A new global multi-source sea ice concentration composite

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1 Introduction and motivation

Sea ice concentration (SIC) is a vital climate indicator, serving as one of the most evident indicators of climate change. Passive microwave sensors used for monitoring SIC are consistency updated, providing higher resolution data. However, due to the shorter time span of these sensors they are typically not used in the production of long term SIC products, where ensuring consistency is a key factor.
Here we present a new global multi-source sea ice concentration composite (DMI-MSC), where different SIC products have been combined allowing the use of the highest possible resolution, while ensuring consistency through the use of various filters.

2 Method

To produce the Global DMI-MSC we use a range of input data, which are listed in figure 1a and shown in figure 1b. The primary input data is passive microwave based global SIC products from OSI SAF and Sea Ice CCI+, where the OSI-458, which is based on the higher resolution AMSR, is the first priority followed by SICCI-HR-SIC and lastly OSI-450-a. SICCI-HR-SIC is an advanced pan-sharpened version of OSI-450-a and they are both based on the coarser resolution SMMR, SSM/I and SSMIS sensors. Furthermore, Sea Ice Charts from the U.S. National Ice Center (NIC) are used to fill in landfast ice in the northern hemisphere and sea ice charts from FMI/SMHI are used in the Baltic sea.

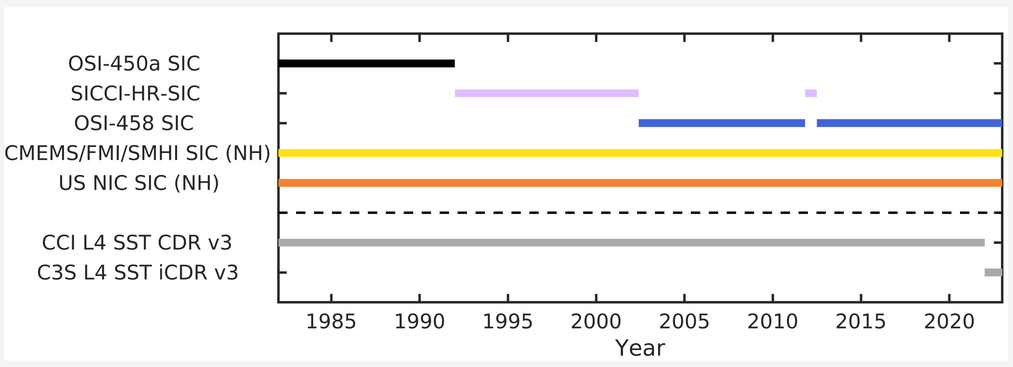
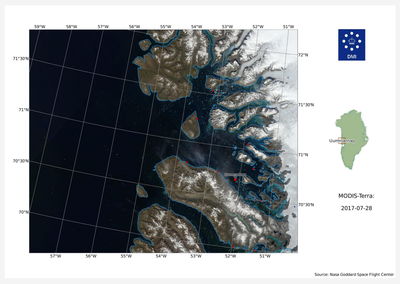
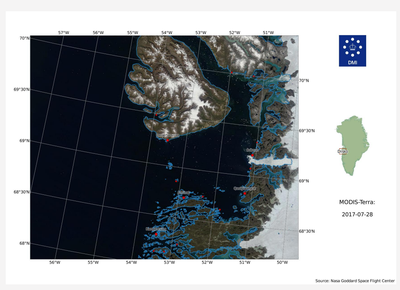


Figure 1: SIC and Sea Surface Temperature (SST) input data

Input data is regridded to a regular 0.05x0.05 lat,lon grid and the SIC data is filtered to remove land and ice-spillover effects using a combination of land vicinity, SST thresholds, sea ice charts and an inter-sensor bias correction. Subsequently the data is extrapolated into fjords and coastal areas. The filters are used to remove primarily land-spillover effects from the SIC input data, as we observe a significant difference in the SIC predicted in near coastal areas (see figure 2).



(a) Reference image for the Uppernavik area (orange square)



(b) Reference image for the Disco Bay area (grey square)

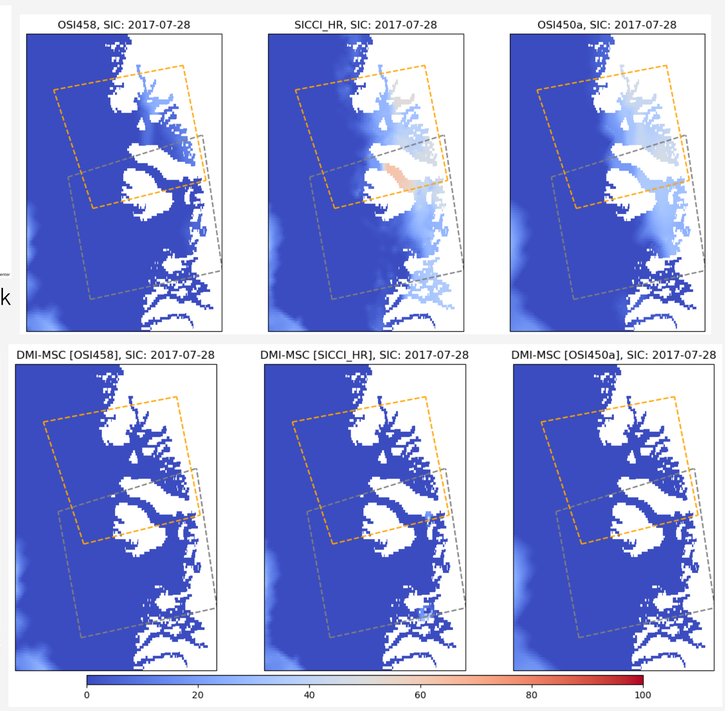


Figure 2: SIC predicted for OSI-458, SICCI-HR-SIC and OSI-450-a in the Disco Bay/Uppernarvik area compared to reference images from MODIS AQUA

From the Disco Bay and Uppernavik reference images we see that the unfiltered OSI-458 SIC show a high agreement with the almost entirely ice free reference images. On the contrary both the unfiltered SICCI-HR-SIC and OSI-450-a show signs of land contamination, as significantly more ice is predicted in the near coastal areas than in the reference images. After filtering we see a much higher consensus between the three SIC products showing that the filters have successfully removed sea ice arising from land contamination.

