ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

ArcticROOS 2016 activies at the Finnish Meteorological Institute

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CONTENT

a) Barents-Kara sea remote sensing activities

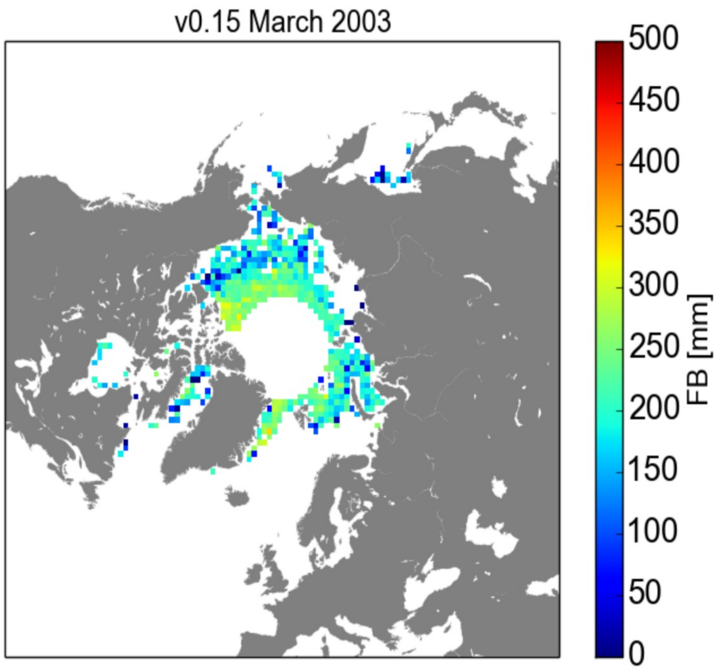
b) Kara sea regional modelling activities

