



Climate Change

Comparison of AROME-Arctic and Satellite-Derived Sea Ice Albedo

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Contents

- Copernicus project
- Sea Ice Albedo
- Model and satellite data
- Comparison
- Results
- Corrections
- Conclusions



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Copernicus reanalysis

- Copernicus project for Arctic Regional Reanalysis
 - Producing a 24-year regional reanalysis for the European sector of the Arctic
 - Lead by MET Norway, partners: DMI, SMHI, MF, IMO, FMI.
- At FMI
 - The main task is to produce satellite based CM SAF albedo data
 - **Comparison of sea ice albedo used for reanalysis and satellite retrieved sea ice albedo**

Two reanalysis domains
(Copernicus Project for Arctic Regional Reanalysis proposal, Harald Schyberg, Met Norway)



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Sea Ice Albedo

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- Sea ice albedo varies seasonally
- Net shortwave radiation flux is sensitive to the albedo
- Energy budget → Melt rate → Albedo → Energy budget

- How well is sea ice albedo going to be represented in the reanalysis?



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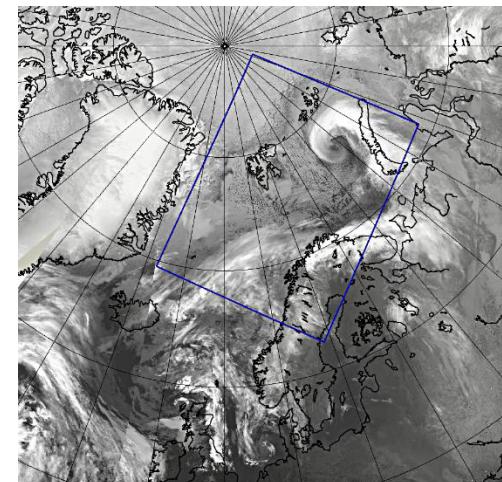


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AROME - Arctic

- HARMONIE-AROME is used for the reanalysis
 - Configuration of the ALADIN-HIRLAM NWP system
 - SURFEX for surface processes
 - Simple ICE (SICE) for ice covered sea areas
- SICE
 - A simple thermodynamical sea ice scheme
 - Gives prognostic sea ice surface temperatures
- AROME-Arctic
 - Operational version of HARMONIE-AROME at Met Norway for forecasts in the European Arctic
 - SICE

AROME-Arctic domain (www.met.no, 2018)



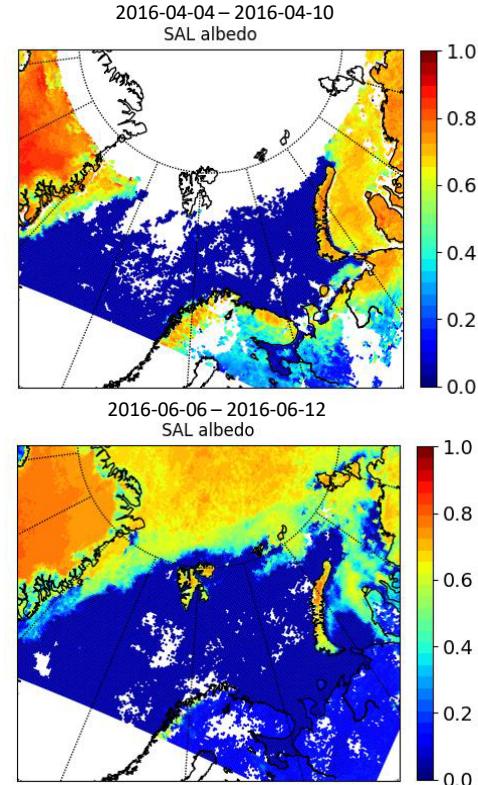
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Surface Albedo product

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- Surface Albedo (SAL) product
 - CM SAF climate data record CLARA-A2
 - Overpass data from AVHRR
 - Spatial resolution of 25 km for the Arctic
 - Available for 1982 - 2015
 - **Operational weekly averages** available for recent years
 - Clear sky moments



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Comparison

- Comparison for weekly averages in May to August 2016
- SAL weekly data
- AROME-Arctic:
 - Calculation of albedo: $1 - \text{SWNET}/\text{SWDN}$
 - 00, 06, 12, 18 UTC runs for 7 days averaged

