Formula for calculating originally published monthly values. 8=environment. 9=Time series forming part of primary time series. 10=Formula. Calculations made after original publication, e.g. reduction of atmospheric pressure. 11=Test procedure, most important results by comparison with neighbouring stations. 12= Adjustment made after test, given as 12 monthly values (0.1 hPa).

Station 32020 Hammer Odde Fyr (lighthouse) metadata			
Start	End	Type	Description
19530301	19740701	1	55 18' N 14 46' E
19740701	-	1	55 18' N 14 47' E
19530301	19740701	2	Hs = 7 m
19740701	19800101	2	Hs = 11 m
19800101	19800101	2	Hs = 11.0 m
19530308	19550501	3	M.P. J..... (signature illegible)
19550501	19550601	3	J. Jensen
19550601	19661101	3	E. Due
19661101	19670301	3	J. Kyhn-Madsen
19670301	19700801	3	E. Due
19700801	19701001	3	Mogens Christensen
19701001	-	3	Pedersen
19530301	19530308	4	8, 14, 21 C.E.T.
19530308	-	4	8, 14, 21 C.E.T.
19530301	19720101	8	Source of data: Station book.
19720101	19740701	8	source of data: klima_man.
19740701	-	8	Therm. Screen and prec. gauge moved
19540701	19800101	2	Hb = 11 m
19800101	19800101	2	Hb = 10.9 m
19540701	19620103	5	Barometer no.?
19620103	-	5	Adie no. 2179
19540701	19710101	7	$P = (p8+p14+p21)/3 + \text{corr } 45 \text{ N} + \text{red. sea level}$
19710101	-	7	$P = (p8+p14+p21)/3 + \text{corr. } 45\text{N}$
19540701	-	10	$P = 4/3*(7000+p)$
19710100	-	10	$P * (1 + 9.82/287.04 * 10.9/(T/10+273.15))$

Table A3.4.2. Meta data regarding pressure measurements at station 32020 Hammer Odde Fyr, Bornholm (used in the 6193 Hammer Odde pressure series) (from NACD and WASA projects, see list of references). Description type number: 2=regarding vertical position. 5=regarding the instrument. 6=units of original measurements and later changes. 7=Formula for calculating originally published monthly values. 8=environment. 9=Time series forming part of primary time series. 10= Formula. Calculations made after original publication, e.g. reduction of atmospheric pressure. 11= Test procedure, most important results by comparison with neighbouring stations. 12= Adjustment made after test, given as 12 monthly values (0.1 hPa).

Station 32025 Hammeren Fyr (Lighthouse) metadata			
Start	End	Type	Description
18800121	-	1	55 17'N 14 47'E 33U 6126.930 484.770
18800121	-	2	Hs = 77.4 m
19441130	19441130	8	Lighthouse evacuated
18880821	19110501	2	Hb = 80 m
19110501	19110501	2	Hb = 88 m
19550701	19550701	2	Hb = 76.51 m
18880821	19040806	5	Aneroidbarometer no. 16
19040806	19110501	5	Bar. no. 2571
19110501	19110501	5	Bar. no. 2571
19590601	19590601	5	Bar. no. 2571
19120101	-	6	0.1 mm Hg - 7000
19120101	-	7	$P = (p8+p14+p21)/3 + \text{corr. } 45 \text{ N}$
18880821	19120101	8	No NACD-data until 1912
19120101	19170101	8	NACD-data from 1912 to 1916 except 1914
19170101	19530101	8	No NACD-data from 1917 to 1953
19530101	19530101	8	Data from 1953 not reduced to sea level
19120101	-	10	$P=4/3*(7000+p)*(1+Hb/k2/(k3+t))$ in 0.1 hPa
-	-	10	$P * (1 + 9.82/287.04 * 76.5/(T/10+273.15))$

Table A3.4.3. See caption for table A3.4.1 and A3.4.2.

Station 21100 Vestervig metadata			
Start	End	Type	Description
18730603	18790701	2	Hb = 47.4 m (Hurupvej 34)
18790701	18831001	2	Hb = 25.7 m (Lindalsminde skole)
18831001	18920816	2	Hs=18-19 m on map: Hb=25.0 m, disputed point!
18920816	19240630	2	Hs=22 m on map, Hb=25.0 m, matter of dispute!
19240630	19370413	2	Hb = 19.3 m (Vestergade 45)
19370413	19460401	2	Hb = 27.0 m (Margrethevej 6)
19460401	19810101	2	Hb = 19.6 m (Klostergade 20)
19810101	19810101	2	Hb = 19.6 m
18730603	18760722	5	Barometer (Kappler) no. 1188
18760722	18800324	5	no. 6
18800324	18800324	5	Barometer cleaned. Reduction changed.
18831001	18831001	5	Bar. No. 6
18920725	18930510	5	Barometer new. No number.
18930510	18930907	5	Bar. No. 2233
18930907	18970917	5	Bar. No. 2177
18970917	-	5	Bar. No. 2364
18731201	-	6	0.1 mm Hg – 7000
18731201	18930101	7	$P = (p8+p14+p21)/3$
18930101	19530101	7	$P=(p8+p14+p21)/3 + \text{corr. } 45 \text{ N}$
19530101	19710101	7	$P=(p8+p14+p21)/3 + \text{corr. } 45 \text{ N} + \text{red. sea level}$
19710101	-	7	$P=(p8+p14+p21)/3 + \text{corr. } 45 \text{ N}$
18870819	18870819	8	New reduction table
18731201	18930101	10	$P=4/3*(7000+p)*(1-k1*\cos(2*\emptyset))*(1+Hb/k2/(k3+t))$
18930101	19530101	10	$P=4/3*(7000+p)*(1+Hb/k2/(k3+t))$ in 0.1 hPa
19530101	19710101	10	$P=4/3*(7000+p)$ in 0.1 hPa
19710101	-	10	$P=4/3*(7000+p)*(1+Hb/k2/(k3+t))$ in 0.1 hPa
19870800	-	9	6052
-	18790600	10	$P * (1 - 0.00259 * \cos(2 * 56.75 * 3.14/180)) * (1 + 9.82/287.04 * 47.4/(T/10+273.15))$
18790700	18830900	10	$P * (1 - 0.00259 * \cos(2 * 56.75 * 3.14/180)) * (1 + 9.82/287.04 * 25.7/(T/10+273.15))$
18831000	18921200	10	$P * (1 - 0.00259 * \cos(2 * 56.75 * 3.14/180)) * (1 + 9.82/287.04 * 25.0/(T/10+273.15))$
18930100	19240600	10	$P * (1 + 9.82/287.04 * 25.0/(T/10+273.15))$
19240700	19370300	10	$P * (1 + 9.82/287.04 * 19.3/(T/10+273.15))$
19370400	19460300	10	$P * (1 + 9.82/287.04 * 27.0/(T/10+273.15))$
19460400	19460400	10	$P * (1 + 9.82/287.04 * 19.0/(T/10+273.15))$
19460500	19521200	10	$P * (1 + 9.82/287.04 * 19.6/(T/10+273.15))$
19710100	-	10	$P * (1 + 9.82/287.04 * 19.6/(T/10+273.15))$
-	19240600	11	97.5% significant break, station moved
-	18920800	11	97,5% significant break, station moved
-	19671200	11	97.5% significant break, not supported in meta data
-	19240600	12	-4.0-4.0-4.0-4.0-4.0-4.0-4.0-4.0-4.0-4.0-4.0-4.0
-	18920800	12	4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0
-	19671200	12	7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0

Table A3.4.4. Meta data regarding pressure measurements at station 21100 Vestervig (from NACD and WASA projects, see references). Description type number: 2=regarding vertical position. 5=regarding the instrument. 6=units of original measurements and later changes. 7=Formula for calculating originally published monthly values. 8=environment. 9=Time series forming part of primary time series. 10= Formula. Calculations made after original publication, e.g. reduction of atmospheric pressure. 11= Test procedure, most important results by comparison with neighbouring stations. 12= Adjustment made after test, given as 12 monthly values (0.1 hPa) to be added.



