IOMASA – Integrated Observing and Modeling of the Arctic Sea ice and Atmosphere

EU project EVK3-CT-2002-00067

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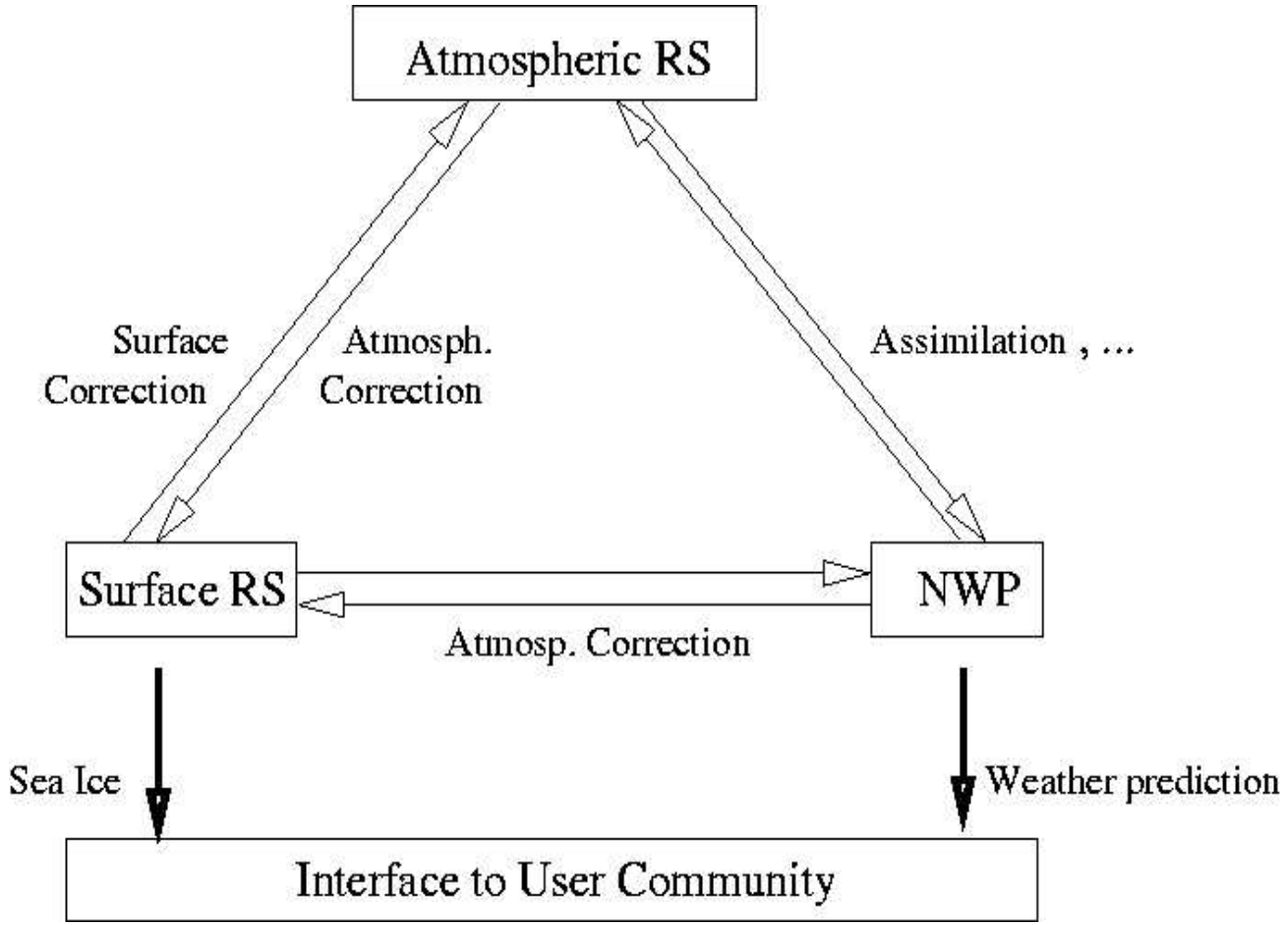
Innovation of IOMASA



