IOMASA MTR

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DMI

Status

- Activities have focussed on:
  - Ice/snow emission modelling
  - Concentration algorithm evaluation
  - Extending the toolbox (drift data)
  - Routine SAR classification

Emission modelling

- MEMLS obtained from C. Mätzler
  - Added sea ice module (->MEMLSI)
- In-situ ice profiles from Polarstern March 2003 and collocated AMSR Tbs through DTU
  - Grain sizes poorly defined
  - Snow described qualitatively at best
  - Lacks snow/ice density data for many stations
  - Representativeness/varying spatial scales?
- Initial sensitivity study
  - Draft report in progress

First-try, simulating AMSR measurements using MEMLSI and *in situ* observations, 23.03.2003 near 76.26°N, 23.28°E

Thick snow (36cm) profile on FY ice:

14 cm soft wind slab

0.1 cm thin icy layer

16 cm hard wind slab

6 cm depth hoar

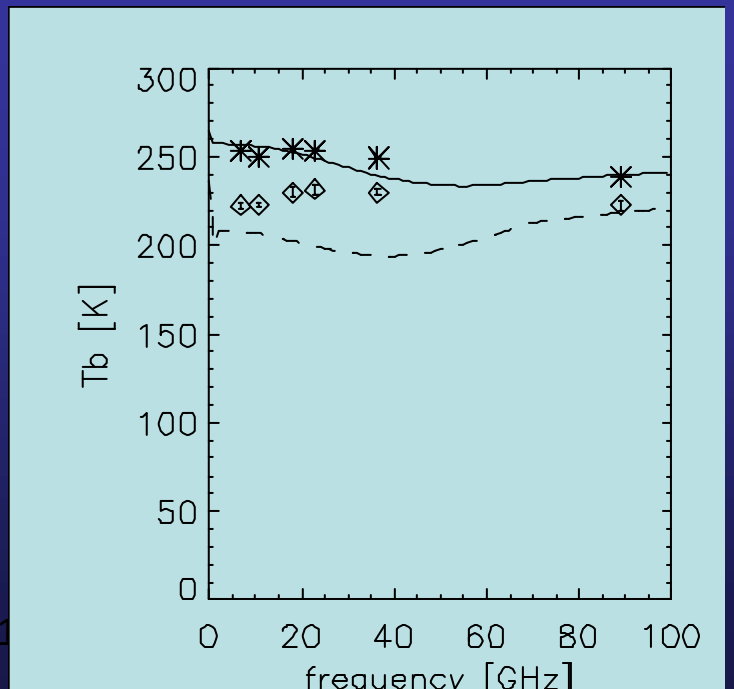
First year ice, S: 4-13.6 psu.

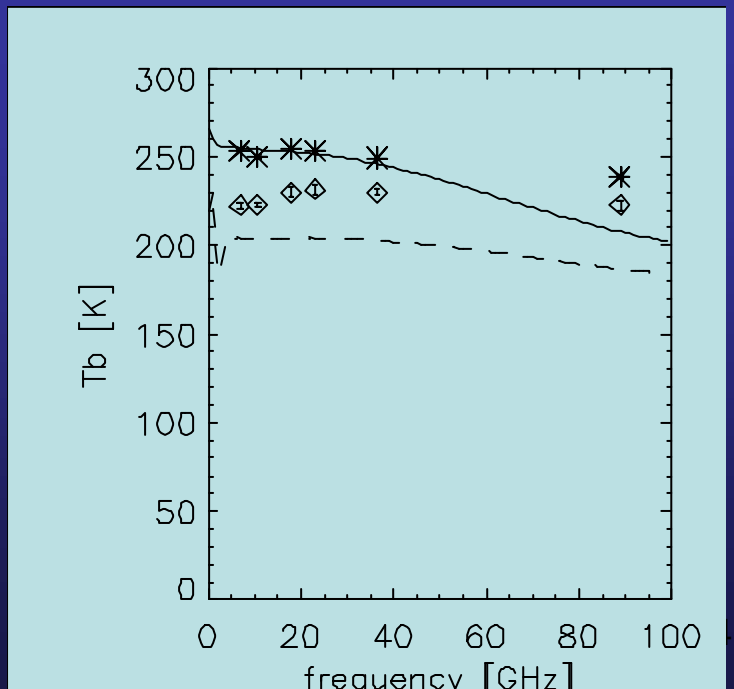
Thin snow (7cm) profile on FY ice:

4 cm hard wind slab

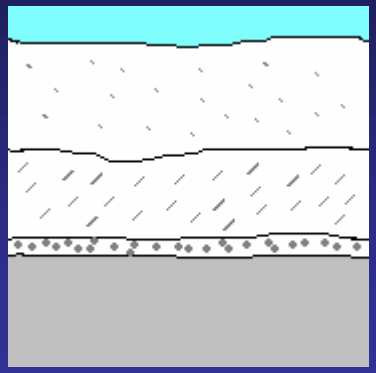
3 cm depth hoar

First year ice, S: 4.4-13.5 psu.

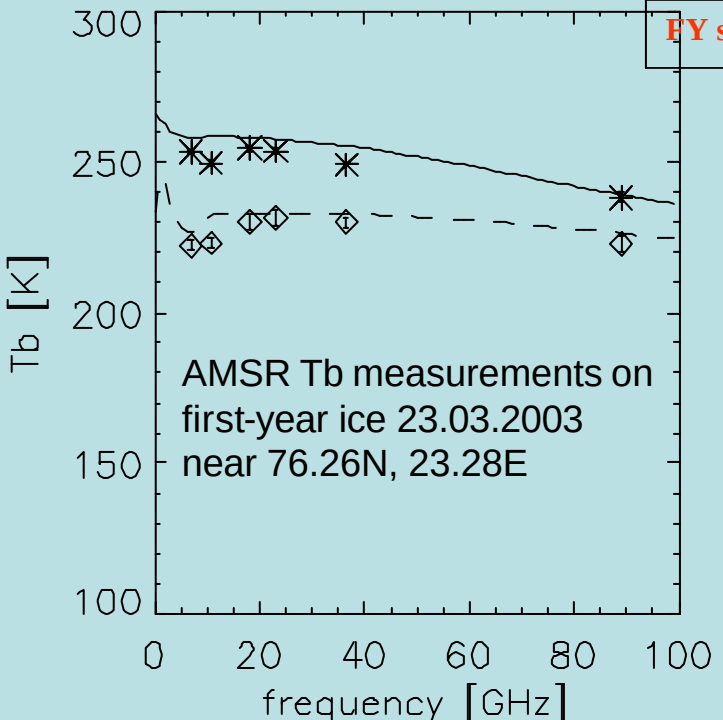




Profile used to initialise MEMLSI in sensitivity studies



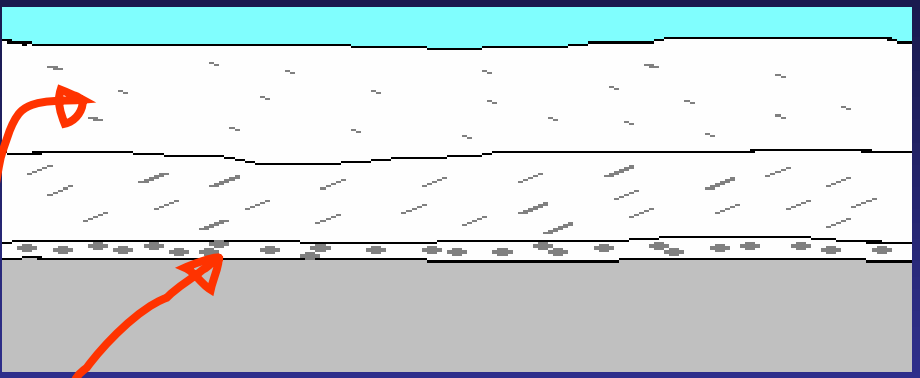
Type	T[K]	Density [kg/m3]	Thickness [cm]	PCI [mm]	S [psu]	Snow/ic
Nearly new snow	253.0	260	7.0	0.05	0	Snow
Hard densified slap	257.0	410	5.0	0.08	0	Snow
Coarse grains	261.0	320	1.0	0.14	0	Snow
FY sea ice	262.0	920	2.0	0.18	7.0	Ice
FY sea ice	262.5	920	100.0	0.15	5.0	Ice