Station 25140 Nordby metadata			
Start	End	Type	Description
-	19940114	2	No barometer on this station
18711201	18740101	2	Hb = 5.5 m (Hovedgaden 101)
18740101	18740101	2	Hb = 5.5 m (Hovedgaden 101)
18920501	18991201	2	Hb = 8.0 m. (Nordby Realskole)
18991201	19030101	2	Hb = 5.5 m (Hovedgaden 101)
19030101	19030101	2	Hb = 5.5 m (Hovedgaden 101)
19050101	19050101	2	Hb= 5.5 m (Hovedgaden 103?)
19130101	19130101	2	Hb = 5.5 m (Hovedgaden 103)
19280806	19360405	2	Hb = 10.5 m (Vestervejen 43)
19360405	19441216	2	Hb = 6.9 m (Kallesbjergvej 1)
19441216	19450615	2	Hb = 7 m? (situated on first floor?)
19450615	19551121	2	Hb = 3.0 m (moved to ground floor?)
19551121	19600822	2	Hb = 9.7 m Navigationskolen, Vestervejen 1
19600822	19940114	2	Hb = 6.7 m (Bavnebjerg Toft 1)
-	19940114	5	No barometer
-	19420620	5	Barometer broken
18710723	18730601	5	Siphon barometer
18730601	18770326	5	Kappler mercury (cistern) barometer no. 4
18770326	18770627	5	Bar. no. 14
18770627	18780501	5	Bar. no. 12
18780501	18780501	5	Bar. no.?
18801227	18801227	5	New reduction tabel.
18870501	18870501	5	Barometer needs cleaning
18870721	18870721	5	Barometer cleaned?
18870820	18950721	5	Bar. no. 2015
18950721	18950816	5	Bar. no. 3021
18950816	18950816	5	Some data unreliable
18980929	19001218	5	Bar. no. 2177
19001218	19360405	5	Bar. no. 2439
19360405	19361220	5	Barometer moved
19361220	19420620	5	Bar. no. 115521
19420929	19490510	5	Bar. no. 194704
19490510	19490510	5	Barometer no.?
18720101	-	6	0.1 mm Hg – 7000
18720101	18930101	7	$P=(p8+p14+p22)/3$
18930101	19280806	7	$P=(p8+p14+p22)/3 + \text{corr. } 45 \text{ N}$
19280806	-	7	$P = (p8+p14+p21)/3 + \text{corr. } 45 \text{ N}$
19280801	19360405	8	Station moved to Vestervejen 23
19360405	19441216	8	Station moved to Kallesbjergvej 1
19441216	19530101	8	Station moved to Sparekassen, Hovedgaden?
19530101	19530101	8	From 1953: data not reduced to sea level
18720101	18930101	10	$P=4/3*(7000+p)*(1-k1*\cos(2*\emptyset))*(1+Hb/k2/(k3+t))$
18930101	-	10	$P=4/3*(7000+p)*(1+Hb/k2/(k3+t))$ in 0.1 hPa
19420600	19420900	9	25100
19520900	19520900	9	25150
19521100	19521100	9	25150
19870800	-	9	6080
-	18920400	10	$P * (1 - 0.00259 * \cos(2 * 55.5 * 3.14/180)) * (1 + 9.82/287.04 * 5.5/(T/10+273.15))$
18920500	18921200	10	$P * (1 - 0.00259 * \cos(2 * 55.5 * 3.14/180)) * (1 + 9.82/287.04 * 8.0/(T/10+273.15))$
18930100	18991100	10	$P * (1 + 9.82/287.04 * 8.0/(T/10+273.15))$
18991200	19280700	10	$P * (1 + 9.82/287.04 * 5.5/(T/10+273.15))$
			table continues.....
		table continued
19280800	19360300	10	$P * (1 + 9.82/287.04 * 10.5/(T/10+273.15))$
19360400	19441100	10	$P * (1 + 9.82/287.04 * 6.9/(T/10+273.15))$
19441200	19450500	10	$P * (1 + 9.82/287.04 * 7.0/(T/10+273.15))$



Station 25140 Nordby metadata			
Start	End	Type	Description
19450600	19551100	10	$P * (1 + 9.82/287.04 * 3.0/(T/10+273.15))$
19551200	19600800	10	$P * (1 + 9.82/287.04 * 9.7/(T/10+273.15))$
19600900	-	10	$P * (1 + 9.82/287.04 * 6.7/(T/10+273.15))$
-	19420900	11	97,5% significant break, barometer broken
-	19360400	11	97,5% significant break, station moved
-	19661200	11	97,5% significant break, not supported in meta data
-	19040200	11	97,5% significant break, station moved
-	19441200	11	97,5% significant break, station moved
-	19420900	12	12.012.012.012.012.012.012.012.012.012.0
-	19360400	12	3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0
-	19661200	12	6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0
-	19040200	12	5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0
-	19441200	12	-21 -21 -21 -21 -21 -21 -21 -21 -21 -21 -21

Table A3.4.5. Meta data regarding pressure measurements at station 25140 Nordby, Fanø (from NACD and WASA projects, see references). Description type number: 2=regarding vertical position. 5=regarding the instrument. 6=units of original measurements and later changes. 7=Formula for calculating originally published monthly values. 8=environment. 9=Time series forming part of primary time series. 10= Formula. Calculations made after original publication, e.g. reduction of atmospheric pressure. 11= Test procedure, most important results by comparison with neighbouring stations. 12= Adjustment made after test, given as 12 monthly values (0.1 hPa) to be added.

Appendix 3.5. Introduction of the Hellmann rain gauge and Stevenson screens

Some events like replacement of rain gauges and thermometer screens can sometimes cause serious “break points” in the time series. In table A3.5.1 is listed relevant information on dates (it took place from app. 1910 – 1925) for introduction of the Hellmann rain gauge and for introduction of Stevenson screens concerning the stations in this report. The information originates from DMI Technical Report 94-20 [8].

Station No.	Name	Fjord gauge replaced by Hellmann	Stevenson screen mounted
21100	Vestervig	~1915	1924.07
21430	Grønbæk/Allingskovgård	N/A	
25140	Nordby, Fanø	~1913	1928.08
26410	Broderup/Bajstrup/Gårdeby/Rødebæk/Broderup Mark	N/A	
27080	Tranebjerg	1911.09	1919.08
30210	Meteorologisk Institut	N/A	
30380	Landbohøjskolen	Before 1922	1919.09
32030	Sandvig	1911.09	1913.09

Table A3.5.1. Information on station instrumentation concerning rain gauge and Stevenson screen (thermometer screen). From 'table 6' in [8].

Appendix 3.6. Information about corresponding monthly series

No test for homogeneity has been performed on the series of daily observations presented in this report.

But as part of the NACD project (see chapter 4.1. Introduction) the corresponding *monthly* series for some of the stations and elements were tested, adjusted and published in [27]. The quality codes of these series of monthly data are shown in table A3.6.1 together with comments on the adjustments made. Element numbers and quality codes are explained in tables A3.6.2 and A3.6.3.

Station No.	Element No.	Period	Quality	Comments
21100	101	1890.01-1995.12	H	No adjustments made
21100	111	1890.01-1995.12	T	Adjusted 1890.01-1953.12 due to new observation procedure
21100	112	1890.01-1995.12	T	Adjusted 1890.01-1953.12 due to new observation procedure
21100	121	1890.01-1995.12	T	Adjusted 1890.01-1924.03 due to introduction of Stevenson screen 01 Apr. 1924. Adjusted 1890.01-1946.03 due to relocation of screen 01 Apr. 1946
21100	122	1890.01-1995.12	T	Adjusted 1890.01-1924.03 due to introduction of Stevenson screen 01 Apr. 1924. Adjusted 1890.01-1946.03 due to relocation of screen 01 Apr. 1946
21100	601	1873.10-1995.12	H	No adjustments made
21430	601	1862.08-1994.12	N	No adjustments made
25140	101	1890.01-1995.12	H	No adjustments made. Values from station 25150 inserted 1942.06-1942.09, 1952.09 and 1952.11
25140	111	1890.01-1995.12	T	Adjusted 1890.01-1899.11 due to relocation of screen 1 Dec. 1899. Adjusted 1890.01-1928.07 due to introduction of Stevenson screen August 1928
25140	112	1890.01-1995.12	T	Adjusted 1890.01-1899.11 due to relocation of screen 1 Dec. 1899. Adjusted 1890.01-1928.07 due to introduction of Stevenson screen August 1928. Adjusted 1914.12-1928.07 cause of break unknown
25140	121	1890.01-1995.12	T	Adjusted 1890.01-1904.03 due to relocation of screen 7 Apr. 1904 and new screen. Adjusted 1890.01-1995.12 due to introduction of Stevenson screen 6 Aug. 1928. Adjusted 1890.01-1936.03 due to relocation of screen 5 Apr. 1936. Adjusted 1890.01-1944.12 due to relocation of screen 16 Dec. 1944. Adjusted 1890.01-1960.08 due to relocation of screen 22 Aug. 1960
25140	122	1890.01-1995.12	T	Adjusted 1890.01-1928.07 due to introduction of Stevenson screen 6 Aug. 1928. Adjusted 1890.01-1944.12 due to relocation of screen 16 Dec 1944. Adjusted 1936.03-1958.07 due to relocation of screen 5 Apr. 1936 and painting of screen 2 Aug. 1958
25140	601	1871.12-1995.12	H	No adjustments made
26410	601	1894.11-1990.12	N	No adjustments made
27080	101	1890.01-1994.12	H	No adjustments made
27080	111	1890.01-1995.12	T	Adjusted 1890.01-1918.05 due to relocation and new Stevenson screen 01 Jun. 1918. Adjusted 1890.01-1972.11 due to relocation 16 Nov. 1972
27080	121	1890.01-1995.12	T	No adjustments made
27080	601	1872.12-1995.12	H	No adjustments made
27080	801	1890.01-1995.12	H	Adjusted 1890.01-1918.08 due to new observer Adjusted 1890.01-1963.08 due to new observer
30380	101	1751.01-1889.12	T	No adjustments made
30380	101	1890.01-1997.03	E	No adjustments made
30380	111	1896.01-1995.12	T	Adjusted 1896.01-1919.08 due to new Stevenson screen