3 Results

To further asses the impact of our filtering we do a monthly comparison of the primary SIC input data to Sea Surface Temperatures from ESA CCI before (figures (a), (b) and (c)) and after (figures (d), (e) and (f)) filtering as shown in figure 3. Here we observe a much higher consistency between the SIC products after having applied corrections.

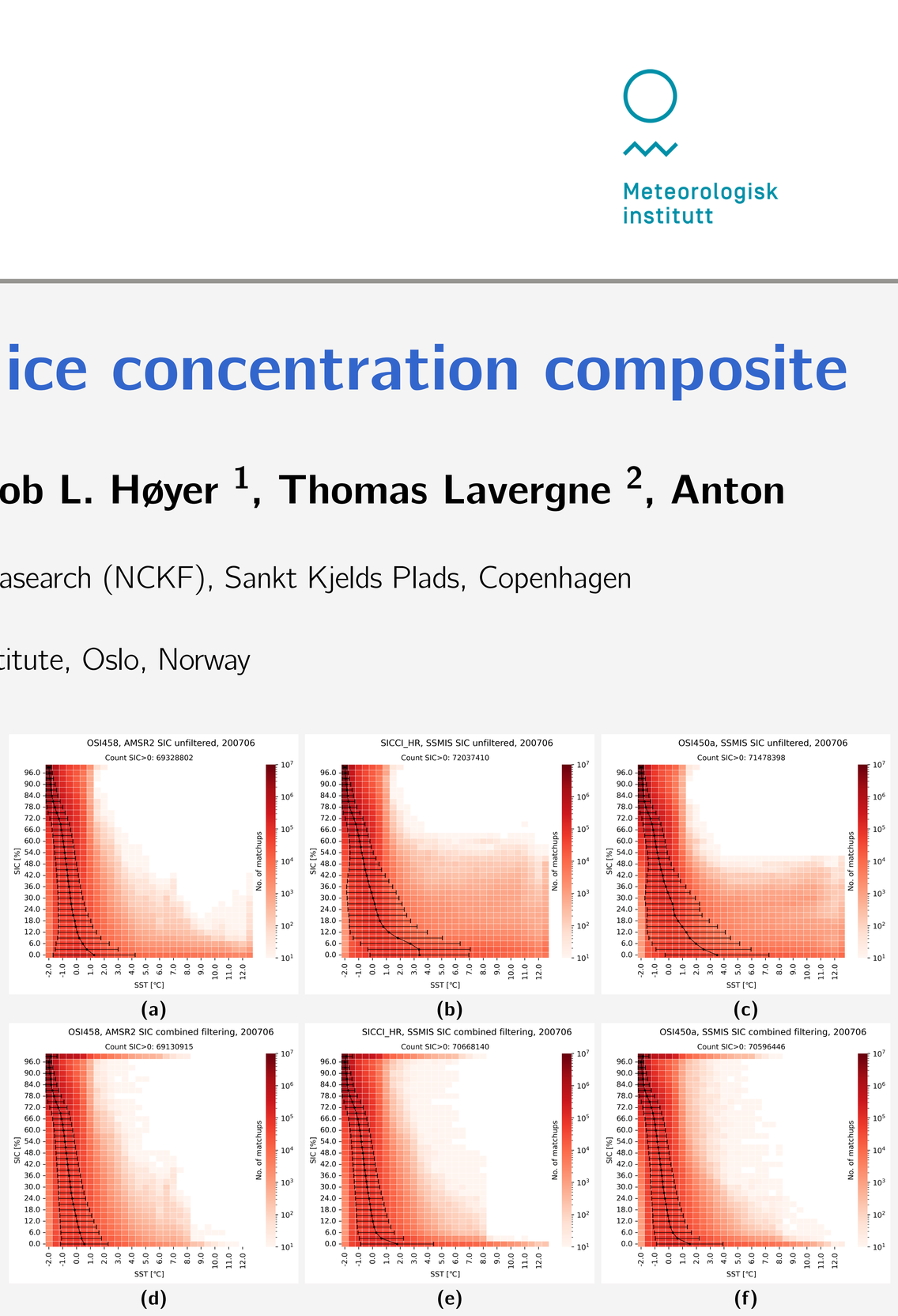


Figure 3: SIC data (NH) used to produce the DMI-MSC versus ESA CCI SST before filtering (a,b,c) and after filtering (d,e,f)

To asses whether unwanted trends have been introduced in our dataset from the combination of multiple SIC sources, we compare the Sea Ice Extend (SIE) of our SIC time series to SIC Climate Data Records (CDRs) from OSI-450-a, OSI-458 and NOAA/NSIDC, as shown in figure 4. We see that the climatological trend of both September and March fall within those of OSI-450-a and NOAA/NSIDC.

Figure 4: Sea Ice Extend (SIE) trends of DMI-MSC, OSI-450-a, OSI-458 and NOAA/NSIDC for September and March

4 Conclusions

- Combining existing SIC datasets to provide the best available sea ice information in the period 1982-2023
- Much higher consistency between the SIC input sources after applying our filters
- Similar trend in DMI-MSC SIE compared to those observed from NOAA/NSIDC and OSI-450-a CDRs