Important snow parameters:

- Density contrast between layers
- Correlation length (grain size)

MEMLSI simulations of ice concentration



Upper snow-layer density 100-410kg/m3

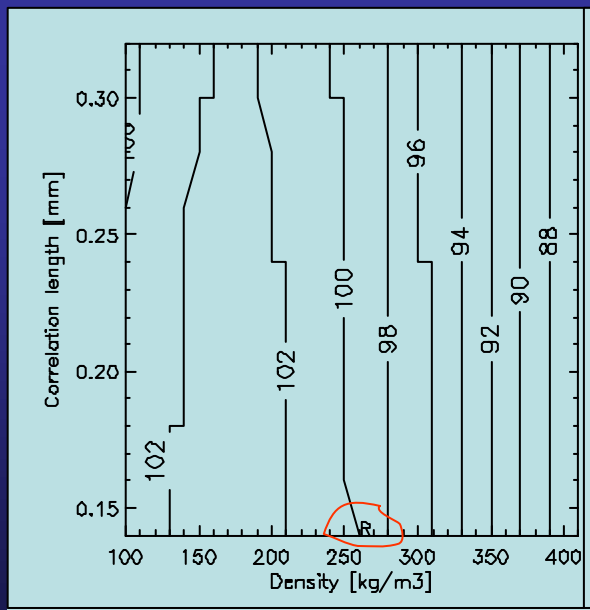
Above ice correlation length 0.14-0.32mm

NASA Team: sensitive to layer contrast.

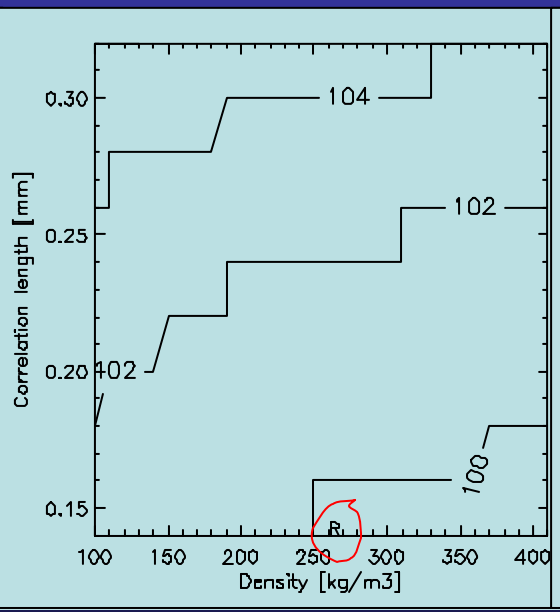
Comiso frequency: moderately sensitive to scattering.

Near 90 GHz: moderately sensitive to deep scattering, sensitive to layer contrast.

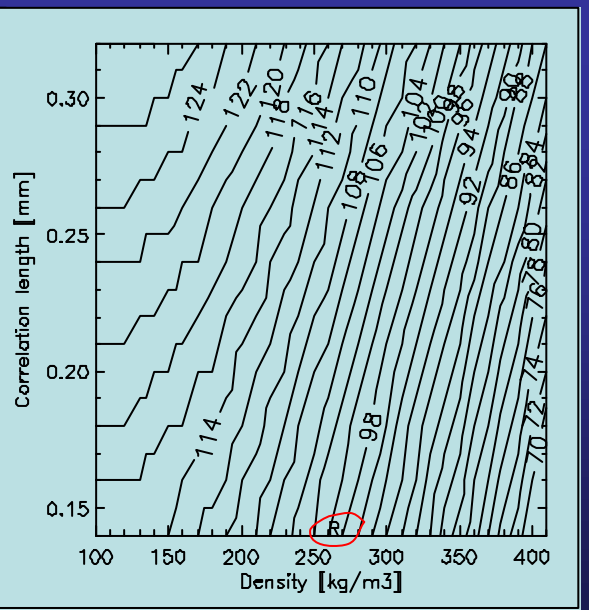
NASA Team



Comiso frequency

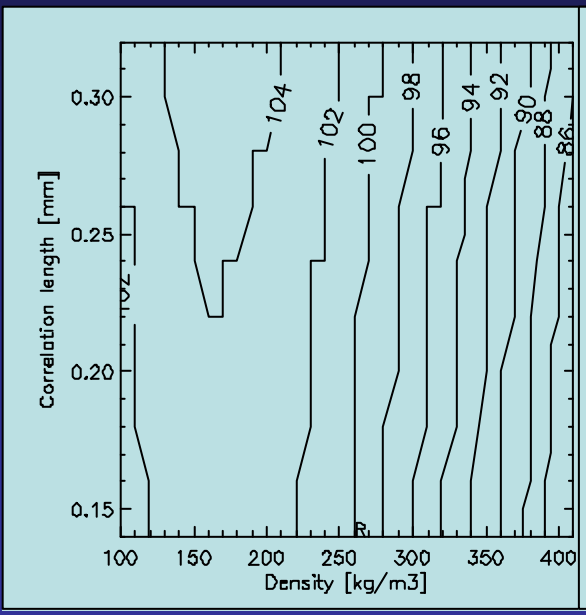


Near 90GHz

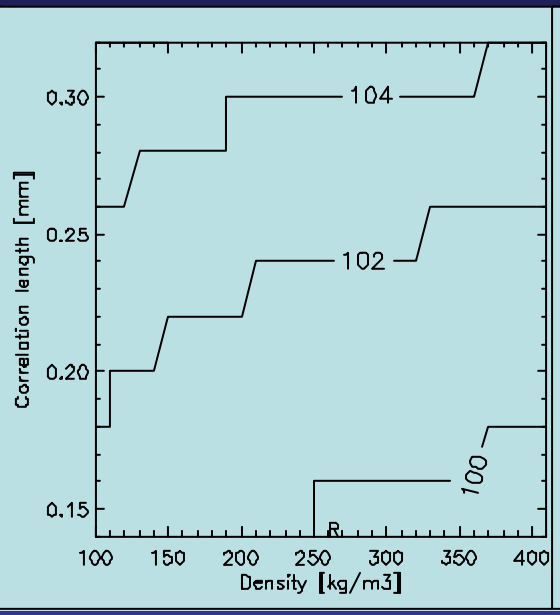


MEMLSI simulations of ice concentration

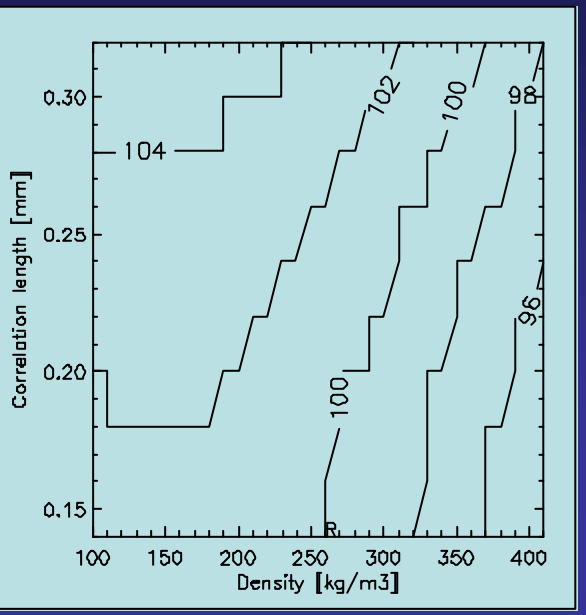
Comiso pol.