				1919/08/20. Adjusted 1894.01-1984.12 due to urban warming
30380	112	1890.01-1995.12	T	Adjusted 1890.01-1919.08 due to new Stevenson screen 1919/08/20. Adjusted 1890.01-1977.12 due to urban warming.
30380	601	1861.01-1995.12	H	No adjustments made
6193	101	1890.01-1995.12	H	Series consists of stations 32030, 32020 and 6193. No adjustments made
6193	111	1890.01-1995.12	T	Series consists of stations 32030, 32020 and 6193. Adjusted 1890.01-1913.09 due to introduction of Stevenson screen. Adjusted 1890.01-1953.08 due to relocation of screen
6193	112	1890.01-1995.12	T	Series consists of stations 32030, 32020 and 6193. Adjusted 1890.01-1913.09 due to introduction of Stevenson screen
6193	121	1890.01-1995.12	T	Series consists of stations 32030, 32020 and 6193. Adjusted 1890.01-1913.09 due to installation of Stevenson screen 17 Sep. 1913
6193	122	1890.01-1995.12	T	Series consists of stations 32030, 32020 and 6193. Adjusted 1890.01-1970.12 due to relocation 31 Dec. 1970
6193	601	1890.01-1995.12	H	Series consists of stations 32030, 32020 and 6193. No adjustments made

Table A3.6.1. Quality of series of monthly values published in [27].

Element no.	Description	Unit	Method
101	Average temperature	0.1 °C	Mean
111	Average maximum temperature	0.1 °C	Mean
112	Absolute maximum temperature	0.1 °C	Max
121	Average minimum temperature	0.1 °C	Mean
122	Absolute minimum temperature	0.1 °C	Min
601	Precipitation sum	0.1 mm	Sum
801	Average cloud cover	%	Mean

Table A3.6.2. Explanation of element numbers used in table A3.6.1.

Quality code	Description
H	Homogeneous, rigorously tested and possibly adjusted
T	Tested, possibly adjusted but not perfectly homogeneous
E	Environmental changes prevent climatic change studies
I	Inhomogeneous series which is presently not adjustable
N	Not tested, but not necessarily inhomogeneous

Table A3.6.3. Explanation of quality codes used in table A3.6.1.



Appendix 4. Monthly section - File formats and metadata

Appendix 4.1. File formats; Monthly data files

The monthly files included in this report contain monthly DMI data sets 1768-2014 comprising different parameters from 5 stations in Denmark.

The files are provided for each data set, for each element, named by the 4-letter station abbreviation plus station id, element number and period.

The file names are determined as follows:

dk_monthly_<station abbreviation>_<station id>_<element number>_<period>.dat
ex. *dk_monthly_hamm_6193_101_1873_2014.dat* (all files are not listed here)

The fixed format text files consist of 3 columns: YEAR, MONTH, "VALUE".
The units of "VALUE" can be seen in the data dictionary in tables 6.2.12 in chapter 6.2.

In addition a data set containing all monthly data sets is also available as both a fixed format text file (dat), an Excel file (xlsx) and a csv file (; separated) named: dk_monthly_all

In the fixed format text file **dk_monthly_all.dat** each record contains:

Variable	Start	End	Format	Description
STAT_NO	1	5	F5.0	Station id (see section 6.2)
ELEM_NO	6	8	F3.0	Element number (see section 6.2.12)
YEAR	9	12	F4.0	Year
JAN	13	17	F5.0	Jan. value (units described in section 6.2.12)
FEB	18	22	F5.0	Feb. value (units described in section 6.2.12)
MAR	23	27	F5.0	Mar. value (units described in section 6.2.12)
APR	28	32	F5.0	April value (units described in section 6.2.12)
MAY	33	37	F5.0	May value (units described in section 6.2.12)
JUN	38	42	F5.0	June value (units described in section 6.2.12)
JUL	43	47	F5.0	July value (units described in section 6.2.12)
AUG	48	52	F5.0	Aug. value (units described in section 6.2.12)
SEP	53	57	F5.0	Sep. value (units described in section 6.2.12)
OCT	58	62	F5.0	Oct. value (units described in section 6.2.12)
NOV	63	67	F5.0	Nov. value (units described in section 6.2.12)
ANNUAL	73	77	F5.0	Ann. value (units described in section 6.2.12)
CO_CODE	78	80	A3	Country code (DK= Denmark).

In the file **dk_monthly_all** data are sorted according to element and station id. Furthermore all missing values have been replaced with the dummy value -9999 **and a calculated annual value and a country code have been included.**

Data are only to be used with proper reference to the accompanying report:

Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.



Special remarks:

In the monthly section the reference “NARP1” refers to the “NARP dataset version 1”, see [29].

The monthly data sets referred to in this report have been constructed by a number of persons. Their names and initials/abbreviations are: Poul Frich (PF), John Cappelen (JC), Ellen Vaarby Laursen (EVL), Rikke Sjølin Thomsen (RST), Bent Vraae Jørgensen (BVJ) and Lotte Slinging Stannius (LSS).

The monthly data sets are referred to by their creator (abbreviations seen above) and the number they have in the internal DMI data set classification.

Therefore, monthly data set “JC-TS1220” means a data set (time series TS) created by John Cappelen with number 1220 in the data set classification.

“Monthly_db” refers to an internal DMI monthly database Ingres klimadb/postgreSQL ClimaDB with monthly values of various weather parameters.

The reference “TR” refers to DMI Technical Reports. Therefore, “TR99-5” as an example means DMI Technical Report 99-5 [31] available from:

<http://www.dmi.dk/laer-om/generelt/dmi-publikationer/>

In this report months are referred to by year/month number (ex. 2000/03 = March 2000) and the minimum criteria used here for calculating a valid monthly value is that measurements from more than at least 21 days are present in that month, so the number of daily values are ranging 22-31. Additionally a subjective validation has been performed.

Appendix 4.2. Metadata - Description of monthly data sets

Vestervig (VEST) – 6051; 1874-2014

Element No.101 (Mean Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	Monthly-db VEST 21100/6051 + TR99-5	1692	0
Details: Created using monthly-db VEST 21100: 1874-1960, TR99-5: 1961-1990, monthly-db VEST 21100: 1991-2003/8, monthly-db VEST 6051: 2003/10-2014. Three months (2000/1+2, 2003/9) were filled using monthly-based regression with 6052 Thyborøn: Jan. 2000: $st21100 = 1.0718*st6052 - 9.417$ ($r^2=0.988$), Feb. 2000: $st21100 = 1.0474*st6052 - 6.970$ ($r^2=0.995$), Sept. 2003: $st21100 = 1.003*st6052 - 9.573$ ($r^2=0.954$). Two months (2008/7+8) were filled using monthly-based regression with an average of 6052 Thyborøn and 6019 Silstrup: July 2008: $st6051 = 0.984*(st6052+st6019)/2 - 9.417$ ($r^2=0.99$), Aug. 2008: $st6051 = 1.015*(st6052+st6019)/2 - 5.084$ ($r^2=0.96$).				