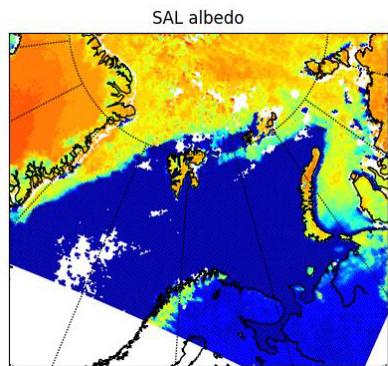


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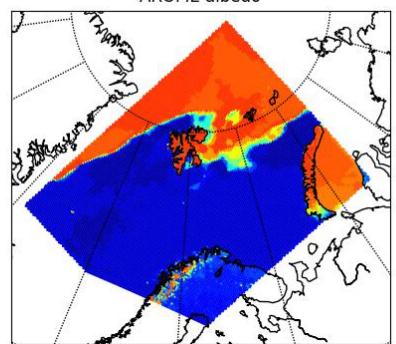


Results - May & June

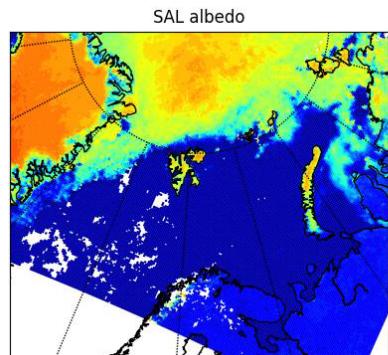
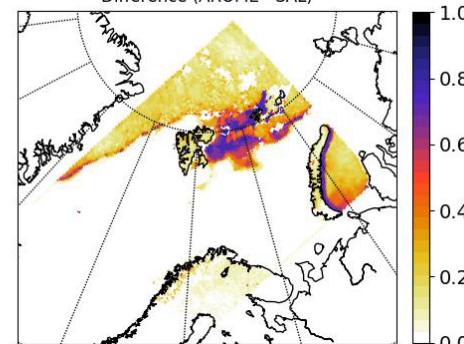
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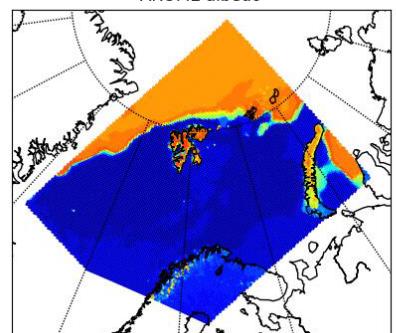
2016-05-16 - 2016-05-22
AROME albedo



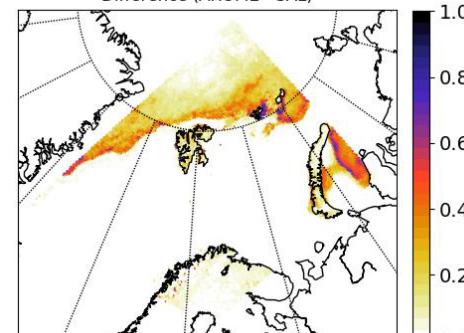
Difference (AROME - SAL)



2016-06-13 - 2016-06-19
AROME albedo



Difference (AROME - SAL)