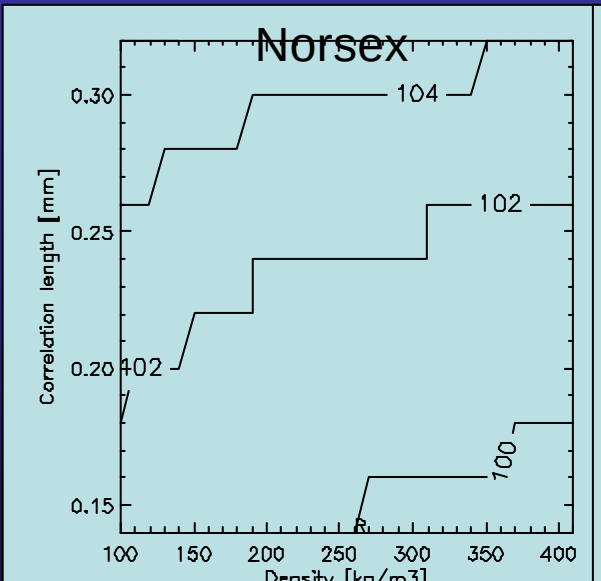
Cal/Val



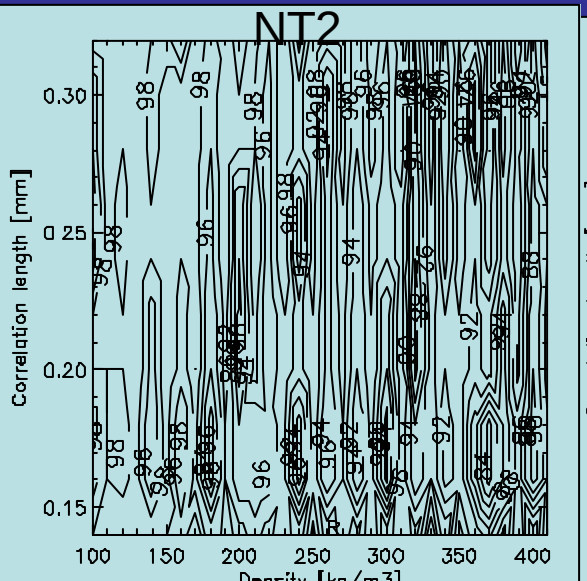
Bristol



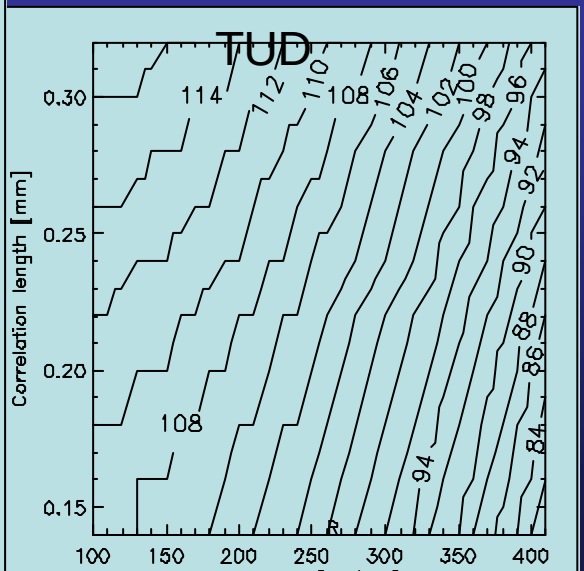
Norsex



NT2

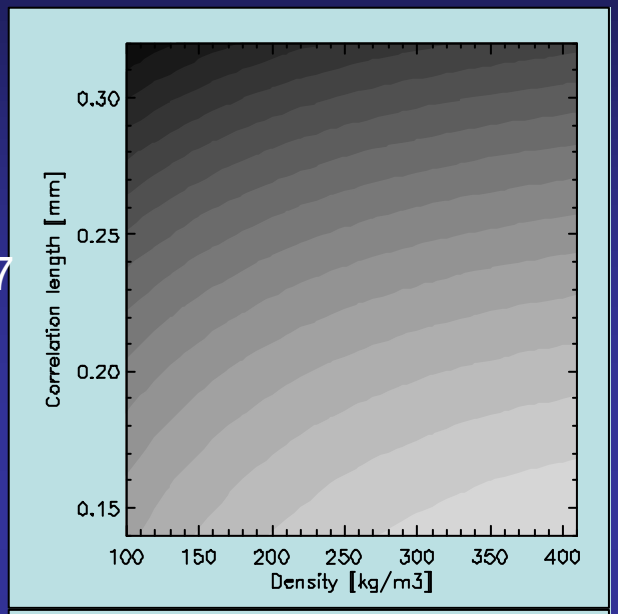


TUD

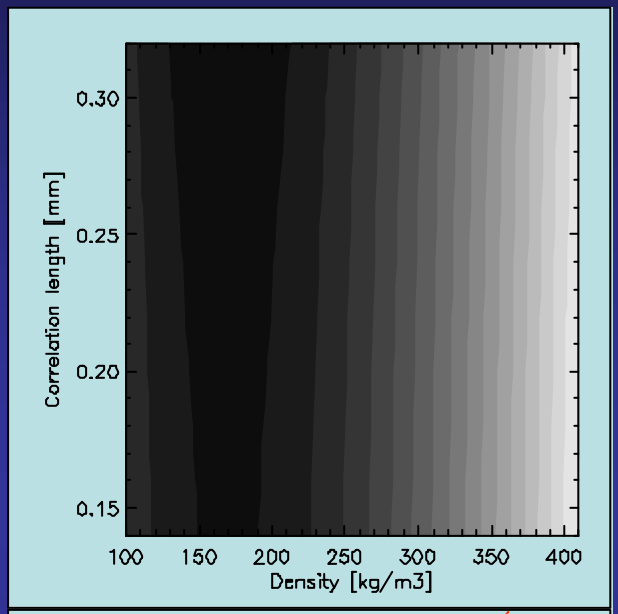


MEMLSI simulation algorithm parameters

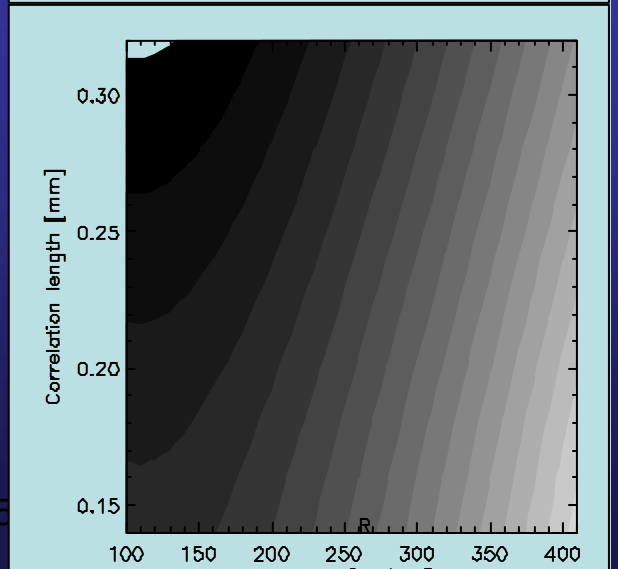
GR19/37



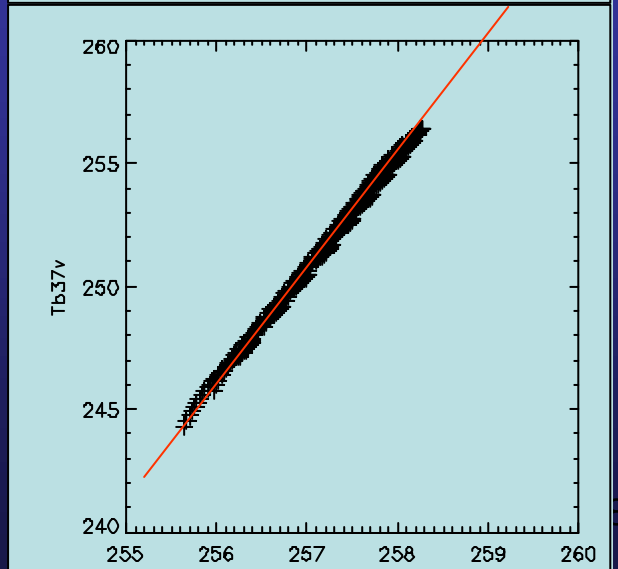
PR19