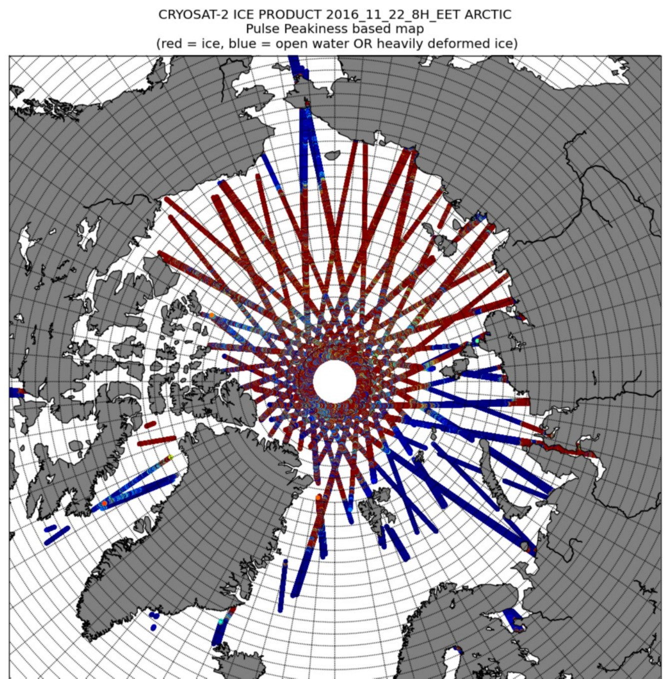
c) New results on ice dynamics

d) Arctic marine meteorology research

RADAR ALTIMETER PRODUCTS

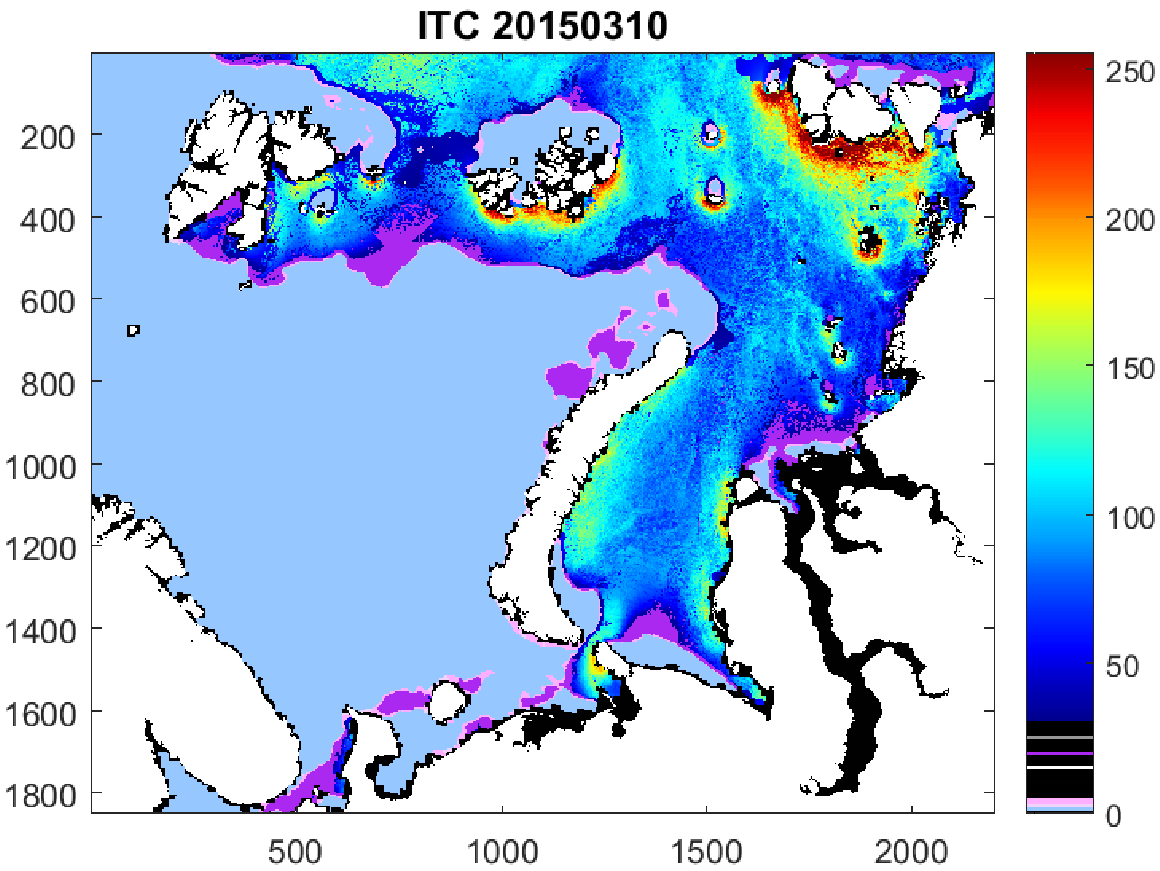
- FMI has set up an NRT-capable Cryosat-2 processing environment at the National Satellite Data Centre in Sodankylä
- Sea ice freeboard and thickness (CCI)
- Sea ice type for navigation (SPICES)
- Plans to build an altimeter based RIO risk class service in 2017, using both Cryosat-2 and Sentinel-3 data as input