Element No.111 (Mean of Daily Maximum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db VEST 21100/6051 + TR99-5	1680	1
Details: Created using monthly-db VEST 21100: 1875-1960, TR99-5: 1961-1990, monthly-db VEST 21100: 1991-2003/8, monthly-db VEST 6051: 2003/10-2014. 3 months (1970/12, 2000/1+2) were filled using data from 6052 Thyborøn. 1 month (2003/9) was filled using monthly-based regression with 6052: Sept. 2003: $st21100 = 1.014*st6052 + 0.64$ ($r^2=0.932$). 2 months (2008/7+8) were filled using monthly-based regression with an average of 6052 Thyborøn and 6019 Silstrup: Jul. 2008: $st6051 = 0.946*(st6052+st6019)/2 + 15.581$ ($r^2=0.98$), Aug. 2008: $st6051 = 1.351*(st6052+st6019)/2 - 66.992$ ($r^2=0.98$). 1924/5 could not be filled, no data available.				

Element No.112 (Highest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db VEST 21100/6051 + TR99-5	1680	0
Details: Created using monthly-db VEST 21100: 1875-1960, TR99-5: 1961-1990, monthly-db VEST 21100: 1991-2003/9, monthly-db VEST 6051: 2003/10-2014. 4 months (1962/6, 1970/12, 2000/1+2) were filled using data from 6052 Thyborøn. 2003/9 for station VEST 21100 is not complete, but the highest temperature in Sept. 2003 occurred in the existing part of the series. Two months (2008/7+8) were filled using data from 6019 Silstrup.				

Element No.121 (Mean of Daily Minimum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db VEST 21100/6051 + TR99-5	1680	0
Details: Created using monthly-db VEST 21100: 1875-1960, TR99-5: 1961-1990, monthly-db VEST 21100: 1991-2003/8, monthly-db VEST 6051: 2003/10-2014. 4 months (1962/6, 1970/12, 2000/1+2) were filled using data from 6052 Thyborøn. 1 month (2003/9) was filled using monthly-based regression with 6052: Sept. 2003: $st21100 = 1.03*st6052 - 21.94$ ($r^2=0.829$). 2 months (2008/7+8) were filled using monthly-based regression with an average of 6052 Thyborøn and 6019 Silstrup: Jul. 2008: $st6051 = 0.975*(st6052+st6019)/2 - 1.092$ ($r^2=1.0$), Aug. 2008: $st6051 = 0.644*(st6052+st6019)/2 + 43.569$ ($r^2=0.82$).				

Element No.122 (Lowest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db VEST 21100/6051 + TR99-5	1680	0
Details: Created using monthly-db VEST 21100: 1875-1960, TR99-5: 1961-1990, monthly-db VEST 21100 1991-2003/9, monthly-db VEST 6051 2003/10-2014. Four months (1962/6, 1970/12, 2000/1+2) were filled using data from 6052 Thyborøn. 2003/9 for station VEST 21100 is not complete, but the lowest temperature in September 2003 occurred in the existing part of the series.				



Vestervig (VEST) – 6051 (continued)

Element No.401 (Mean Atmospheric Pressure)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	Monthly-db VEST 21100 + 6052	1692	0
Details: Created using monthly-db VEST 21100: 1874-1987/7 reduced to mean sea level (see appendix), monthly-db 6052 Thyborøn: 1987/8-2014. Missing (2011/7-8) filled using 6058 Hvide Sande.				

Element No.601 (Accumulated Precipitation) – Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	Monthly-db VEST 21100/6051	1692	0
Details: Created using monthly-db VEST 21100/6051: 1874-2012. 16 November 2010 an automatic raingauge was installed at 6051 Vestervig. Not necessarily homogenous, because of new ways of detection from 2010.				

Element No.602 (Highest 24-hour Precipitation) – Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	Monthly-db VEST 21100/6051	1692	0
Details: Created using monthly-db VEST 21100/6051: 1874-2014. Missing (1950/1+4, 1954/1) filled using the average of 24020 Bovbjerg Fyr and 21120 Erslev. 16 November 2010 an automatic raingauge was installed at 6051 Vestervig. Not necessarily homogenous, because of new ways of detection from 2010.				

Element No.701 (Number of Days with Snow Cover)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1939 – 2014	Monthly-db VEST 21100 + TR99-5	912	0
Details: Created using monthly-db VEST 21100: 1939-1960, TR99-5 VEST 21100: 1961-1990, monthly-db VEST 21100: 1991-2014. VEST 21100 stopped 701 observations in August 2001 and started again January 2004. September 2001- December 2003 were filled using the average of 6030 FSN Aalborg and 6060 FSN Karup. 2004/6-2004/9 had problems, but were filled with zero. The many missing month are missing zero's for June-September months from 1970-1990. These zero's were inserted. After this, two months were missing (1955/3 and 1970/12). 1970/12 was filled using 6052 while 1955/3 was filled using the average of 6030 FSN Aalborg, 6041 Skagen Fyr and 6060 FSN Karup.				

Element No.801 (Mean Cloud Cover) - Inhomogenous based on a visual test				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	PF-TS110 + Monthly-db VEST 21100 + 6052	1692	0
Details: Created using monthly-db VEST 21100: 1874-1889, PF-TS110 1890-1995 and monthly_db 6052 Thyborøn: 1996-2014. VEST 21100 stops cloud cover observations in December 1999. 6052 values were used for the period 2000-2005 + for filling values in 1962/5+6. Eight months (2010/1-5, 2010/12 and 2011/7-8) were filled using data from 6058 Hvide Sande. 22 November 2000 a ceilometer for automatic detection of cloud cover was installed at 6052 Thyborøn. Inhomogenous based on a visual test, possible several breaks. New ways of detection from 2000.				



Nordby (NORD) – 6088; 1872-2014

Element No.101 (Mean Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1872 – 2014	Monthly-db NORD 25140/6088 + TR99-5	1716	0
Details: Created using monthly-db NORD 25140: 1872-1960, TR99-5 25140: 1961-1990, monthly-db NORD 25140: 1991-2003/6, monthly-db NORD 6088: 2003/8-2011/4, ObsDB (calc) 0-23utc NORD 6088: 2011/5-2014. 4 months (1993/12, 1994/1, 2000/1, 2002/6) were filled using average values from stations 6080 Esbjerg Lufthavn, 6081 Blåvandshuk Fyr and 25348 Vester Vedsted. 2003/7 was filled using an average value from stations 6080 Esbjerg Lufthavn, 6081 Blåvandshuk Fyr, 6096 Rømø/Juvre and 25348 Vester Vedsted. 2005/4, 2007/8, 2007/9 were filled using average values from stations 6080 Esbjerg Lufthavn, 6096 Rømø/Juvre and 6093 Vester Vedsted.				

Element No.111 (Mean of Daily Maximum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db NORD 25140/6088 + TR99-5	1680	0
Details: Created using monthly-db NORD 25140: 1875-1960, TR99-5 25140: 1961-1990, monthly-db NORD 25140: 1991-2003/6, monthly-db NORD 6088: 2003/8-2011/4, ObsDB (calc) 0-23utc NORD 6088: 2011/5-2014. 4 months (1993/12, 1994/1, 2000/1, 2002/6) were filled using average values from stations 6080, 6081 and 25348. 2003/7 was filled using an average value from stations 6080, 6081, 6096 and 25348. 2005/4, 2007/8, 2007/9 were filled using average values from stations 6080 Esbjerg Lufthavn, 6096 Rømø/Juvre and 6093 Vester Vedsted.				

Element No.112 (Highest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	Monthly-db NORD 25140/6088 + TR99-5	1692	0
Details: Created using monthly-db NORD 25140: 1874-1960, TR99-5 25140: 1961-1990, monthly-db NORD 6088: 1991-2011/4, ObsDB (calc) 0-23utc NORD 6088: 2011/5-2014. 4 months (1993/12, 1994/1, 2000/1, 2002/6) were filled using average values from stations 6080, 6081 and 25348. 2005/4 was filled using an average value from stations 6080 Esbjerg Lufthavn, 6096 Rømø/Juvre and 6093 Vester Vedsted.				

Element No.121 (Mean of Daily Minimum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db NORD 25140/6088 + TR99-5	1680	0
Details: Created using monthly-db NORD 25140: 1875-1960, TR99-5 25140: 1961-1990, monthly-db NORD 25140: 1991-2003/6, monthly-db NORD 6088: 2003/8-2011/4, ObsDB (calc) 0-23utc NORD 6088: 2011/5-2014. 4 months (1993/12, 1994/1, 2000/1, 2002/6) were filled using average values from stations 6080, 6081 and 25348. 2003/7 was filled using an average value from stations 6080, 6081, 6096 and 25348. 2005/4, 2007/8, 2007/9 were filled using average values from stations 6080 Esbjerg Lufthavn, 6081 Blåvandshuk Fyr, 6096 Rømø/Juvre and 6093 Vester Vedsted.				