IOMASA partners

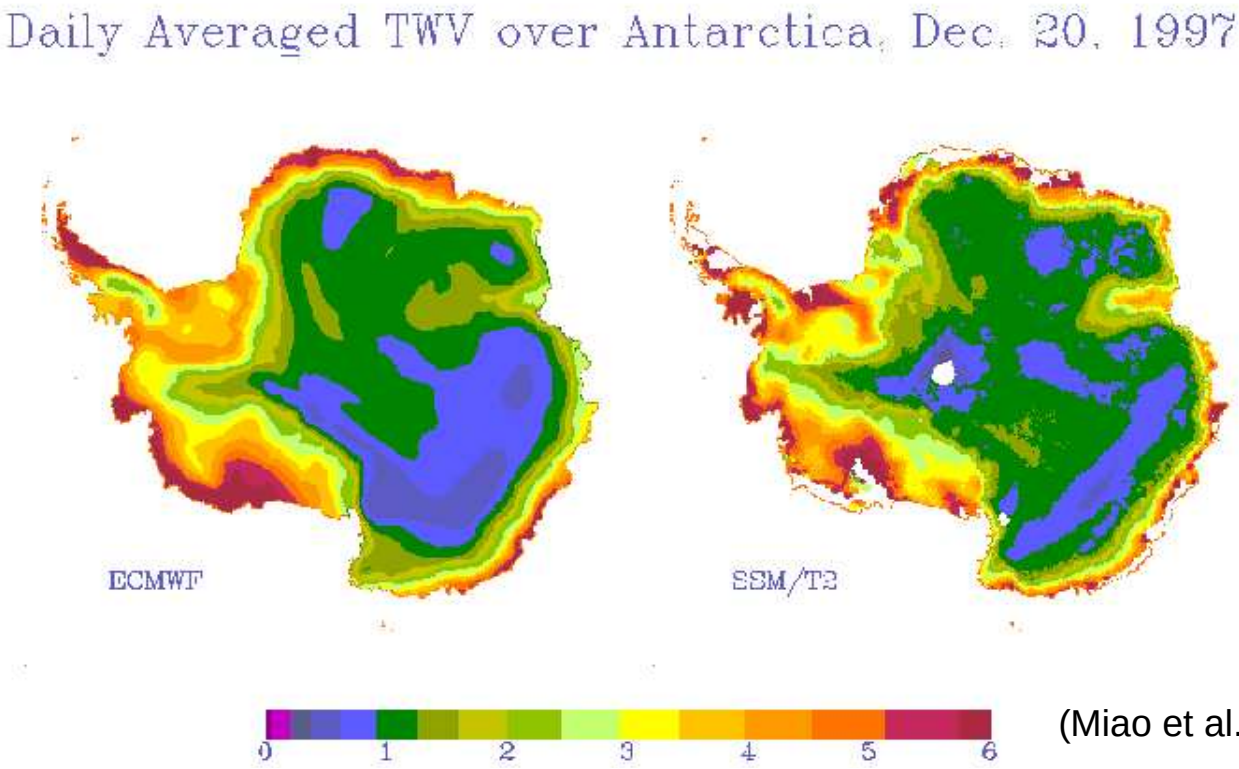
- UB: University of Bremen, Institute of Environmental Physics (Co-ordinator)
- DTU-DCRS: Danish Center for Remote Sensing, TU Denmark
- DMI: Danish Meteorological Institute
- met.no: The Norwegian Meteorological Institute
- SMHI: Swedish Meteorological and Hydrological Institute

IOMASA Project Parts

- Part 1: Atmospheric Remote Sensing : UB
- Part 2: Numerical Weather Prediction Models: met.no, SMHI
- Part 3: Empirical Model for emissivity and backscatter of sea ice: DTU-DCRS
- Part 4: Sea ice concentration retrieval: DMI
- Part 5: Real time processing and user interface: DTU-DCRS

Total Water Vapour (TWV) from humidity sounders

- SSM/T2 and AMSU-B: 5 channels 183±1, ±3, ±5, 150, 89 GHz
- expressions ln (T1-T2)/(T2-T3) ~ TWV