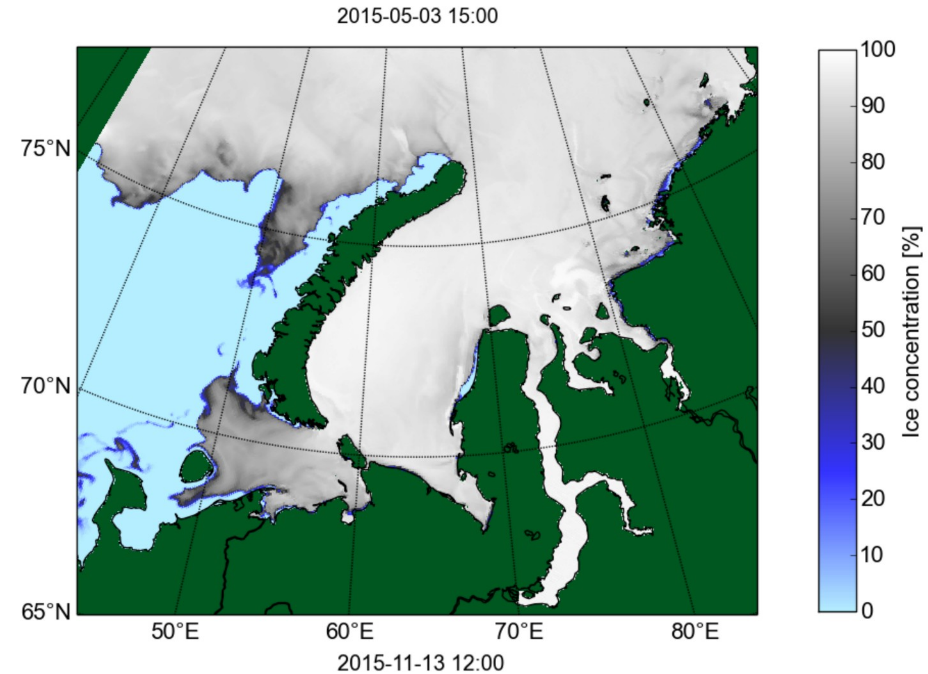
BARENTS AND KARA SEA ICE THICKESS PRODUCTS

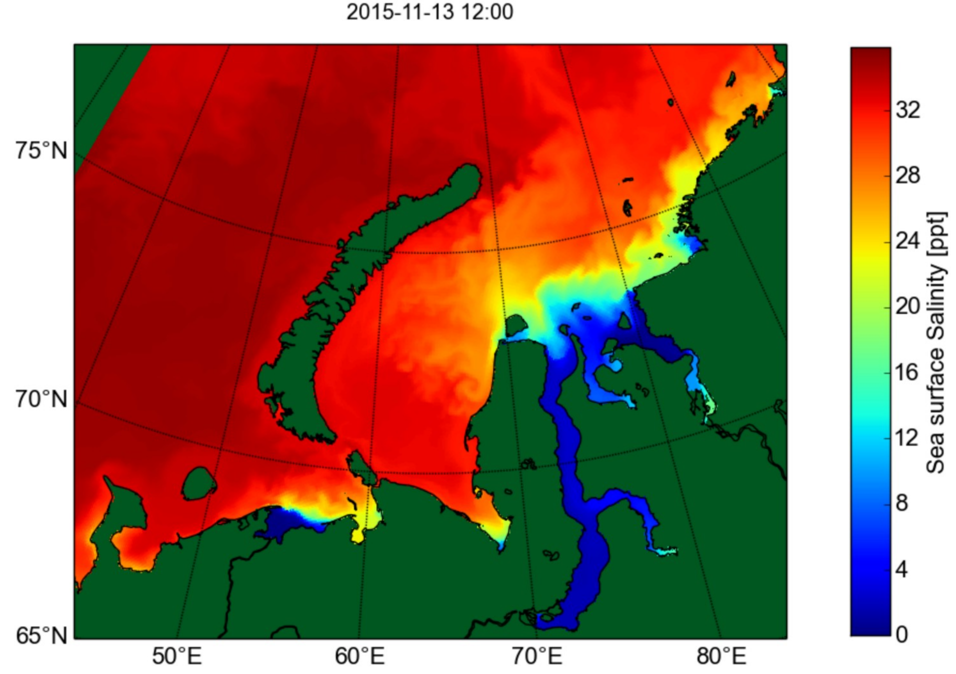
- Satellite data used: AMSR2 radiometer and S-1 EW SAR.
- Radiometer data for thin ice detection; thickness up to 30 cm.
- CMEMS TOPAZ model gives background ice thickness field which is locally modulated by SAR backscatter statistics.
- FYI thickness up to 2.5 m. Pixel size is 1 km.
- Submitted daily from Nov 2015 to early May 2016 to ICEMAR system in FP7 POLAR ICE.
- Accuracy of ice thickness chart (ITC) has been investigated using CS-2 in winter 2015. An underestimation bias of 20-30 cm was observed due to TOPAZ ice thickness values.
- More in LPS 2016 paper: Similä et al., ”Modeled sea ice thickness enhanced by remote sensing data”.



KARA SEA REGIONAL MODELLING

- Based on NEMO-LIM3 ice ocean model
- 5 ice thickness categories
- Resolution: 2 NM, 45 vertical levels
- Bathymetry: etopo1
- Boundary conditions from global model run (eORCA025): SSH, v_{baro}, T, S, ice conditions
- 9 tidal components from TPXO7.2 (OSU) prescribed at the boundaries
- Climatological river runoff
- Atmospheric forcing: DRAKKAR 5.2
- Hindcast run: Aug 2014 – Dec 2015
- Operational model under development, target is to provide pre-operational products during the YOPP