Element No.122 (Lowest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db NORD 25140/6088 + TR99-5	1680	0
Details: Created using monthly-db NORD 25140: 1875-1960, TR99-5 25140: 1961-1990, monthly-db 6088: 1991-2011/4, ObsDB (calc) 0-23utc NORD 6088: 2011/5-2014. 4 months (1993/12, 1994/1, 2000/1, 2002/6) were filled using average values from stations 6080, 6081 and 25348. 2005/4 and 2007/8 were filled using average values from stations 6080 Esbjerg Lufthavn, 6081 Blåvandshuk Fyr, 6096 Rømø/Juvre and 6093 Vester Vedsted.				



Nordby (NORD) – 6088 (continued)

Element No.401 (Mean Atmospheric Pressure)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1872 – 2014	Monthly-db NORD 25140 + 6080/6081/6096	1716	5
Details: Created using monthly-db NORD 25140: 1872-1987/7 reduced to mean sea level (see appendix). Extended using the average of 6080, 6081 and 6096 for the period 1987/7 – 2014. Five months 1942/6 – 1942/9 and 1952/11 are missing.				

Element No.601 (Accumulated Precipitation) – Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1872 – 2014	Monthly-db NORD 25140/6088	1716	0
Details: Created using monthly-db NORD 25140/6088: 1872-2014. 1 month (1993/12) was filled using the average from 4 nearby manual stations (25135 Langli, 25145 Sønderho, 25171 Esbjerg Renseanlæg Vest and 25172 Hjerting). In the period 2 January – 13 June 2009 the daily acc. precipitation are interpolated values. 11 June 2009 an automatic raingauge was installed at 6088 Nordby. Not necessarily homogenous, because of new ways of detection from 2009.				

Element No.602 (Highest 24-hour Precipitation) – Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1872 – 2014	Monthly-db NORD 25140/6088	1716	0
Details: Created using monthly-db NORD 25140/6088: 1872-2014. 1 month (1993/12) was filled using the average from 3 nearby manual stations (25135 Langli, 25171 Esbjerg Renseanlæg Vest and 25172 Hjerting). In the period 2 January – 13 June 2009 the precipitation are interpolated values. 11 June 2009 an automatic raingauge was installed at 6088 Nordby. Not necessarily homogenous, because of new ways of detection from 2009.				

Element No.701 (Number of Days with Snow Cover) – Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1957 – 2014	Monthly-db NORD 25140 + 6080 + 25045 +TR99-5	696	0
Details: Created using monthly-db NORD 25140: 1957-1960, TR99-5 NORD 25140: 1961-1990, monthly-db NORD 25140: 1991-2001/8, 6080: 2001/9-2006, 25045: 2007-2014. Jun – Sept. months 1970-1990 had missing zero's which were inserted. 2 missing months (1993/12 and 1994/1) were filled using values from 6080. Not necessarily homogenous, different locations involved.				

Element No.801 (Mean Cloud Cover) - Inhomogenous based on a visual test				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1872 – 2014	Monthly-db NORD 25140 + PF-TS126 + 6080 + 6096	1716	2
Details: Created using monthly-db NORD 25140: 1872-1889, PF-TS126 1890-1995 and monthly-db 25140: 1996-1999. 6080 are used for 2000/1- 2000/3 and 6096 for the remaining period 2000/4 – 2014. 6096 are used because 6080 Esbjerg Lufthavn has an unstable number of observations per month. 1959/10 was filled using a value from 6081 Blåvandshuk, 1993/12 + 1994/1 were filled using values from 6080. 2006/8 and 2006/9 are missing. 2006/1, 2008/2, 2008/3, 2008/8+10, 2010/4+5+6, 2011/10 and 2013/10 were filled using values from 6058 Hvide Sande. 7 April 2000 a ceil-ometer for automatic detection of cloud cover was installed at 6096 Rømø/Juvre. Inhomogenous based on a visual test, possible several breaks. New ways of detection from 2000.				



Tranebjerg (TRAN) – 6132; 1872-2014

Element No.101 (Mean Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db TRAN 27080/6132 + TR99-5	1704	0
Details: Created using monthly-db TRAN 27080: 1873-1960, TR99-5 27080: 1961-1990, monthly-db TRAN 27080: 1991-2003/7, monthly-db TRAN 6132: 2003/9-2014. 1995/2, 2000/2, 2003/4-5, 2003/8, 2005/1 and 2009/5 were filled using values from 6159 Røsnæs Fyr, the closest station outside Samsø.				

Element No.111 (Mean of Daily Maximum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 - 2014	Monthly-db TRAN 27080/6132 + TR99-5	1704	4
Details: Created using monthly-db TRAN 27080: 1875-1960, TR99-5 27080: 1961-1990, monthly-db TRAN 27080: 1991-2003/7, monthly-db TRAN 6132: 2003/9-2014. 1873/12, 1925/10, 1947/11 and 1949/3 could not be filled, while 1995/2, 2000/2, 2005/1 and 2009/5 were filled using values from 6159 Røsnæs Fyr.				

Element No.112 (Highest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db TRAN 27080/6132 + TR99-5	1704	3
Details: Created using monthly-db TRAN 27080: 1873-1960, TR99-5 27080: 1961-1990, monthly-db TRAN 27080: 1991-2003/7, monthly-db TRAN 6132: 2003/9-2014. 1925/10, 1947/11 and 1949/3 could not be filled, while 1995/2, 2000/2, 2003/4 and 2009/5 were filled using values from 6159 Røsnæs Fyr.				

Element No.121 (Mean of Daily Minimum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db TRAN 27080/6132 + TR99-5	1704	2
Details: Created using monthly-db TRAN 27080: 1873-1960, TR99-5 27080: 1961-1990, monthly-db TRAN 27080: 1991-2003/7, monthly-db TRAN 6132: 2003/9-2014. 1947/11 and 1949/3 could not be filled, while 1995/2, 2000/2, 2003/4-5, 2003/8, 2005/1 and 2009/5 were filled using values from 6159 Røsnæs Fyr.				

Element No.122 (Lowest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 - 2014	Monthly-db TRAN 27080/6132 + TR99-5	1704	2
Details: Created using monthly-db TRAN 27080: 1873-1960, TR99-5 27080: 1961-1990, monthly-db TRAN 27080: 1991-2003/7, monthly-db TRAN 6132: 2003/8-2014. 1947/11 and 1949/3 could not be filled, while 1995/2, 2000/2 and 2003/4 were filled using values from 6159 Røsnæs Fyr.				



Tranebjerg (TRAN) – 6132 (continued)

Element No.401 (Mean Atmospheric Pressure)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1872 – 2014	Monthly-db TRAN 27080 + 6159	1705	12
Details: Created using monthly-db TRAN 27080: 1872/12-1987/7 reduced to mean sea level (see appendix). Extended using 6159 Røsnæs Fyr for the period 1987/8 – 2014. One month (2009/2) was filled using an average of 6073 Sletter Hage Fyr, 6169 Griben, 6120 Odense Airport. 2011/9 was filled using 6169 Griben. Twelve months are missing: 1911/5-8, 1924/8, 1925/1, 1945/11, 1946/9, 1947/11, 1949/3, 1972/10-11.				

Element No.601 (Accumulated Precipitation) - Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db TRAN 27080 + 27082 + 5165	1704	0
Details: Created using monthly-db TRAN 27080: 1873-2001/7, 27082: 2001/8 – 2011/3, /4, monthly-db TRAN 5165: 2011/4-2014. Months 1972/10+11 and 1995/2 were filled using average values from stations 27070 Langør and 27090 Brattingborg. 18 November 2010 an automatic rain gauge was installed at 5165 Tranebjerg Øst. Not necessarily homogenous, because of new ways of detection from 2010.				

Element No.602 (Highest 24-hour Precipitation) - Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db TRAN 27080 + 27082 + 5165	1704	0
Details: Created using monthly-db TRAN 27080: 1873-2001/7, 27082: 2001/8-2011/3, monthly-db TRAN 5165: 2011/4-2014. Months 1972/10+11 and 1995/2 were filled using average values from stations 27070 Langør and 27090 Brattingborg. 18 November 2010 an automatic rain gauge was installed at 5165 Tranebjerg Øst. Not necessarily homogenous, because of new ways of detection from 2010.				

Element No.701 (Number of days with Snow Cover)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1949 – 2014	Monthly-db TRAN 27080 + TR99-5 + 27082	792	44
Details: Created using monthly-db TRAN 27080: 1949-1960, TR99-5: 1961-1990, monthly-db TRAN 27080: 1991- 2000, 27082: 2004/9 - 2014. Months 1949/3, 1955/1+2 were filled using values from 28180 Blangstedgaard. 44 months are missing: 2001/1 -2004/8. This series was continued from 2004/9 using data from 27082 Tranebjerg Øst.				