Tb89

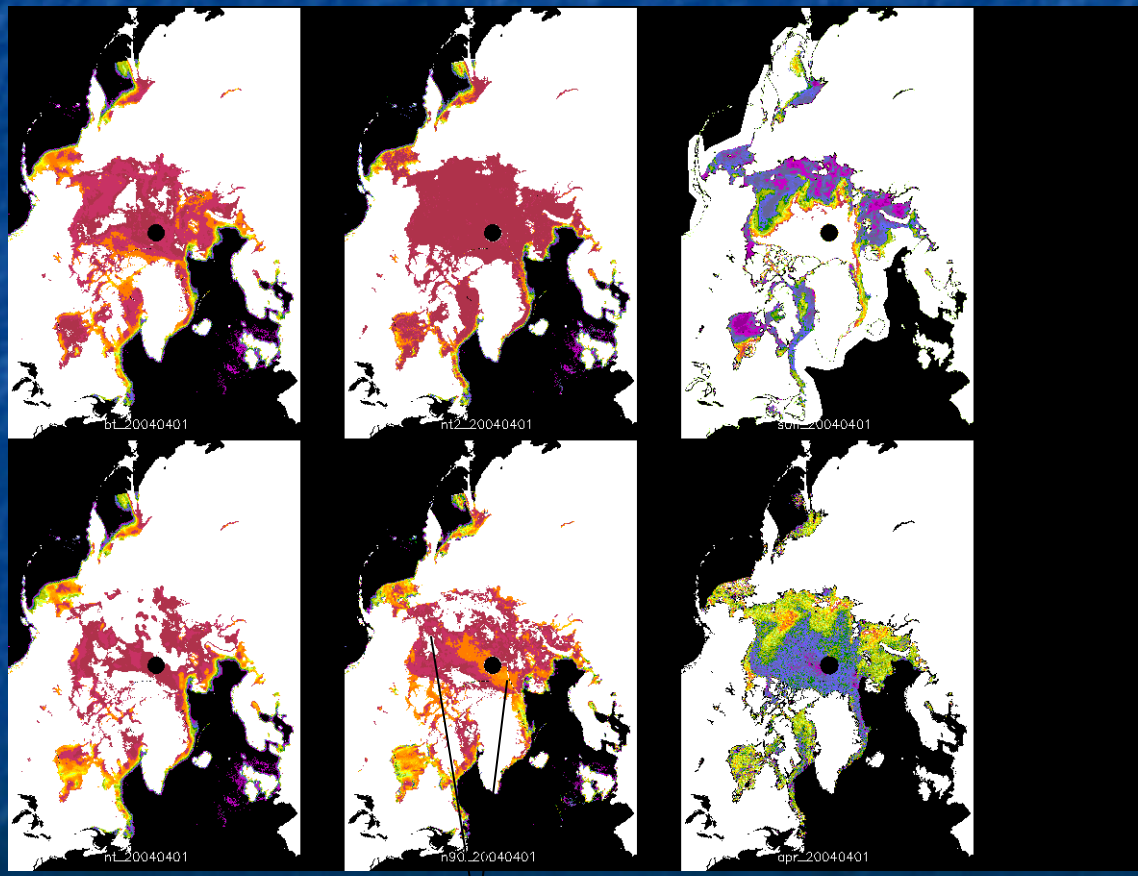


Tb19v/Tb37v

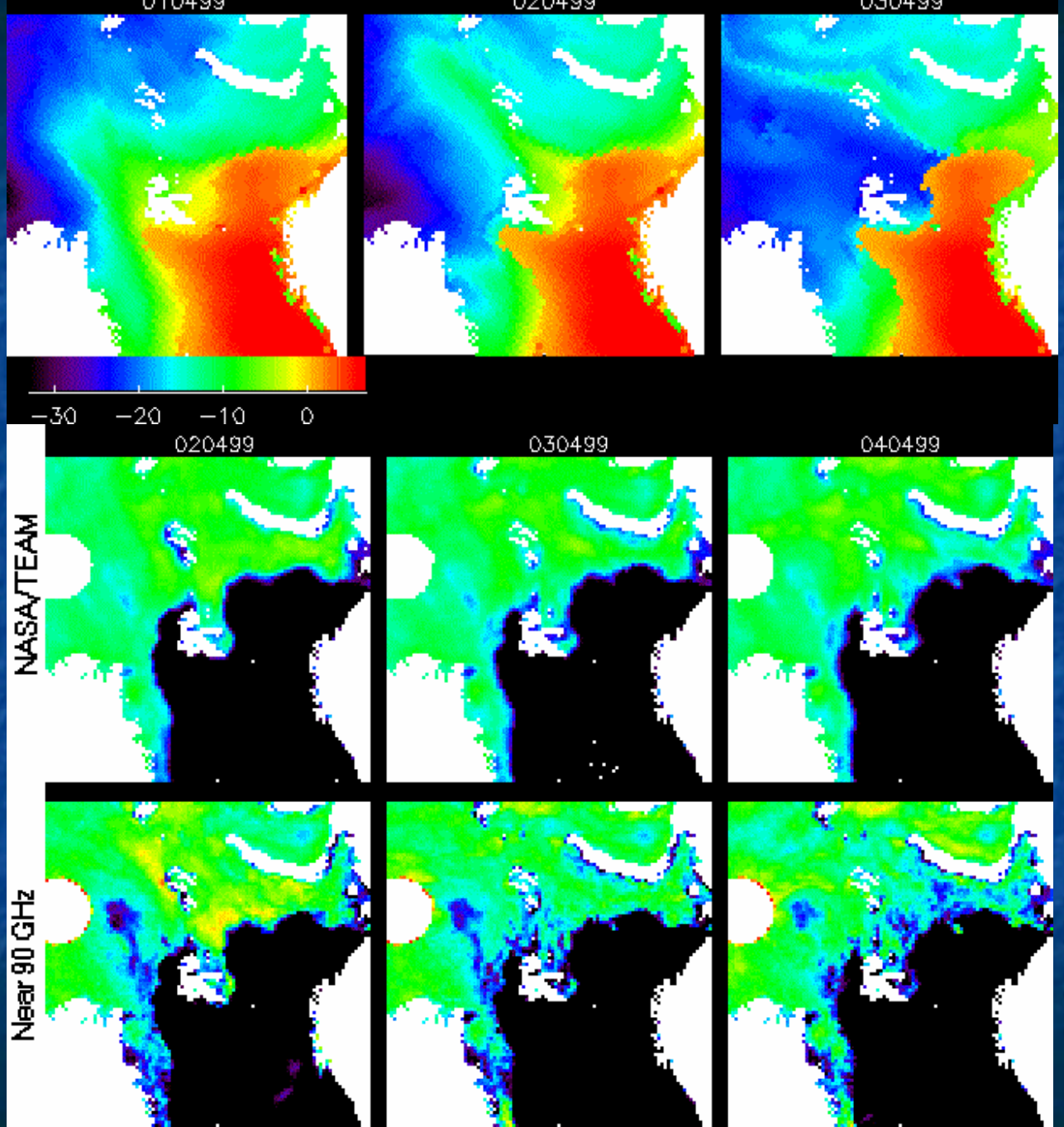


Observations April 2004

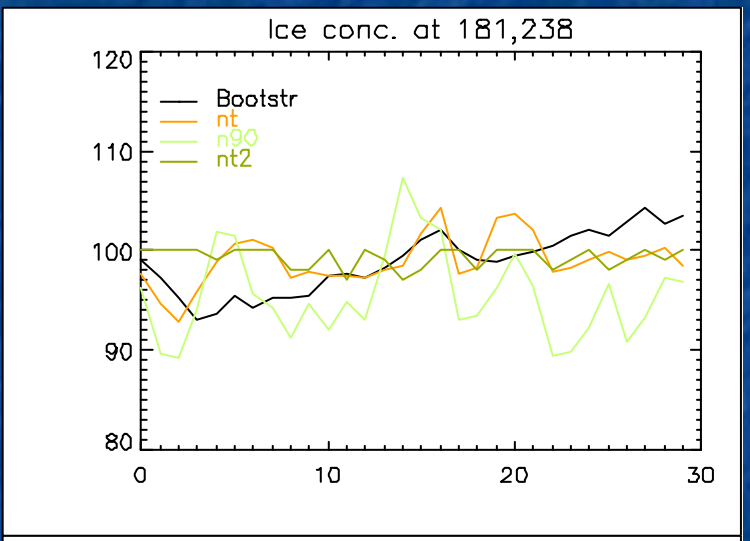
- NT2 is very stable
- Some long lasting 85 GHz depressions not noticed earlier



Surface


010499
020499
030499
−30
−20
−10
0
020499
030499
040499
NASA/TEAM
Near 90 GHz

April 1999


Ice conc. at 181,238
Bootstr
nt
n90