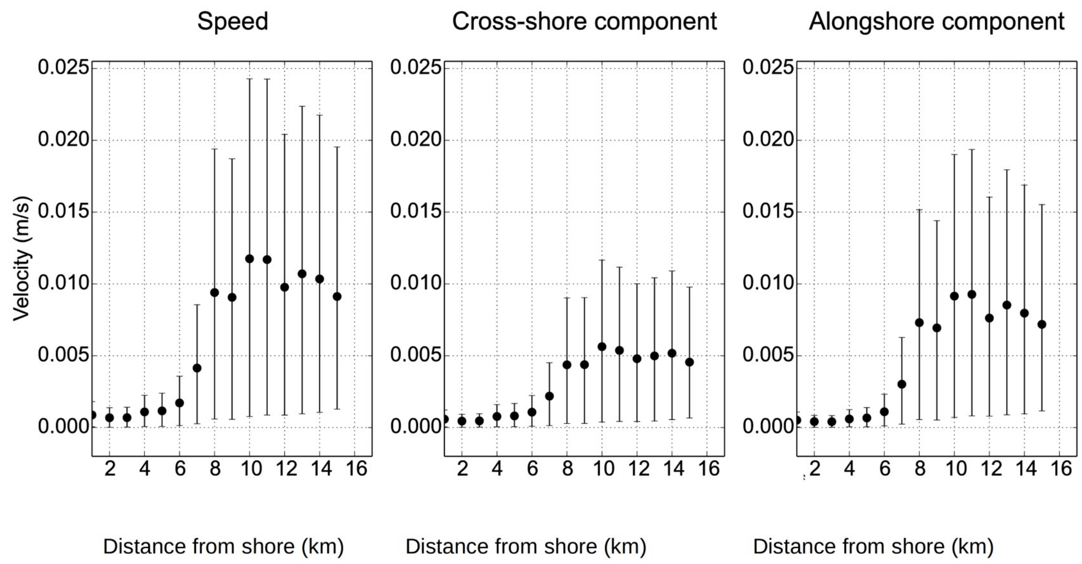




SEA ICE DYNAMICS AT THE COASTAL BOUNDARY ZONE

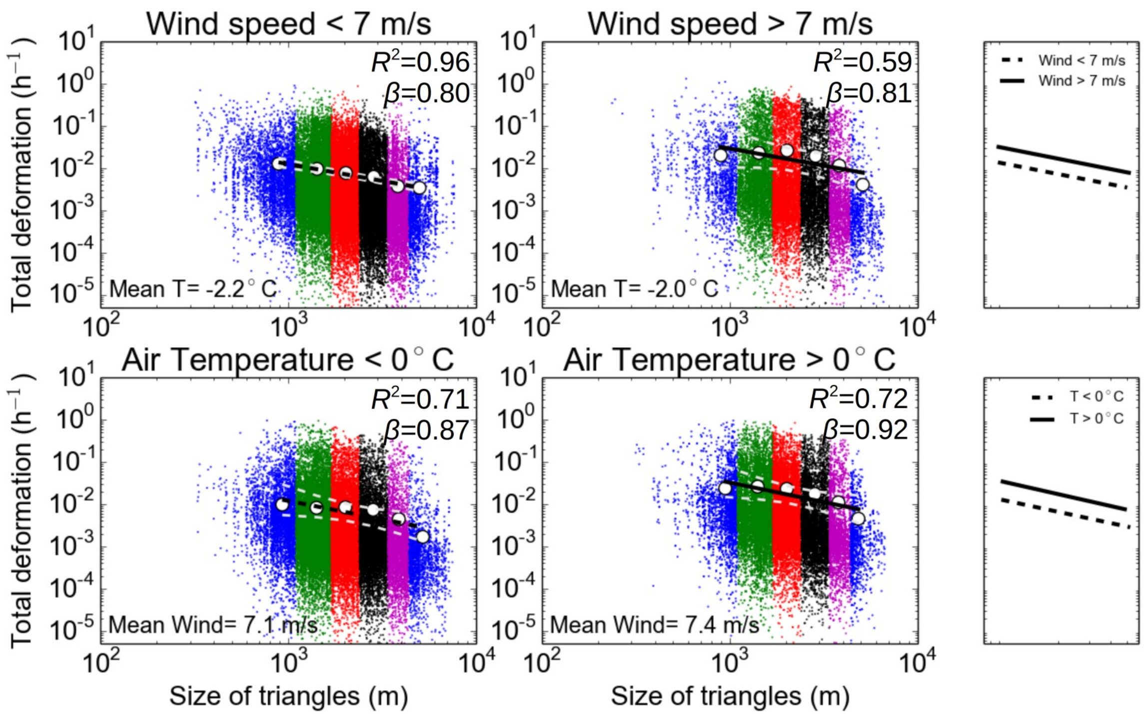
Method

- Ice motion from coastal radar images with 2 min interval were calculted by the virtual buoy method
- Location of the radar station : Tankar, Baltic Sea
- Sea ice deformations were calculated for the length scales of ~ 0.1 km - 10km



Key findings

- Deformation are short and local.
- Deformations follow power law scaling also in smaller length scales.
- Connection between air temperature and sea ice deformation on a short time scale.
- Refrozing of new fractures (heeling) is an important mechanism to control rate of deformation.



