

DMI Report 22-25 Arctic Sea Ice

**Final scientific report of the 2021 National Centre for Climate
Research Work Package WP3.2 Arctic Sea Ice**

Till Andreas Soya Rasmussen, Gorm Dybkjær, Imke
Sievers, Mads Hvid Ribergaard, Andrea Gierisch, Vasily
Korabel, Magnus Barfoed Suhr and Stefan Rethmeier

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Till Andreas Soya Rasmussen, Gorm Dybkjær, Imke Sievers, Mads Hvid Ribergaard, Andrea Gierisch, Vasily Korabel, Magnus Barfoed Suhr and Stefan Rethmeier

Andre bidragsydere

Anthony Craig LTD, Rasmus Thonboe (DTU Space), Seul National University and Calgary University

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1. Scientific summary

Short description of work package

Sea and sea ice are affected by climate change while also playing an active role in the global changes as well. In Nationalt Center for Klimaforskning (NCKF), we work on the extension and improvement of current sea and sea ice time series in order to understand trends and status on the Arctic climate indicators. This work package work on improving the understanding of the Arctic including Greenland ocean and sea ice based on a combination of in-situ measurements, remotely sensed data, physical models and combination of these.

The work package

In this work package we:

- Created an improved data fusion of remotely sensed data and in-situ observations in order to improve the description and understanding of the sea ice thickness products. This will lead to better time series and trend analysis of the Arctic sea ice and snow within the Cryosat period.
- Created a new hindcast of ocean and sea ice for the Arctic in a resolution of 5 kilometers. The hindcast will be used to build climate indicators and trends. There has already been interest for the trends and statistics of sea ice and ocean parameters in the proximity of Greenland.
- Continued our engagement in the development of the state of the Arctic sea ice model CICE (<https://github.com/CICE-Consortium/CICE>). More specific we integrated an optimized solver for the EVP dynamics and contributed to development of a C-grid solver for CICE. A manuscript is being drafted based on this.
- Improved validation and generalization of validation of sea-ice products. This is currently focused on the sea ice edge but will be expanded to other parameters.
- Improved initialization of sea ice thickness based on sea ice altimetry. This includes test with a state of the art assimilation scheme, which is used for both the Arctic and the Baltic/inner Danish waters setups.

Further process and status

The continuation of this work package will improve the understanding of the processes that governs the ocean circulation and the state of the sea ice. The work package will aim at continuing the international collaboration. This will be based on better combinations and integration of in situ data, remotely sensed data and model data. Output will be focused on time series and analysis of these and peer reviewed scientific publications.

2. Scientific publication

Work within this work package has led to at least four publications that are accepted, accepted with minor changes and in draft. Additional manuscripts will be written in 2022 based on work carried out this year. Status of the four drafts are listed below.

- 1. Extreme High Greenland Blocking Index Leads to the Reversal of Davis and Nares Strait Net Transport Toward the Arctic Ocean**

<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094178>

DMI authors: Mads Hviid Ribergaard co-author, published

- 2. Sea ice Rheology Experiment (SIREx), Part I: Scaling and statistical properties of sea-ice deformation fields**

DMI authors: Till Andreas Soya Rasmussen (co-author)

Manuscript will be published latest in summer 2022.

- 3. Sea ice Rheology Experiment (SIREx), Part II: Evaluating linear kinematic features in high-resolution sea ice simulations**

DMI authors: Till Andreas Soya Rasmussen (co-author)

Manuscript will be published latest in summer 2022.

- 4. Sea ice model Comparison CICE vs. SI3**

DMI authors: Imke Sievers, Andrea Gierisch and Till Andreas Soya Rasmussen

Manuscript will be published latest in summer 2022.