nt2
120
110
100
90
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20
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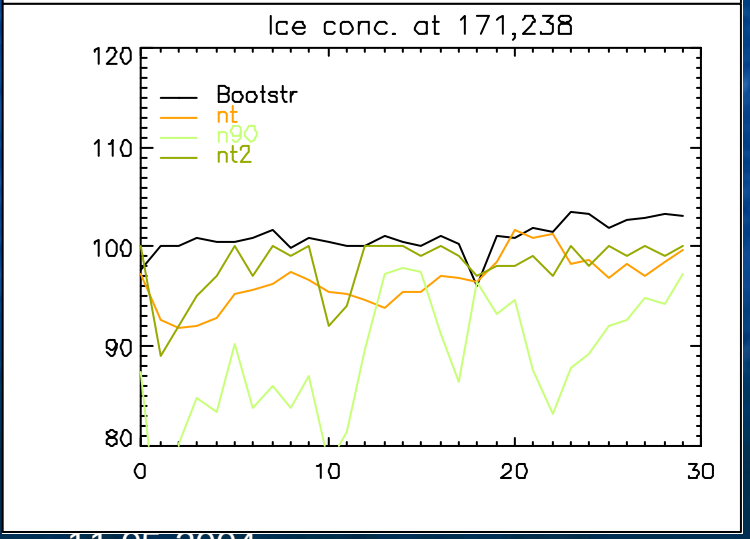
Ice conc. at 171,238
Bootstr
nt
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nt2
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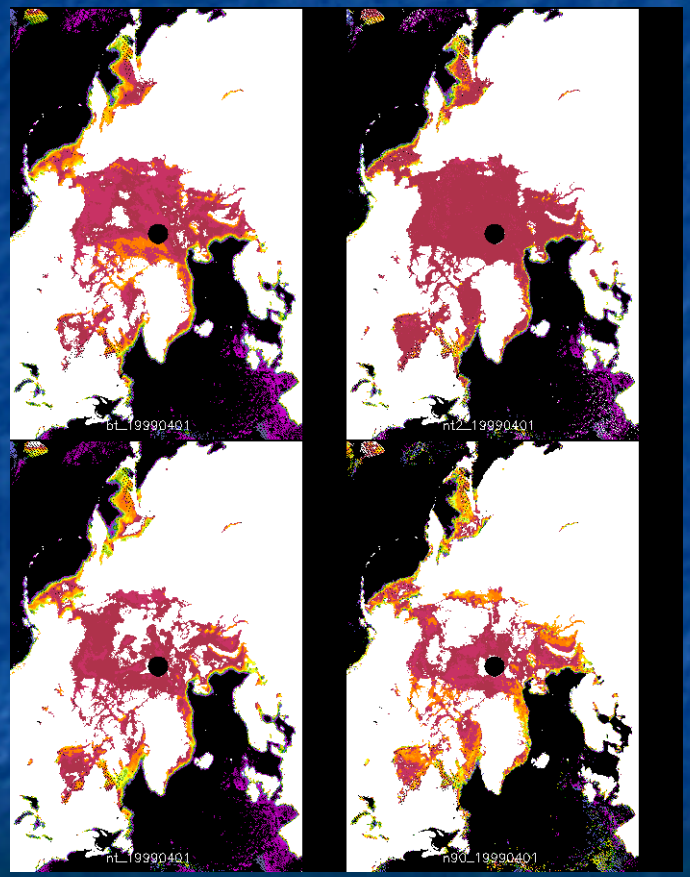
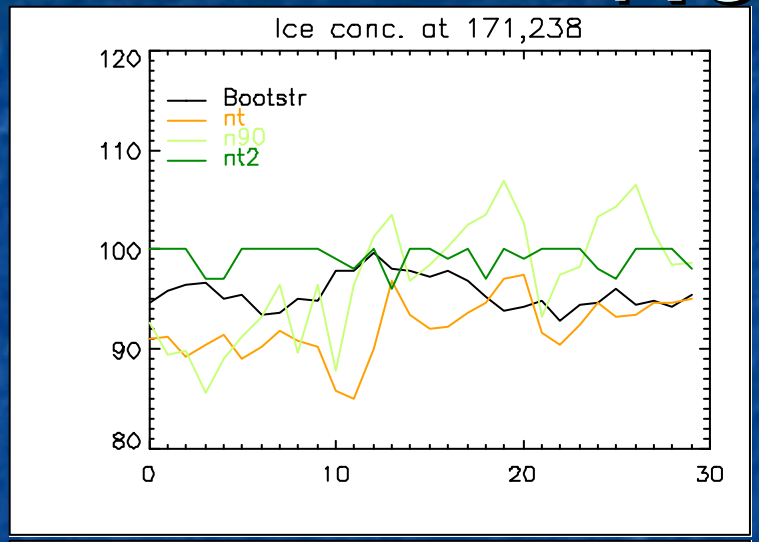