Oikkonen et al., 2016, GRL

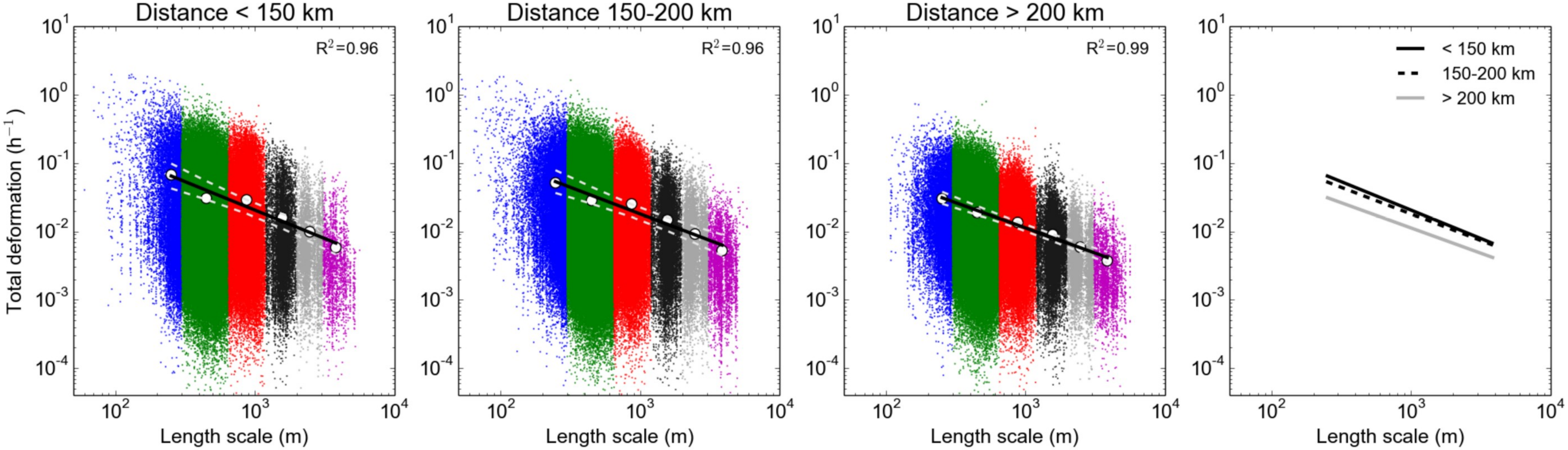
SEA ICE DYNAMICS AT THE MARGINAL ICE ZONE

Method

- We used ship radar images with 1 min interval recorded on board R/V Lance during N-ICE2015 campaign
- Sea ice deformations for the length scales of ~ 50 m - 5km

Key findings

- Deformation events were initiated along the lines of previous damages.
- Deep in the ice pack high deformation rates were connected to high wind and drift speed. Close to ice edge intense deformation occurred also with low wind and drift speed.
- Deformations follow power law scaling



Oikkonen et al., 2017, JGR (in rev.)

ARCTIC MARINE METEOROLOGY & CLIMATE RESEARCH

- Process studies on temperature inversions over sea ice (Palo et al., subm.), wind gusts over open sea and ice (Suomi et al., 2016), relationships of changes in sea ice concentration and wind (Jakobson et al., 2016), ABL over Svalbard fjords (several ongoing studies), and atmosphere-ice-ocean interaction in general (Spengler et al., 2016)

- Effects of Arctic sea ice decline (and other Arctic changes) on mid-latitude weather and climate (Overland et al., 2016, NCC; Vihma, 2016)

- Atmospheric component of the Arctic freshwater cycle (Vihma et al., 2016a)

- Atmospheric transports in and out of the central Arctic (Vihma et al., 2016b)

- Arctic Ocean as a component in the Pan-Eurasian Experiment (Lappalainen et al., 2016) and global observation systems (Hari et al., 2016)

- Comprehensive book chapter on the atmosphere over sea ice (Persson and Vihma, 2017)

FMI/MARINE CONTRIBUTION TO PPP/YOPP

ENHANCED OBSERVATIONS OF THE ARCTIC OCEAN

- Deployment of basic ice drifters as a part of the IABP
- Deployment of ice mass balance buoys
- Deployment of Argo floats as a part of the Euro-Argo

REMOTE SENSING

- Develope methods to retrieve ice parameters from satellites
- Pan-Arctic products : radar altimeter based ice classification
- Regional product : ice concentration, ridging and motion

OPERATIONAL MODELLING AND SERVICE DEVELOPMENT

- Pre-operational sea ice forecast for Barents-Kara Sea region
- Delivery of met-ice-ocean products for Arctic operators