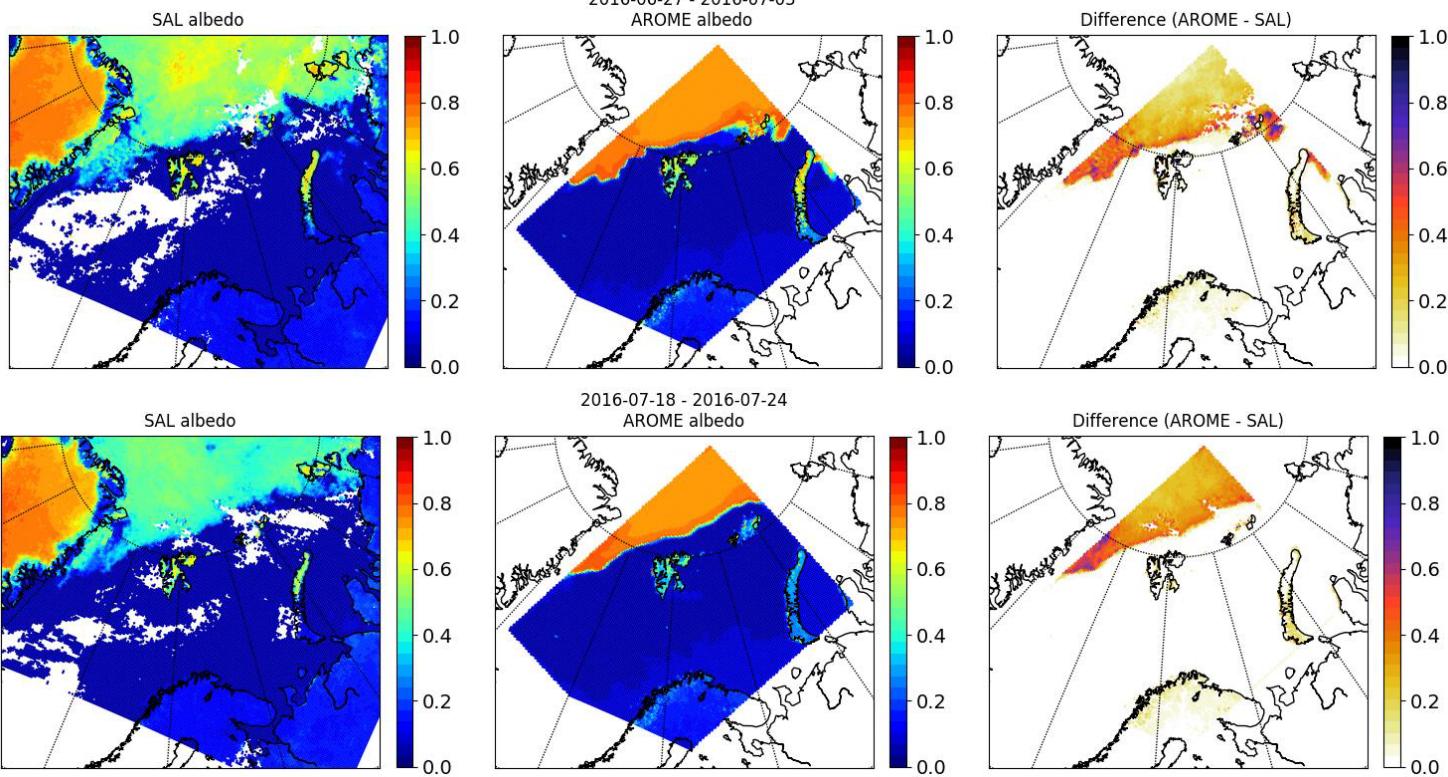
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Results - July

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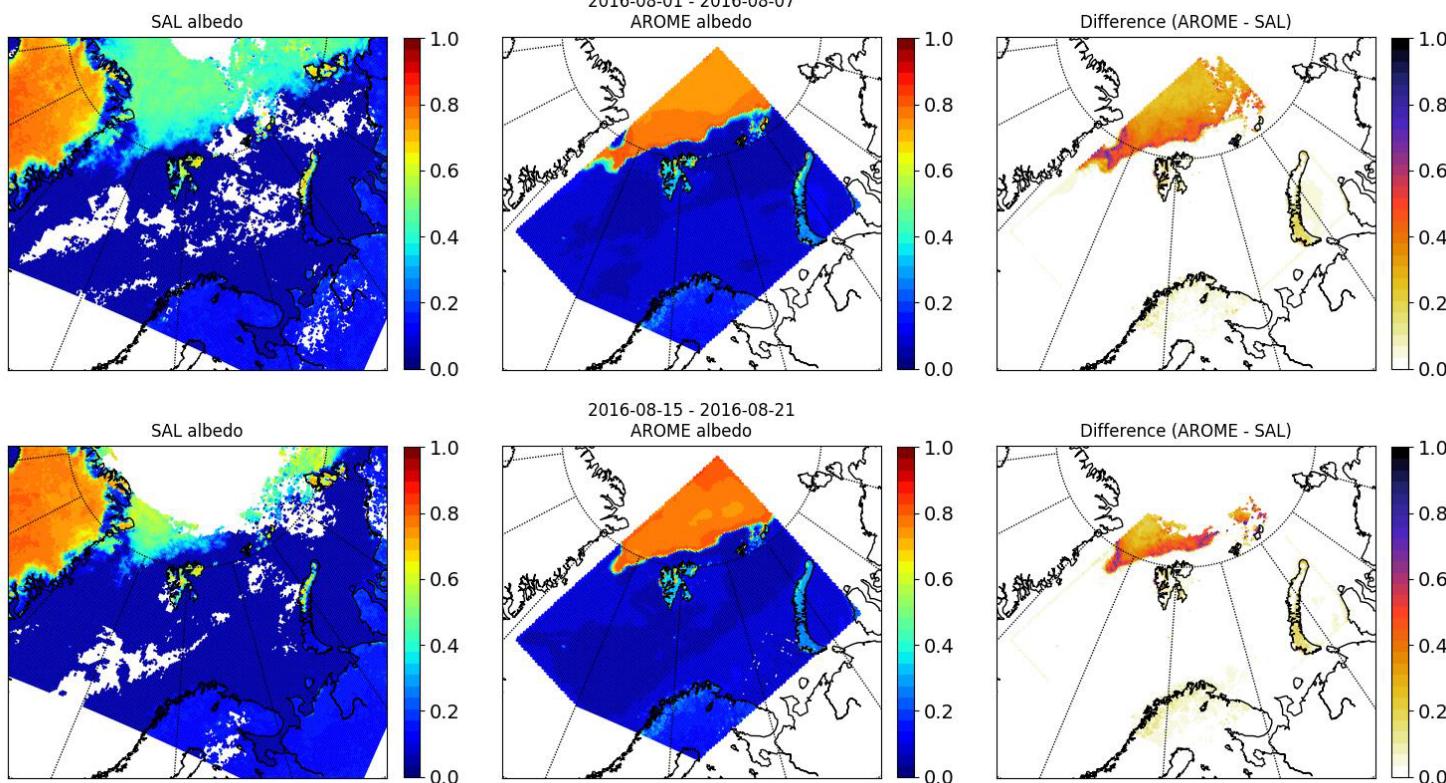
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Results - August