bt_19990401
nt2_19990401
nt_19990401
n90_19990401

Nov 1998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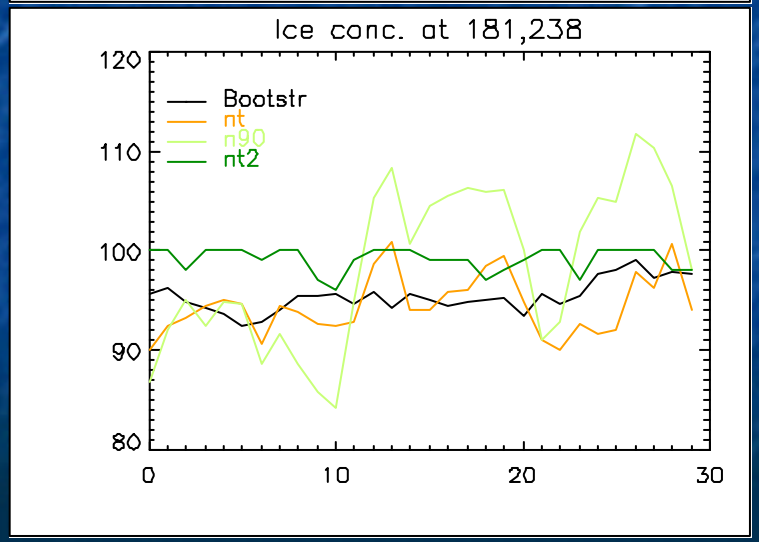
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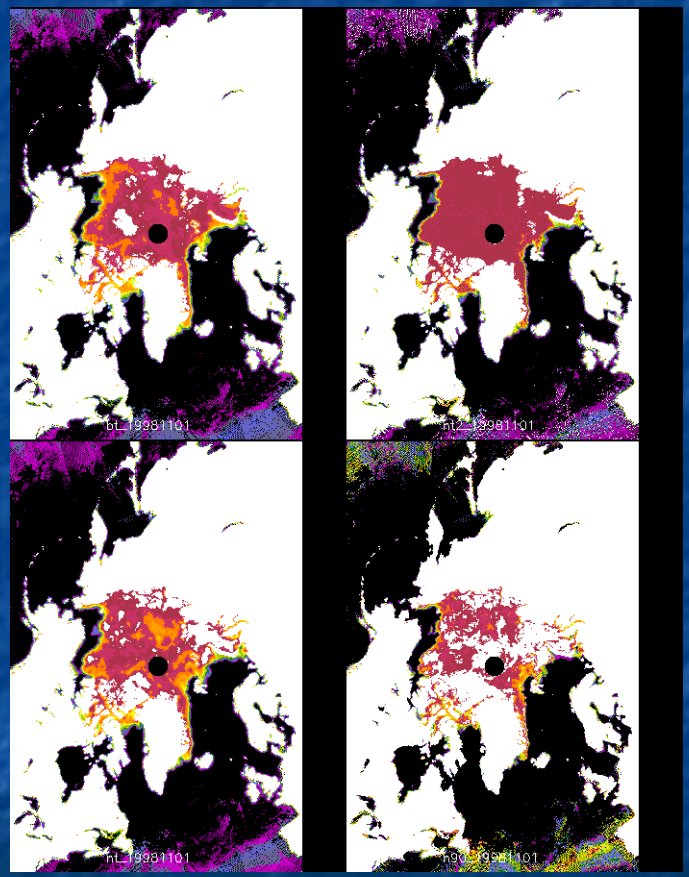


Sea ice (satellite data assimilation) model

Input to model:

-Ice drift vectors derived from SeaWinds data.

-SSM/I Ice concentration using Boot-strap, frequency mode.

(-Meteorological data)

Output:

-Age (& thickness) distribution

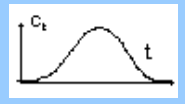
-Deformation (ridging)

-New-ice formation

-Brine flux

-Melt rate

The distribution of ice age by partial concentration, k



Ice drift, u, v

Total concentration, c (measured, boot-strap)

The age-distribution k, is updated by local advection.

←Local drift field, u, v

The concentration distribution k, is updated by the deformation field:

←Deformation factor, df

$$uc = df \int_0^{365} k \partial t$$

$$dc = c - uc$$

if dc < 0 → remove, melting or ridging:

$$dc = -\int_0^{age \leq 365} uc \partial t$$

if dc > 0 → add, new-ice formation:

$$dc = \int_0^1 uc \partial t$$

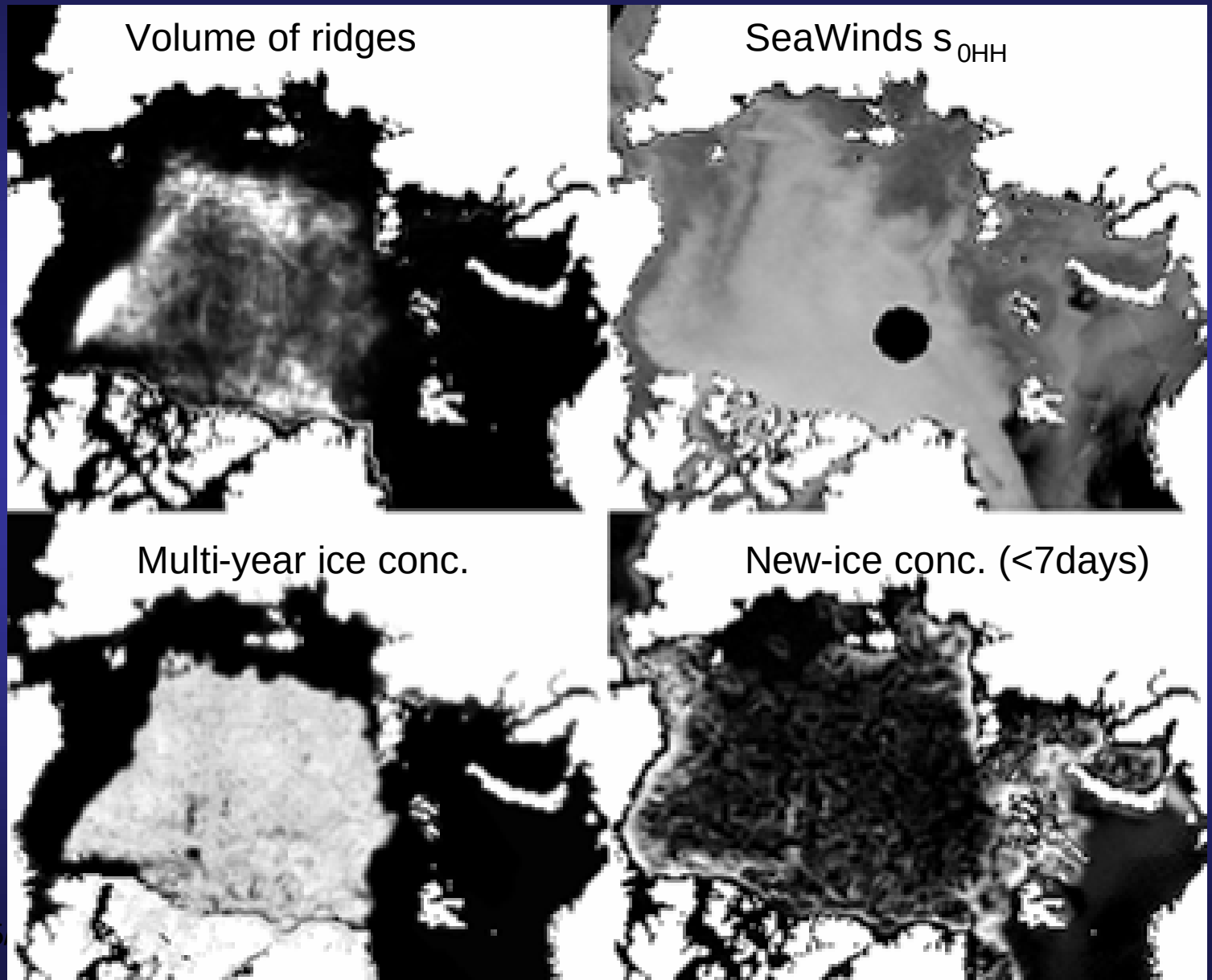
uc, is updated by one day

$$k = uc$$

→begin next iteration

Future products by combining satellite remote sensing data in model

Modelled period: 20001001-20001231.



