IOMASA Background and Objectives

The polar regions belong to the regions of which the least information is available about the current and predicted states of surface and atmosphere. Because of sparse observations, we only have at a rough quality weather forecasts for northern Europe, and ice charts for the ice frequented waters of the European Arctic.

The objective of IOMASA (running from November 2002 to October 2005; 247 person-months) is to improve our knowledge about the Arctic atmosphere by using satellite information which is continuously available, but currently not optimally exploited. This progress will be achieved through an integrated approach involving the following four components:

1. Remote sensing of the atmospheric parameters humidity, cloud liquid water and temperature over sea and land ice.
2. Improved remote sensing of sea ice with more accurate and higher resolved ice concentrations (percentage of ice-covered sea surface).
3. Improving numerical weather prediction (NWP) models by assimilating the results of the points 1 and 2.
4. In order to prove the usefulness of this concept, a real time processing set-up and a user interface will be demonstrated.

Expected Results and Impact

We expect from IOMASA progress in the fields of

1. Weather forecast for northern Europe
2. Ice charts for the ice frequented waters of the European Arctic
3. Estimation of the fraction of open water in the higher Arctic which is very important for the total heat budget of the region, affecting both local and regional weather and climate (the heat exchange between the ocean and the atmosphere is about two orders of magnitude larger when no ice is present).

Satellite Data to be Exploited

The remote sensing data to be exploited in IOMASA come from the following instruments

AMSU and **SSM/T2** Microwave humidity sounders aboard the NOAA and DMSP satellites, respectively.

SSM/I Imaging microwave radiometer aboard the DMSP satellites.

AMSR and **AMSR-E** (Advanced Microwave Scanning Radiometer) aboard the satellites ADEOS-2/Midori-2 (NASDA) and Aqua (NASA), respectively: Similar to SSM/I, but higher spatial resolution and four additional frequency channels.

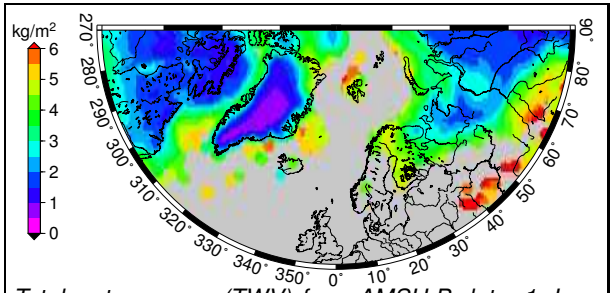
QuikSCAT satellite carrying the **SeaWinds** scatterometer: An active microwave instrument operating at of 13.4 GHz (K_u band).

IOMASA Components

1. Remote sensing of atmospheric parameters over ice

Existing algorithms to derive atmospheric parameters over ice from satellite data will be adapted/improved:

- Adapt a procedure to retrieve the total water vapour (TWV) over Antarctic sea and land ice from SSM/T2 data (see Figure below) for use with AMSU-B data in Arctic conditions.



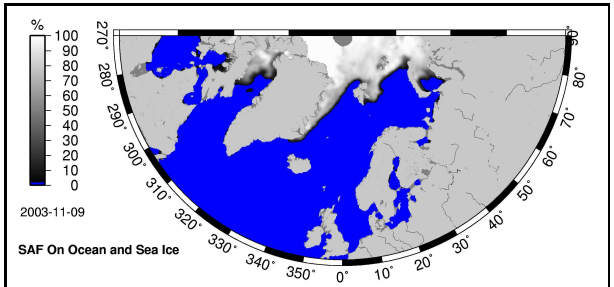
Total water vapour (TWV) from AMSU-B data, 1 January, 2000. (Grey: saturation of algorithm because of too high TWV.)

- Adapt a procedure to derive the cloud signature (roughly the cloud liquid water) over ice from SSM/I data of the Antarctic for use with SSM/I and AMSR(-E) data and Arctic conditions.
- Improve the utilisation of temperature profile information from microwave sounders working in the oxygen absorption band near 60 GHz (e.g. AMSU-A, SSM/T1) by including surface emissivity information at the frequencies and incidence angles of the sounder in regions (partially) covered by sea ice

2. Remote sensing of sea ice

Existing ice concentration retrieval algorithms using SSM/I data will be improved by additionally using data from other sources in the following way:

- Improved knowledge of the ice surface type which allows a more accurate specification of reference radiative properties (tie points) that span the scale of ice concentrations; this will be obtained mainly from surface emissivity and backscatter models in combination with synergies between data from the the Quikscat scatterometer and SSM/I.
- Improved accounting for the atmospheric contribution to the satellite-measured radiances and backscatter values, using, e.g., wind data from numerical weather prediction (NWP) models,
- use of higher resolution radiometer data from AMSR(-E) instead of SSM/I



SAF Ice concentration map, 9 November, 2003.

3. Improving numerical weather prediction models

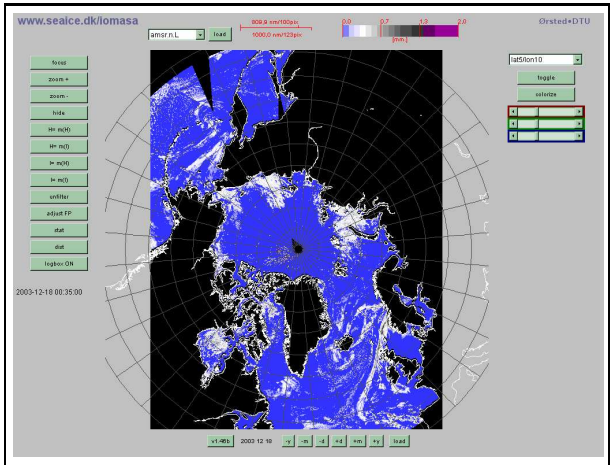
The improved knowledge about the atmosphere and sea ice in the Arctic gained from satellite data as described above can help to improve numerical weather prediction (NWP) models by means of data assimilation and improved modelling:

- Assimilation of atmospheric humidity data (TWV) over ice
- Assimilation of temperature sounder data over ice
- Improved surface heat flux modelling using ice concentration data (until now, only ice edge data have been used).

This should result in improved weather forecasts in the Arctic and surrounding areas.

4. User interface

A user interface has been set up (see figure below) and is accessible at http://www.seaice.dk/iomasa
A real-time processing system will be set up as well.



Screenshot of the data distribution interface IWICOS at http:// www.seaice.dk/ iomasa

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IOMASA

Integrated Observing and Modelling of the Arctic Sea Ice and Atmosphere

http://www.uni-bremen.de/~pharos/iomasa