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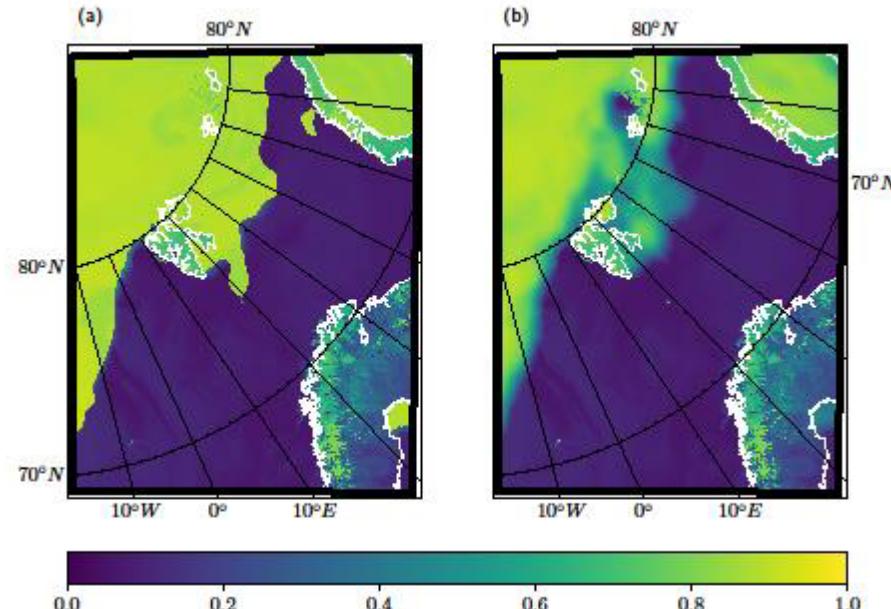


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Updated Albedo Averaging

Albedo averaging in the HARMONIE SICE scheme has been updated.

Effect is large where ice concentration is small, small elsewhere.



Effect of albedo averaging correction (Yuri Batrak, 2018)



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Albedo calculation correction

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- Sea ice albedo in SICE
 - **0.85** for ice surface temperatures under -3°C
 - Descending from **0.85** to **0.55** for -3°C to 0°C
- Currently AROME-Arctic maximum ice surface temperature is set to the freezing temperature of saline water (-1.7°C)
 - minimum albedo of **0.73**
 - maximum temperature by freezing temperature of sea ice (lower salinity) (-0.2°C)
 - minimum albedo of ~**0.57**



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Conclusions

- Sea ice albedo for the Arctic area compared
 - AROME-Arctic
 - SAL product
- Sea ice albedo in AROME-Arctic higher than the SAL product
 - Difference largest in marginal ice zone and during summer
 - correction in tile averaging improved edge areas
 - correction in sea ice temperature will reduce summer albedo



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Thank you!

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