Dec. 31st, 2000

Conclusions

- Ice drift data seem promising
- Algorithm pros and cons (working hypothesis):

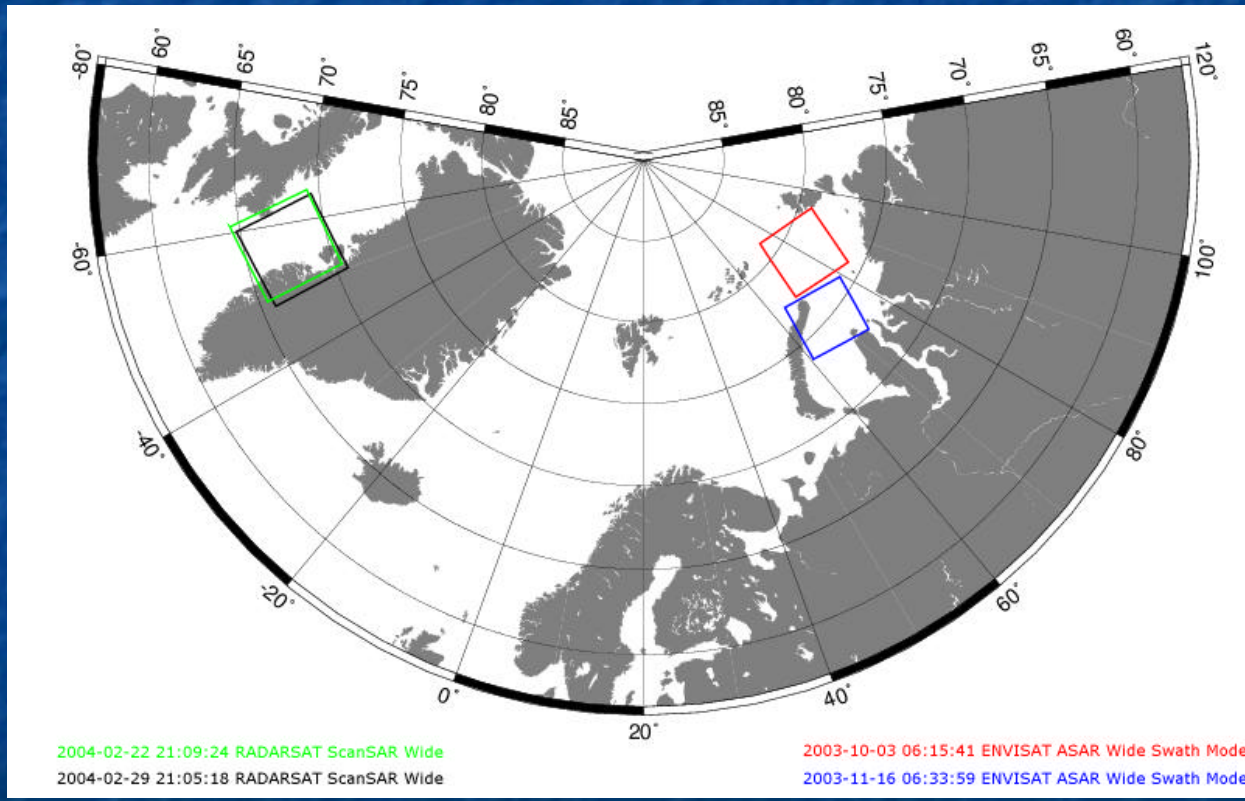
90 GHz pol	Bootstrap	NT	NT2
Resolution	Weather insensitive	Temperature insensitive	Surface insensitive
Weather, Surface/snow	Temperature	Surface/snow	Weather in MIZ?

Plans

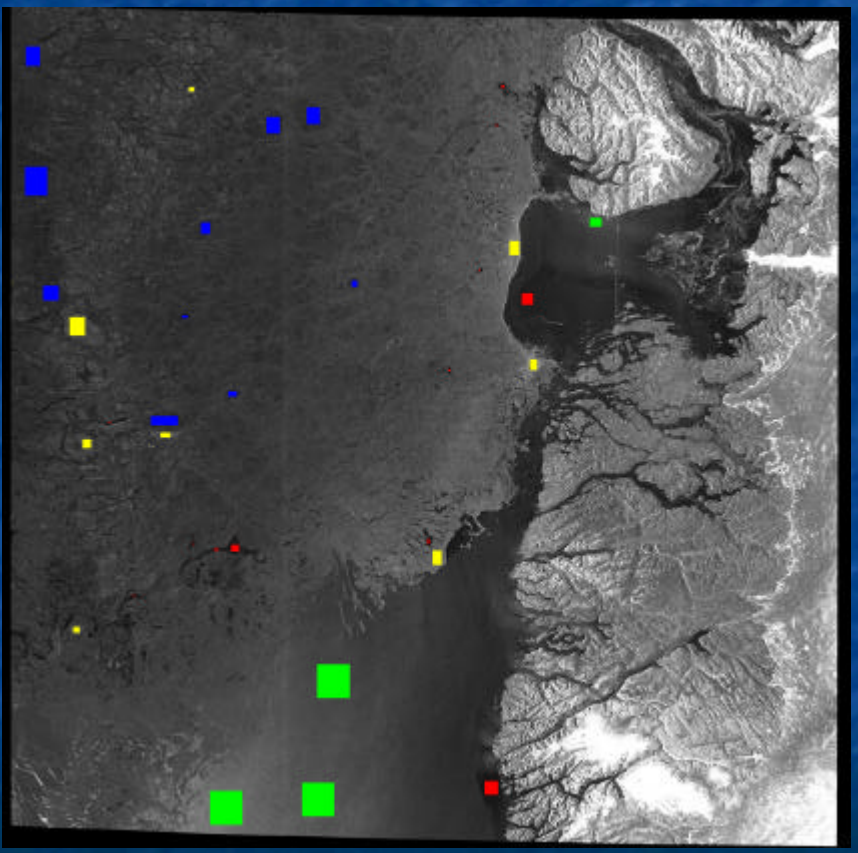
- Continue ice model + ice timeseries analyses
- Run Sealion alg.
- New Wentz RTM
- Experimental SAF chain
- Explore 6 and 10 GHz channels and 37-89 GHz gradient
- More and better in-situ data.

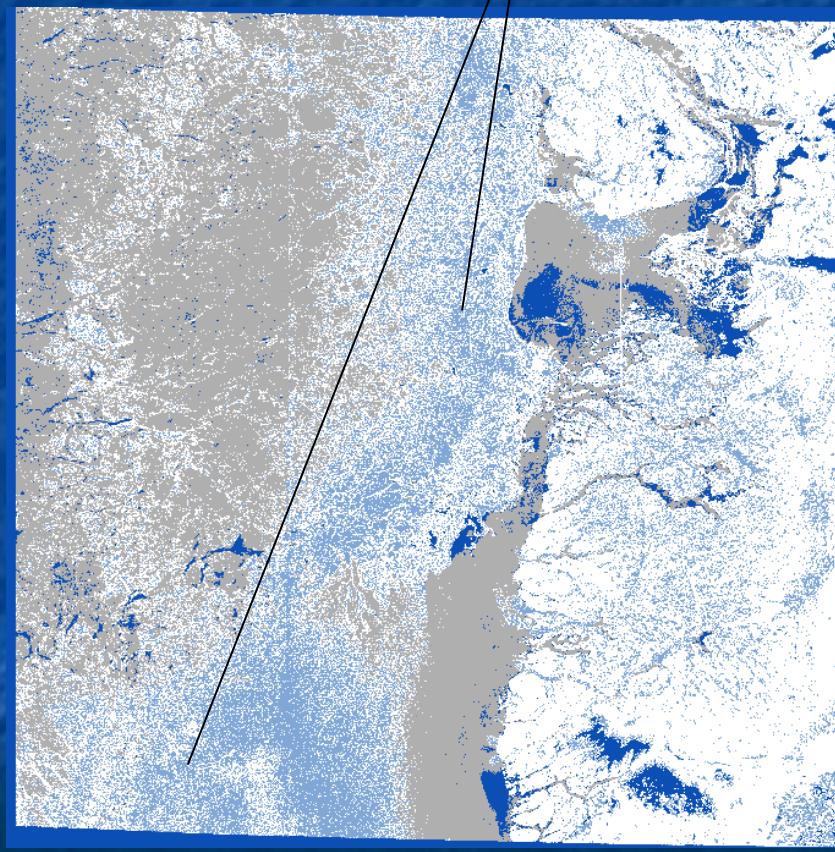
SAR classification

- Classification by ice analysts initiated
  - Mixed results
- Envisat data ordered
  - >32 scenes
  - No supply!