Element No.801 (Cloud Cover)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2001	Monthly-db TRAN 27080 + 6159 + TR99-5	1534	0
Details: Created using monthly-db TRAN 27080: 1874-1960, TR99-5: 1961-1990, monthly-db TRAN 27080: 1991- 2000/1, monthly-db 6159 2000/2 – 2001/10. Months 1947/4+11, 1948/1+11 were filled using values from 28180 Blangstedgaard. Months 1949/3, 1972/10+11, 1995/2 were filled using values from 6159 Røsnæs Fyr. This series could not without severe problems be extended using data from a station on the islands Fyn or Sjælland i.e. 6159 Røsnæs Fyr, so this is not done.				



København (KOEB) – 6186; 1768-2014

Element No.101 (Mean Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1768 – 2014	Monthly-db KOEB 6186/30380+ Rundetårn+old Botanical Garden	2964	168
Details: Created using monthly-db KOEB 6186/30380: 1860-2014, and keyed in data from Rundetårn: 1768-1819 and the old Botanical Garden: 1820-1859 (Willaume-Jantzen, V. (1896) [45]). 168 missing months: 1777/1-1781/12 and 1789/1-1797/12.				

Element No. 111 (Mean of Daily Maximum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1861 – 2014	Monthly-db KOEB 6186/30380	1848	0
Details: Created using monthly-db KOEB 6186/30380: 1861-2014. 1970/12 was filled using a value from station 6180 Københavns Lufthavn.				

Element No. 112 (Highest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1861 – 2014	Monthly-db KOEB 6186/30380	1848	0
Details: Created using monthly-db KOEB 6186/30380: 1861-2014. 1970/12 was filled using a value from station 6180 Københavns Lufthavn.				

Element No. 121 (Mean of Daily Minimum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1861 – 2014	Monthly-db KOEB 6186/30380	1848	0
Details: Created using monthly-db KOEB 6186/30380: 1861-2014. 1970/12 was filled using a value from station 6180 Københavns Lufthavn.				

Element No. 122 (Lowest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1861 – 2014	Monthly-db KOEB 6186/30380	1848	0
Details: Created using monthly-db KOEB 6186/30380: 1861-2014. 1970/12 was filled using station 6180 Københavns Lufthavn.				



København (KOEB) – 6186 (continued)

Element No.401 (Mean Atmospheric Pressure)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1923 – 2014	Monthly-db KOEB 30380 + 6180	1104	1
Details: Created using monthly-db KOEB 30380: 1923/1-1987/7 reduced to mean sea level (see appendix). Extended using 6180 Københavns Lufthavn for the period 1987/8 – 2014. One month is missing: 1957/10. In monthly-db there are also data from 30380 in the period 1860/1- 1875/12 reduced to mean sea level, but these data are not part of this publication.				

Element No. 504 (Hours of bright sunshine)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1876 – 2014	EVL-TS276+Monthly-db KOEB30380/30340/30341/6187	1668	0
Details: Created using EVL-TS276 1876-1997 (see also [30]), monthly-db 30340 Københavns Toldbod: 1998-2004, monthly_db 30341 Københavns Toldbod: 2005-2011 and 6187 Københavns Toldbod: 2012-2014. The EVL-TS276 + 30340 from 1998-2004 series was converted from casella to star level by JC using following monthly conversion factors: (1,05;0,98;0,94;0,91;0,87;0,84;0,83;0,83;0,84;0,88;0,96;1,10) [33].				

Element No. 601 (Accumulated Precipitation) - Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1821 – 2014	Monthly-db KOEB 6186/30380 + 30370 + 5735 + old botanical garden	2328	19
Details: Created using monthly-db KOEB 6186/30380: 1860-1995, 30370: 1996-2011/3, monthly-db 5735: 2011/4-2014 plus keyed in data from the old Botanical Garden 1821-1859 (Willaume-Jantzen, V. (1896) [45]). The 19 missing months are all month in 1825, 1926/1-1926/4 and 1926/9-1926/11. The former published series (latest 1821-2004 and earlier) has been changed, because the use of the station 30381 in that series for the period 1996/1-2004/12 wasn't appropriate. 14 January 2010 an automatic raingauge was installed at 5735 Botanisk Have. Not necessarily homogenous, because of new ways of detection from 2010.				

Element No. 602 (Highest 24-hour Precipitation) - Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1843 – 2014	Monthly-db KOEB 6186/30380 + 30370 + 5735 + old botanical garden	2064	0
Details: Created using monthly-db KOEB 6186/30380: 1860-1995, 30370: 1996-2011/3, monthly-db 5735: 2011/4-2014 plus keyed in data from the old Botanical Garden 1843-1859 (Willaume-Jantzen, V. (1896) [45]). For 1974/4 a value from 6180 was used. The former published series (latest 1843-2004 and earlier) has been changed, because the use of the station 30381 in that series for the period 1996/1-2004/12 wasn't appropriate. 14 Jan 2010 an automatic raingauge was installed at 5735 Botanisk Have. Not necessarily homogenous, because of new ways of detection from 2010.				

Element No. 701 (Number of Days with Snow Cover)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1938 – 2014	Monthly-db KOEB 6186/30380 + 6180 + 30370	924	0
Details: Created using monthly-db KOEB 6186/30380: 1938-1996, 6180: 1997-2009 and 30370: 2010-2014. Jun, Jul, Aug & Sep months 1970-1990 had missing data, zero's were inserted. 1970/12 was filled using a values from 6180.				

Element No. 801 (Cloud Cover) - Inhomogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1876 – 2014	PF-TS153 + Monthly-db KOEB 6186/30380 + 6180	1668	0
Details: Created using monthly-db KOEB 6186/30380: 1876-1889, PF-TS153 1890-1995 and monthly-db 6180: 1996-2014. 1937/1 was filled using 6183, which was the only possibility. From January 2011 observations from a ceilometer for automatic detection of cloud cover are used at some hours at 6180 Københavns Lufthavn. Inhomogenous, because of new ways of detection from 2011.				



Hammer Odde Fyr (HAMM) – 6193; 1873-2014

Element No.101 (Mean Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db HAMM 6193/32020 + 32030 + TR99-5	1704	0
Details: Created using monthly-db 1873-1953: 32030 Sandvig, 1953-1960: mean of 32030 and 32020 Hammer Odde Fyr /6193 Hammer Odde Fyr, 1961-1990: TR99-5 6193 Hammer Odde Fyr, 1991-2014: 6193 Hammer Odde Fyr.				

Element No.111 (Mean of Daily Maximum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1875 – 2014	Monthly-db HAMM 6193/32020 + 32030 + TR99-5	1680	0
Details: Created using monthly-db 1875-1953: 32030 Sandvig, 1953-1960: mean of 32030 and 32020/6193, 1961-1990: TR99-5 6193, 1991-2014: 6193 Hammer Odde Fyr. Missing values for 1951/9+10 were filled using 32025 Hammeren Fyr.				

Element No.112 (Highest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1874 – 2014	Monthly-db HAMM 6193/32020 + 32030 + TR99-5	1692	2
Details : Created using monthly-db 1874-1953: 32030-Sandvig, 1953-1960: mean of 32030 and 32020/6193, 1961-1990: TR99-5 6193, 1991-2014: 6193 Hammer Odde Fyr. Missing 1874/3 and 1874/5. Missing values for 1951/9+10 were filled using 32025 Hammeren Fyr.				

Element No.121 (Mean of Daily Minimum Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db HAMM 6193/32020 + 32030 + TR99-5	1704	0
Details: Created using monthly-db 1873-1953: 32030-Sandvig, 1953-1960: mean of 32030 and 32020/6193, 1961-1990: TR99-5 6193, 1991-2014: 6193 Hammer Odde Fyr.				

Element No.122 (Lowest Temperature)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db HAMM 6193/32020 + 32030 + TR99-5	1704	0
Details: Created using monthly-db 1873-1953: 32030-Sandvig, 1953-1960: mean of 32030 and 32020/6193, 1961-1990: TR99-5 6193, 1991-2014: 6193 Hammer Odde Fyr.				



Hammer Odde Fyr (HAMM) – 6193 (continued)

Element No.401 (Mean Atmospheric Pressure)				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db HAMM 6193/32020 + 32030	1704	0
Details : Created using monthly-db 1873-1970: 32030-Sandvig reduced to mean sea level (see appendix), 1971-1987/06: 32020 Hammer Odde Fyr/Lighthouse reduced to mean sea level (see appendix) and 1987/07-2014: 6193 Hammer Odde Fyr/Lighthouse. Missing value 1966/07 filled with 32020 reduced to mean sea level.				