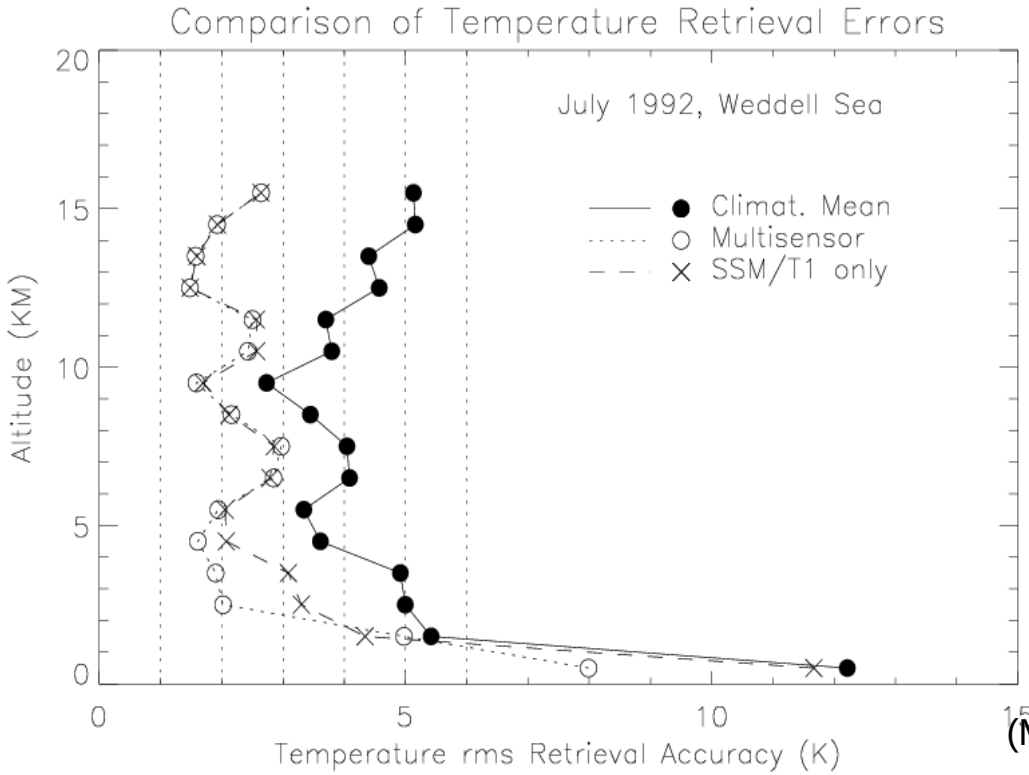
(Miao et al., 2001)

Part 1 (UB): Atmospheric Remote Sensing

1. **Transfer TWV procedure to**
    1. Arctic conditions
    2. using a set of Arctic R/S and low TWV values over open water
2. **Transfer Cloud Signature procedure to**
    1. Arctic atmospheric conditions,
    2. Arctic sea ice emissivity (literature and ice types from Part 3)
    3. AMSR(-E)
3. **Estimate surface emissivity at AMSU-A frequencies and incidence angles**
    - needed to improve temperature profiles in NWPs
    - use ice concentrations from SSM/I,
    - use surface temperatures from AVHRR, cloud free
    - R/S for atmospheric data

Temperature profiles over sea ice

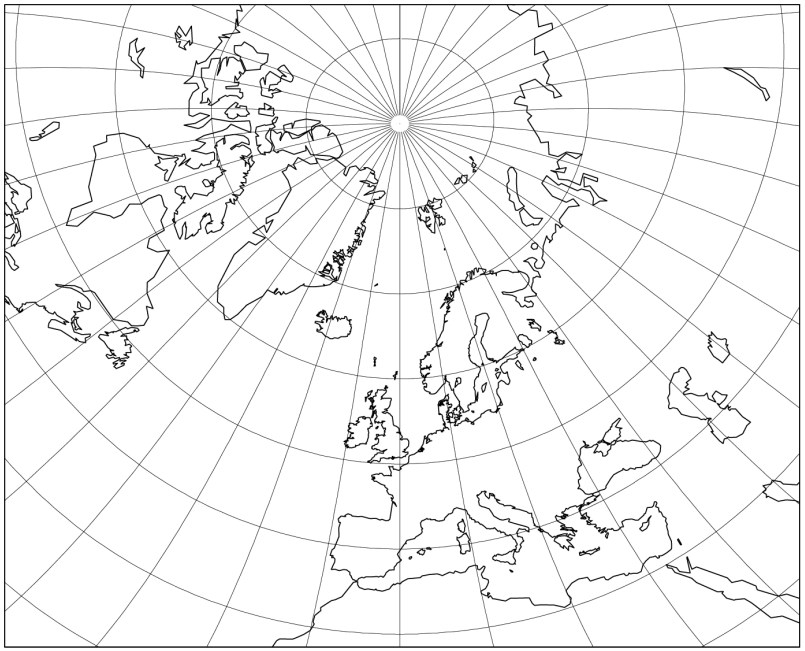
- from microwave temperature sounder SSM/T1, SSM/I (sea ice) and OLS (surface temp.)
- improved by knowledge about sea ice emissivity and concentration



