Finnish Activities and Plans in the Antarctic sea ice zone

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Objectives:

- to better understand the interactive physical processes in the Antarctic climate system
- to improve NWP and climate models

Main international collaborators:
AWI, BAS, CSIRO, Texas A & M University, Brown University, Ohio State Univ.
Interaction of cyclones and sea ice (Uotila et al., 2011, JGR)

- 17,000 cyclones in 2001-2009 analysed on the basis of AMPS archive
- Large cyclones control the atmosphere-ocean heat exchange, but the heat exchange and surface properties control the strength of small cyclones

Occurrence of small cyclones (diameter < 1000 km)

Occurrence of large cyclones (> 1000 km)
The Antarctic cyclonicity budget and large scale atmospheric circulation

Uotila, Vihma, Tsukernik
Atmospheric forcing on large-scale ocean and sea ice models

Parameterization of wind stress over heterogeneous sea ice (Stössel et al., 2008, JGR)
- In long integrations (1000 years), the parameterization method applied affects ocean salinity, temperature, deep convection, and formation of Antarctic Bottom Water.

Effects of presentation of continental orography on sea ice modelling
(Stössel et al., 2011, JGR)

Ongoing: AMPS – ECMWF comparisons: effects on sea ice concentration and thickness in the Weddell Sea
Joint Airborne Study of the Peninsula Region: JASPER

In February – March 2010, aircraft measurements were carried out by BAS, AWI and FMI over the Weddell and Bellingshausen Seas. The focus was on meteorology, but the data also include sea ice concentration, surface temperature, as well radiative and turbulent fluxes at low altitude.

Studies:
- boundary-layer processes over Ronne Polynya; observations and modelling: talk on Monday
- reanalysis validation: talk on Tuesday
- cloud-radiation-turbulence interaction
- clear-sky radiative fluxes over sea ice and ice shelves
- large-scale heterogeneity and effective albedo: observations and modelling
Surface energy budget over sea ice in early summer (ISPOL) (Vihma et al., 2009, JGR)

Figure 11. Mean surface fluxes at SHEBA in June 1998 (red), at ISPOL (blue), and at McMurdo Sound on 28–31 December 2000 (yellow [Wendler et al., 2005, Table 3]).
Modelling of the ISPOL period

Valkonen, Vihma, Johansson, Launiainen: Atmosphere - sea ice interaction in early summer in the Antarctic: evaluation and challenges of the Polar WRF model, to be submitted in summer 2012

Major challenges:
Modelling of clouds: errors results in errors in Ts
Too much turbulent mixing
Modelling of the ISW 1992 period


- Surprisingly good results for Ts (bias 0-2 K)
- Largest challenges with low-level jets → further affect surface turbulent fluxes

Tastula, Vihma, Andreas, Galperin: Validation of the diurnal cycles in atmospheric reanalyses over Antarctic sea ice, to be submitted in GRL in summer 2012.

- great variability in the diurnal cycles of surface fluxes given by different reanalyses
- for near-surface temperature, specific humidity and wind speed, the diurnal cycles are more alike
- failure to capture diurnal cycle in cloud cover fraction leads to errors in other cycles
- the diurnal cycles by NCEP-CFSR are found to have shapes and ranges closest to those observed
Recently started studies

1. Cyclone effects on moisture transport
2. Links between Arctic and Antarctic sea ice conditions
3. Surface energy balance on Larsen and Wilkins Ice Shelves
4. GEWEX Atmospheric Boundary Layer Study, 4th Experiment (GABLS4)
Participation in Polarstern Winter Weddell Sea Cruise, Jan – Aug 2013

Small Unmanned Meteorological Observer (SUMO)

Quadrocopter

Ice mass balance buoys?
Publications in 2011-2012