Element No.601 (Accumulated Precipitation) - Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db HAMM 6193/32020 + 32030	1704	0
Details : Created using monthly-db 1873-1953: 32030-Sandvig, 1953-1971: mean of 32030 and 32020/6193, 1971-2014: 6193/32020-Hammer Odde Fyr. The value for 2009/3 is added 3,0 mm (missing values have been replaced by interpolated values 4-9/3). The value for 2011/9 is added 0,4 mm (missing values have been replaced by interpolated values 1/10) and 2011/10 is added 21,6 mm (missing values have been replaced by interpolated values 2-14/10). 30 August 2001 an automatic raingauge was installed at 6193 Hammer Odde Fyr. Not necessarily homogenous, because of new ways of detection from 2001.				

Element No.602 (Highest 24-hour Precipitation) - Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	Monthly-db HAMM 6193/32020 + 32030	1704	0
Details Created using monthly-db 1873-1953: 32030-Sandvig, 1953-1971: mean of 32030 and 32020/6193, 1971-2014: 6193/32020-Hammer Odde Fyr. Missing values (1948/3, 1951/7 and 1952/12) were filled using values from 32025 Hammeren Fyr. 30 August 2001 an automatic raingauge was installed at 6193 Hammer Odde Fyr. Not necessarily homogenous, because of new ways of detection from 2001.				

Element No.701 (Number of days with Snow Cover) – Not necessarily homogenous				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1939 – 2014	Monthly-db HAMM 6193/32020+32030+6190+32080 +32175	912	10
Details : Created using monthly-db mean of 32030-Sandvig 1939-1971, 6193/32020 Hammer Odde Fyr, 6190 1953-2002, Bornholms Lufthavn 32080 Klemensker 2002-2010/7 and 32175 Østerlars 2010/8-2014. Period 2001/9-2002/12 taken from 6190 because 6193 had stopped these observations. 2004/1-2005/12 taken from 32080 Klemensker because 6190 had stopped these observations. Out of the 46 missing values, the the months 6, 7, 8 and 9 in the period 1971-77 and 2003 were set to zero. After this, 11 missing months are left. One (1955/1) was filled using 32025 Hammeren Fyr. The remaining ten (1952/1, 1953/5, 2003/1-5 and 2003/9-12) cannot be filled, since there are no observations of element 701 on Bornholm for these months. Not necessarily homogenous, many different locations involved.				

Element No.801 (Mean Cloud Cover) - Inhomogenous based on a visual test				
<i>Dataset</i>	<i>Period</i>	<i>Content</i>	<i>Total months</i>	<i>Missing months</i>
Recommended	1873 – 2014	PF-TS97 + Monthly-db HAMM 6193/32020 + 32030	1704	16
Details : Created using monthly-db 32030: 1873-1889, PF-TS97 1890-1995 and monthly-db 6193: 1996-2014. 14 months missing from PF-TS97: 1911/1, 1953/5, 1966/7, 1973/3+7, 1974/3+7+12, 1987/7-12. 1953/5 and 1966/7 were filled with 32020. 1973/3+7 and 1974/3+7 were filled using values from 6190. 1974/12 by an average of 6191 Christianø Fyr and 6199 Dueodde Fyr. 1987/7-12 were filled with 6193. The months 1911/1, 2009/1-4 and 2010/7-2011/6 cannot be filled. 30 August 2001 a ceilometer for automatic detection of cloud cover was installed at 6193 Hammer Odde Fyr. Inhomogenous based on a visual test, possible several breaks. New ways of detection from 2001.				



Appendix 4.3. Regarding monthly data of atmospheric pressure

The reading of a mercury barometer is proportional to the length of a mercury column in the barometer, which is balanced against the weight of the entire atmospheric column of air above the open surface of the mercury. The mercury barometer was therefore calibrated to “standard conditions” (0°C and a certain standard gravity). At other conditions corrections must be used.

The formula used to correct old barometer readings for the stations presented in this publication is given below. The formula simply corrects for gravity (part 1) and reduces the pressure to mean sea level (part 2):

$$P * (1 - 0,00259 * \cos(2 * \varphi * \pi/180)) * (1 + 9.82/287.04 * h/(T/10+273.15))$$

P is atmospheric pressure (0.1 hPa) at station level, φ is the latitude in degrees, h is the height of the barometer in meters above sea level and T is the air temperature at station level (0.1 °C)

For the calculation are used monthly means of P and T. This introduces an error compared to a reduction performed on the actual observations. The error is proportional to the difference between ‘the average P to T ratio’ and ‘the ratio of average P to average T’ (T in Kelvin). This means the error is zero if T is constant within the period. Within a month the maximum T-range would normally be within 30 degrees. And a numerical variation of 30 is small when compared to the temperature in Kelvin and the atmospheric pressure in 0.1 hPa. Therefore the error introduced by using monthly values may be considered small.

The different station specific corrections, which have been used in the construction of the pressure series in this report, can be seen in the following DMI publication:

DMI Technical Report 03-24: Metadata, selected climatological and synoptic stations, 1750-1996, Copenhagen 2003 [35].

This publication can be downloaded from the publication part of DMI’s web site:

<http://www.dmi.dk/laer-om/generelt/dmi-publikationer/>

Station 25140 Nordby: Reduction of atmospheric pressure to mean sea level. Until and including 1892 also correction for gravity.		
Start	End	Formula, P: station level pressure (0.1 hPa), T: Air temperature at station level (0.1°C)
-	18920400	$P * (1 - 0.00259 * \cos(2 * 55.5 * 3.14/180)) * (1 + 9.82/287.04 * 5.5/(T/10+273.15))$
18920500	18921200	$P * (1 - 0.00259 * \cos(2 * 55.5 * 3.14/180)) * (1 + 9.82/287.04 * 8.0/(T/10+273.15))$
18930100	18991100	$P * (1 + 9.82/287.04 * 8.0/(T/10+273.15))$
18991200	19280700	$P * (1 + 9.82/287.04 * 5.5/(T/10+273.15))$
19280800	19360300	$P * (1 + 9.82/287.04 * 10.5/(T/10+273.15))$
19360400	19441100	$P * (1 + 9.82/287.04 * 6.9/(T/10+273.15))$
19441200	19450500	$P * (1 + 9.82/287.04 * 7.0/(T/10+273.15))$
19450600	19551100	$P * (1 + 9.82/287.04 * 3.0/(T/10+273.15))$
19551200	19600800	$P * (1 + 9.82/287.04 * 9.7/(T/10+273.15))$
19600900	-	$P * (1 + 9.82/287.04 * 6.7/(T/10+273.15))$

Example: The formulas take care that the published atmospheric pressure is reduced to mean sea level, 0°C and gravity at 45° Latitude. The temperature used is the monthly mean temperature in the NORD6088 ‘recommended’ series. See also Appendix 3.3.



Appendix 5. Annual section - File formats

Appendix 5.1. File formats - Annual data files

The annual files included in this report contain annual mean temperature 1873 - 2014 for selected meteorological data sets in Denmark, The Faroe Islands and Greenland.

The file names are determined as follows:

dk_annual_temperature_dkfrgr_<period>

More specifically a fixed format text file and an Excel file in this report:

dk_annual_temperature_dkfrgr_1873_2014.dat
dk_annual_temperature_dkfrgr_1873_2014.xlsx

Besides years the files contains the annual mean temperatures in degrees Celsius to one decimal place (the variable is specified with a “T” followed by a station number) and a Gaussian filtered value to 2 decimal places (the variable is specified with a “F” followed by a station number).

Description of the data format for the fixed format text file:

Variable	Type	Start	End	Format
YEAR	YEAR	1	4	F4.0
T04202	TEMP	5	12	F8.1
F04202	FILTER	13	20	F8.2
T04211	TEMP	21	28	F8.1
F04211	FILTER	29	36	F8.2
T04221	TEMP	37	44	F8.1
F04221	FILTER	45	52	F8.2
T04250	TEMP	53	60	F8.1
F04250	FILTER	61	68	F8.2
T04270	TEMP	69	76	F8.1
F04270	FILTER	77	84	F8.2
T04320	TEMP	85	92	F8.1
F04320	FILTER	93	100	F8.2
T04360	TEMP	101	108	F8.1
F04360	FILTER	109	116	F8.2
T06011	TEMP	117	124	F8.1
F06011	FILTER	125	132	F8.2
T06186	TEMP	133	140	F8.1
F06186	FILTER	141	148	F8.2

Note that the annual values of the different data sets mentioned in section 7.2.1 can be found together with the monthly data (see file formats; monthly data files in Appendix 4.1).