(Miao et al., 1997)

Part 2 (met.no, SMHI): Improve NWP models

- HIRLAM, 20 km resolution, 48h



- Assimilate
  - TWV
    - direct
    - conventional
  - sea ice cover to improve
    - temperature retrieval (AMSU-A)
    - surface flux modeling

- validate with
  - R/S (calm conditions)
  - case studies (severe conditions)

Part 3 (DTU): Model of Sea Ice emissivity and backscatter

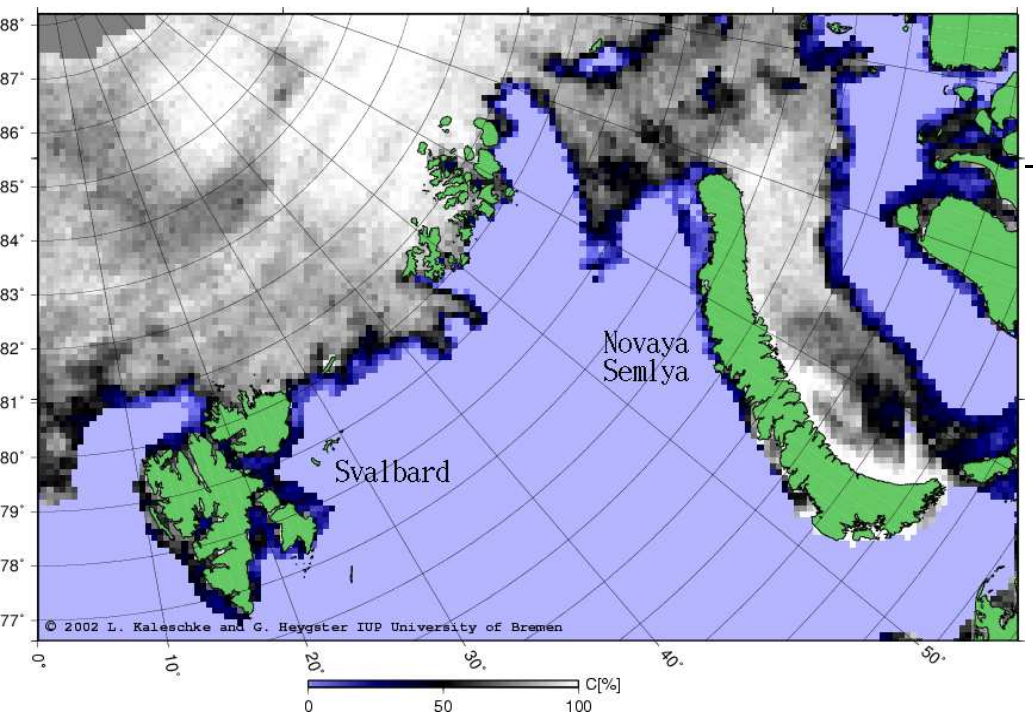
- Passive (SSM/I) and active (Quikscat, Sea Winds) microwave instruments
- Retrieval needs signature of pure surface types, ‘tie points‘
- Vary
- Relate temporal evolution of signature to sea ice parameters:
  - ice type,
  - snow cover (grain size, water content),
  - salinity
  - deformation
- AMSR(-E) on AQUA, ADEOS-2:
  - higher resolution
  - additional channels at 6 and 10 GHz
  - on ADEOS-2 also scatterometer SEA WINDS (~Quikscat)

Part 4 (DMI): Ice Concentration Retrieval

- Accuracy 5...10 %
- Improvement needed at
  - low IC for navigation
  - high IC for heat fluxes:

    5% error at 90% IC 50 % error in OW and heat flux
- achieved by
  - accounting for atmospheric contributions (wind speed, TWV, LWP) to satellite signal
  - knowledge of surface types -> improved tie points
  - using new quasi-operational sensors, e.g. AMSR(-E), SEA WINDS,...