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.



Appendix 5.2. File formats; Annual graphics

Annual graphics included in this report contain graphs showing annual mean temperatures 1873-2014 for one data set 6186 København, Danmark together with data sets from West and East Greenland and Tórshavn at The Faroe Islands. The graphs are available in a Danish and English version and also in a larger version as a poster (only Danish version).

The file names are determined as follows:

dk_annual_temperatur_side_<sidetal>_<periode>_<sprog>.pdf
dk_annual_temperature_page_<page number>_<period>_<language>.pdf
dk_annual_temperature_page_<page number>_<period>_plakat.pdf

More specifically a number of pdf files (Danish and English versions) in this report:

dk_annual_temperatur_side1_1873_2014_dk.pdf:

Annual mean temperatures 1873-2014 Denmark, The Faroe Islands and West Greenland (Danish version)

dk_annual_temperatur_side2_1873_2014_dk.pdf:

Annual mean temperatures 1873-2014 Denmark, The Faroe Islands and East Greenland (Danish version)

dk_annual_temperature_page1_1873_2014_eng.pdf:

Annual mean temperatures 1873-2014 Denmark, The Faroe Islands and West Greenland (English version)

dk_annual_temperature_page2_1873_2014_eng.pdf:

Annual mean temperatures 1873-2014 Denmark, The Faroe Islands and East Greenland (English version)

dk_annual_temperatur_side1_1873_2014_plakat.pdf:

Annual mean temperatures 1873-2014 Denmark, The Faroe Islands and West Greenland (Danish poster)

dk_annual_temperatur_side2_1873_2014_plakat.pdf:

Annual mean temperatures 1873-2014 Denmark, The Faroe Islands and East Greenland (Danish poster)

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.



Appendix 6. Country-wise section - File formats

Appendix 6.1. File formats; country-wise monthly and annual climate data 1874-2014

The monthly and annual country-wise files included in this report contain values of temperature, precipitation and hours of bright sunshine, weather describing text, weather records and normals 1961-90 and averages 2001-10 from Denmark as a whole since 1874. The figures can be compared with the Standard Normal values from the period 1961-90 (latest WMO recommended) and the average 2001-2010 by moving the cursor to the figure. Every month and year in the period 1891-2014 are characterised by a short text as well as the weather during Eastern, Christmas and Midsummer Day. The different record breaking months and years are also marked.

The file name is determined as follows: **dk_country_<period>.xlsx**

More specifically an Excel file in this report: dk_country_1874_2014.xlsx

For every month and year the file contains one line in the following format:

1. Year.
2. Month.
3. Eventually a mark indicating a weather record "R", or an equal weather record "Rt".
4. General description of the weather in text (Danish only).
5. Mean temperature in degrees Celsius.
6. Highest temperature in degrees Celsius.
7. Lowest temperature in degrees Celsius.
8. Mean maximum temperature in degrees Celsius.
9. Mean minimum temperature in degrees Celsius.
10. Accumulated precipitation in mm.
11. Accumulated hours of bright sunshine.
12. The weather during Eastern, Christmas and Midsummer Day are stated in "Særlige begivenheder"(special events) with matching dates (Danish only).

The country-wise climate extremes are separately published in an Excel file. The file name is determined as follows: **dk_country_extremes_<period>.xlsx**

More specifically an Excel file in this report: dk_country_extremes_1874_2014.xlsx

For the twelve months and the year the file contains an extreme for the following parameters in the the specified order:

1. Month and Year
2. Highest temperature 1874-2014
3. Lowest temperature 1874-2014
4. Highest mean temperature 1874-2014
5. Lowest mean temperature 1874-2014
6. Highest accumulated hours of bright sunshine 1920-2014
7. Lowest accumulated hours of bright sunshine 1920-2014
8. Highest accumulated precipitation 1874-2014
9. Lowest accumulated precipitation 1874-2014
10. Highest 24-hour precipitation at a single station 1874-2014

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.



Appendix 6.2. File formats; Data: Country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover and filtered values 1873-2014

The annual country-wise data files included in this section contain annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover 1873-2014 for Denmark as a whole.

The file names are determined as follows:

dk_country_tpsc_<period>

More specifically a fixed format text file and an Excel file in this report:

dk_country_tpsc_1873_2014.xlsx

dk_country_tpsc_1873_2014.dat

Besides years the files contains:

1. *Uncorrected "Published" annual mean temperature for Denmark as a whole* in degrees Celsius to one decimal place (the variable is specified with a "T" followed by a "DK") and a Gaussian filtered value to 2 decimal places (the variable is specified with an "F").
2. *Corrected annual mean temperature for Denmark as a whole* in degrees Celsius to one decimal place (the variable is specified with a "T" followed by a "DK" and a "K") and a Gaussian filtered value to 2 decimal places (the variable is specified with an "F").
3. *Annual accumulated precipitation for Denmark as a whole* in millimetres (the variable is specified with a "P" followed by a "DK") and a Gaussian filtered value to 2 decimal places (the variable is specified with an "F").
4. *Annual accumulated hours of bright sunshine for Denmark as a whole* in hours (the variable is specified with a "S" followed by a "DK") and a Gaussian filtered value to 2 decimal places (the variable is specified with an "F").
5. *Annual mean cloud cover for Denmark as a whole* in % (the variable is specified with a "C" followed by a "DK") and a Gaussian filtered value to 2 decimal places (the variable is specified with an "F").

Description of the data format for the text file:

Variable	Type	Start	End	Format
YEAR	YEAR	1	4	F4.0
T_DK	TEMP	5	12	F8.1
FT_DK	FILTER	13	20	F8.2
T_DK_K	TEMP	21	28	F8.1
FT_DK_K	FILTER	29	36	F8.2
P_DK	PREC	37	44	F8.0
FP_DK	FILTER	45	52	F8.2
S_DK	SUN	53	60	F8.0
FS_DK	FILTER	61	68	F8.2
C_DK	CLOUD	69	76	F8.0
FC_DK	FILTER	77	84	F8.2

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.

Appendix 6.3. File formats; Graphics: Country-wise annual mean temperature, accumulated precipitation, hours of bright sunshine and mean cloud cover and filtered values 1873-2014

Country-wise annual graphics included in this report contain graphs showing annual mean temperatures, accumulated precipitation, hours of bright sunshine and mean cloud cover 1873-2014. The graphs are available in a Danish and English version.

The file names are determined as follows:

dk_country_<parameter forkortelse>_<periode>_<sprog>.pdf
dk_country_<parameter abbreviation>_<period>_<language>.pdf

More specifically a number of pdf files (Danish and English versions) in this report:

dk_country_t_1873_2014_dk.pdf:

Annual mean temperatures 1873-2014, Denmark, Published values (Danish version)

dk_country_t_1873_2014_eng.pdf:

Annual mean temperatures 1873-2014 Denmark, Published values (English version)

dk_country_tk_1873_2014_dk.pdf:

Annual mean temperatures 1873-2014 Denmark, Corrected values (Danish version)

dk_country_tk_1873_2014_eng.pdf:

Annual mean temperatures 1873-2014, Denmark, Corrected values (English version)

dk_country_p_1874_2014_dk.pdf:

Annual accumulated precipitation 1874-2014, Denmark (Danish version)

dk_country_p_1874_2014_eng.pdf:

Annual accumulated precipitation 1874-2014, Denmark (English version)

dk_country_s_1920_2014_dk.pdf:

Annual accumulated hours of bright sunshine 1920-2014, Denmark (Danish version)

dk_country_s_1920_2014_eng.pdf:

Annual accumulated hours of bright sunshine 1920-2014, Denmark (English version)

dk_country_c_1874_2014_dk.pdf:

Annual mean cloud cover 1874-2014, Denmark (Danish version)

dk_country_c_1874_2014_eng.pdf:

Annual mean cloud cover 1874-2014, Denmark (English version)

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.



Appendix 7. Storm section - File formats

Appendix 7.1. File formats; List of storms 1891-2014

A list of storms included in this report contains all classified storms in Denmark 1891-2014.

The file name is determined as follows:

dk_storm_<period>.pdf

More specifically a pdf file in this report:

dk_storm_1891_2014.pdf

For every classified storm the format is as follows:

1. Period - Days.
2. Period - Year.
3. Remarks.
4. Classification - Date.
5. Classification - Index.

Data are only to be used with proper reference to the accompanying report: Cappelen, J. (ed), 2015: Denmark - DMI Historical Climate Data Collection 1768-2014 – with Danish Abstracts. DMI Technical Report No. 15-02. Copenhagen.