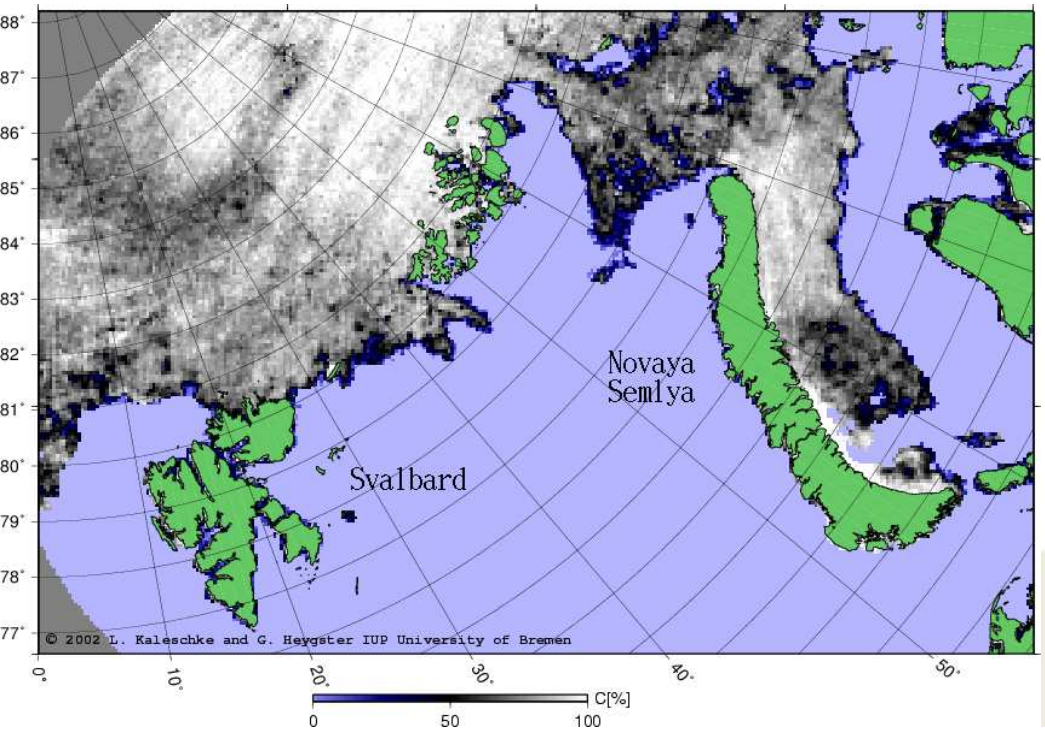
AMSR-E Sea Ice



SSM/I ASI, 15 km res. @ 85GHz

for daily data see

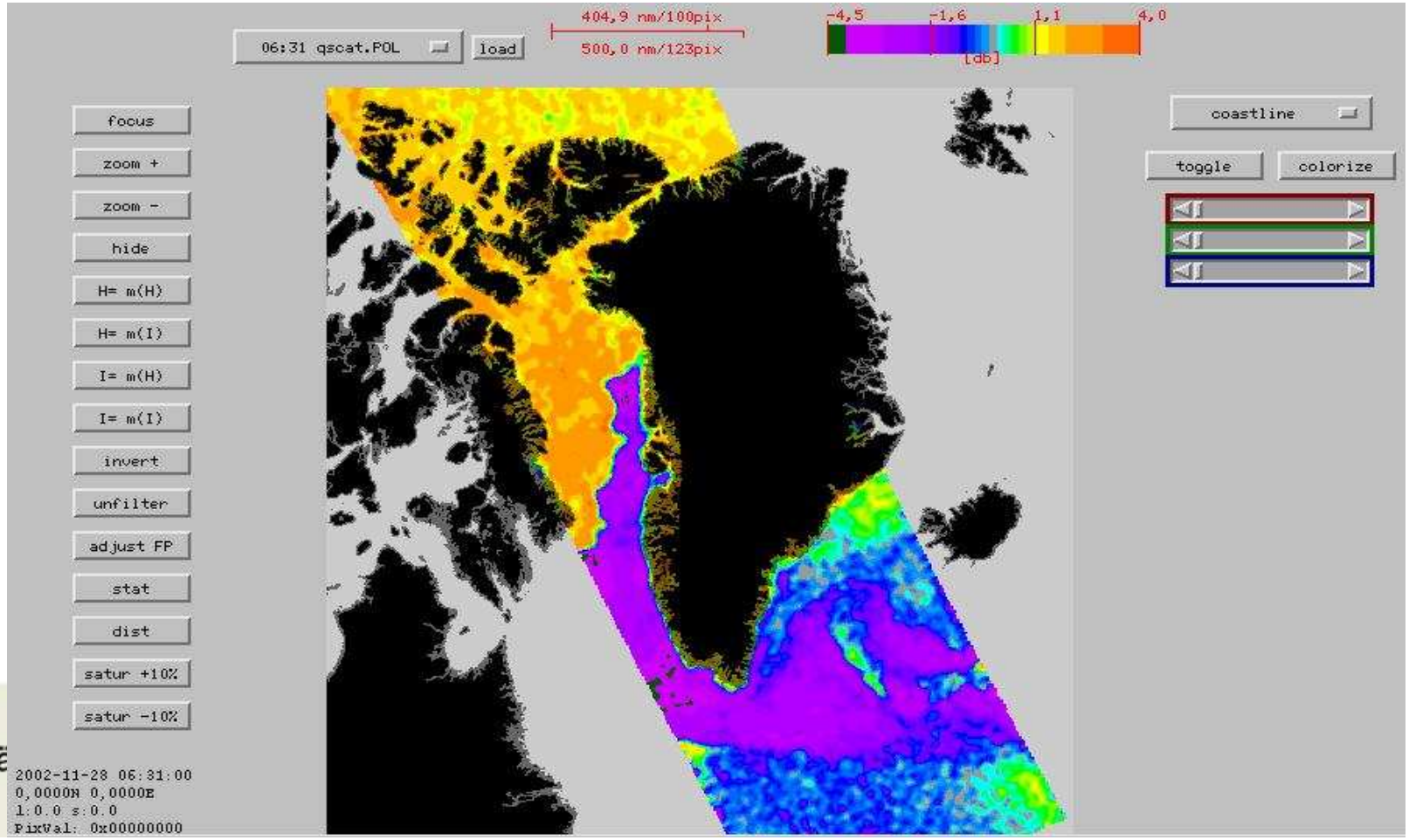
www.seaice.de



AMSR ASI, 6 km res.@ 89 GHz

Part 5 (DTU): Real Time Processing and User Interface

- NWP models: met.no, SMHI, operational chains
- Sea Ice: DMI
- Distribution to public users: DCRS, using IWICOS interface...



IOMASA User Advisory Group

- user dialogue during project
- weather forecast, ice charts
- attend 2...3 meetings
- planned: representatives of
  - ECMWF
  - HIRLAM group
  - ice services
  - .. and YOU?

Conclusions

IOMASA

- accounts for the interdependencies of Arctic atmosphere and surface
- improves weather forecasts and ice analyses
- extends notion of OF from ocean to atmosphere

SSM/I vs. AMSR characteristics

Frequency [GHz]		Resolution [km]	
SSM/I	**AMSR(-E)**	**SSM/I**	**AMSR(-E)**
-	6.9	-	71x41
-	10.7	-	46x25
19	18.7	69x43	25x15
22 V	23.8	50x50	23x14
37	36.5	37x29	14x8
85	89	15x13	6x4
-	50.3 V	-	12x6
-	52.8 V	-	12x6

All channels H + V polarisation if not indicated otherwise.
Channels near 50 GHz on AMSR only.

4 Project Phases

1. Preparatory Phase:
   Provide data, day 0 algorithms, data sets; literature studies

- Development Phase:
  Algorithms for retrieval and assimilation

3. Production experiment:
   Produce on 2-year historic data

4. Validation and real time experiment:
   Demonstrate operational use and data distribution