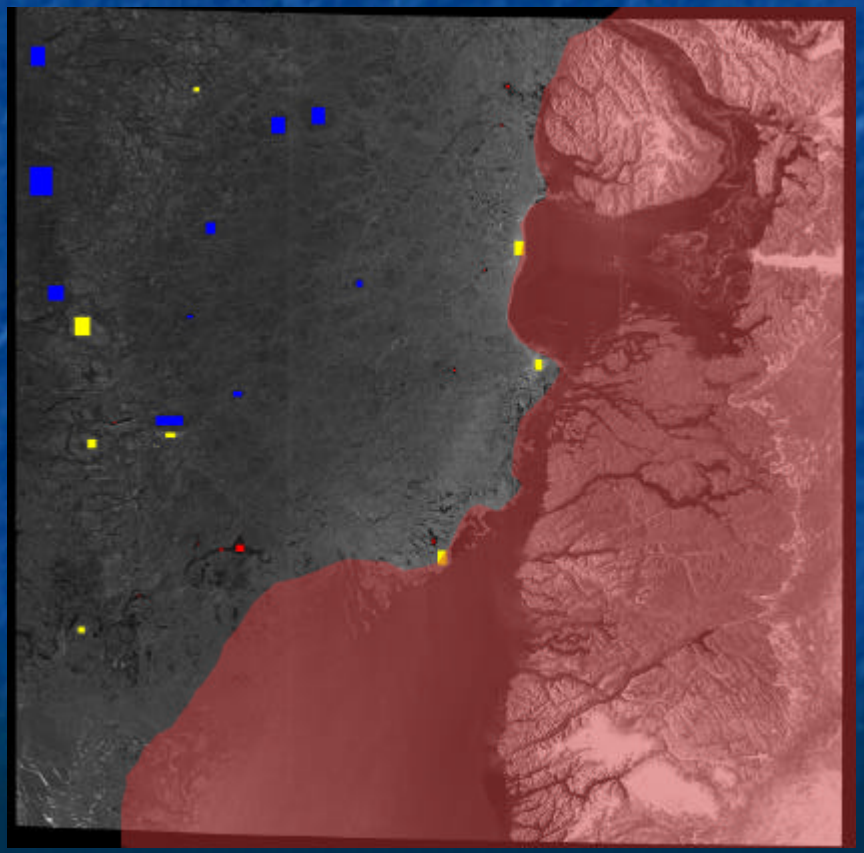
Examples

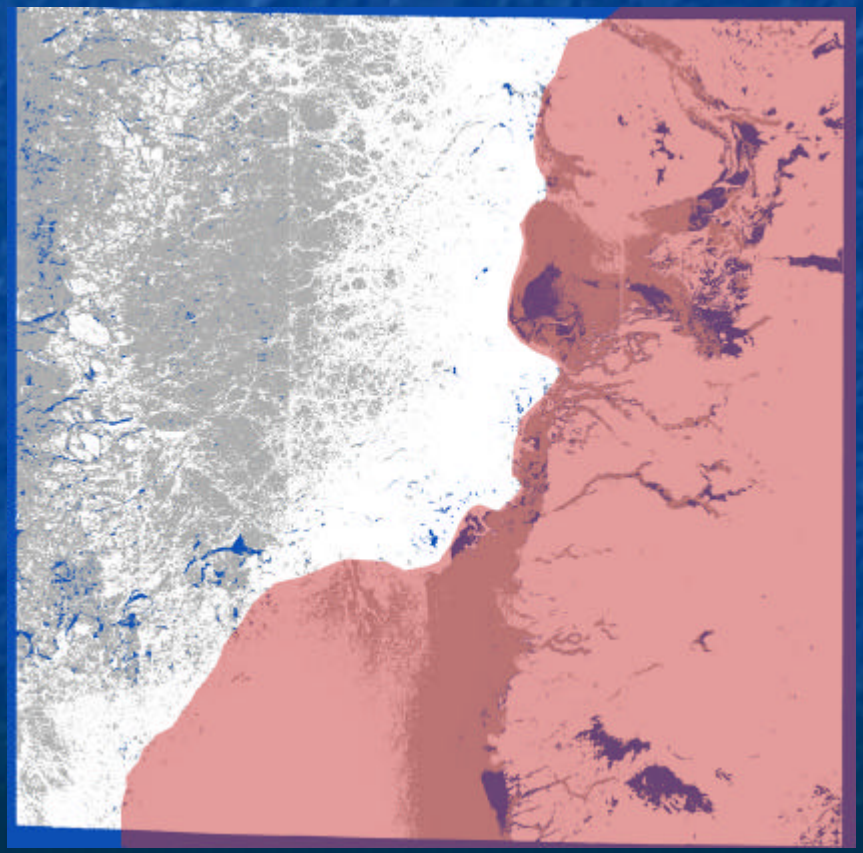




Final result

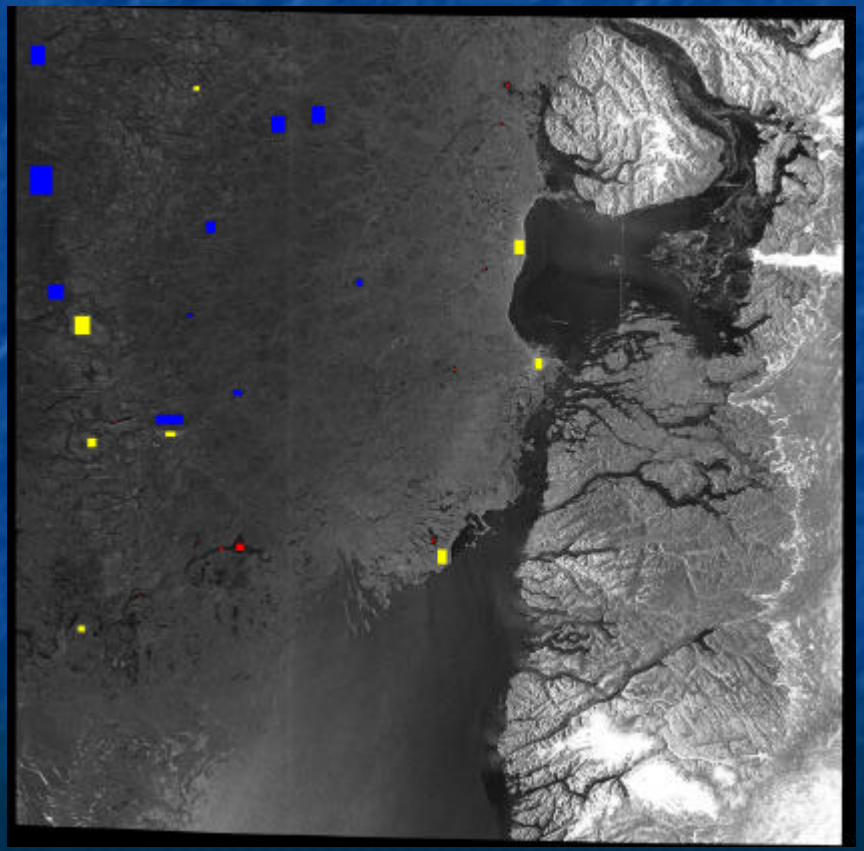
- Turbulent water class discarded
- smooth water class optimised
- Masking
- 2-hrs effort

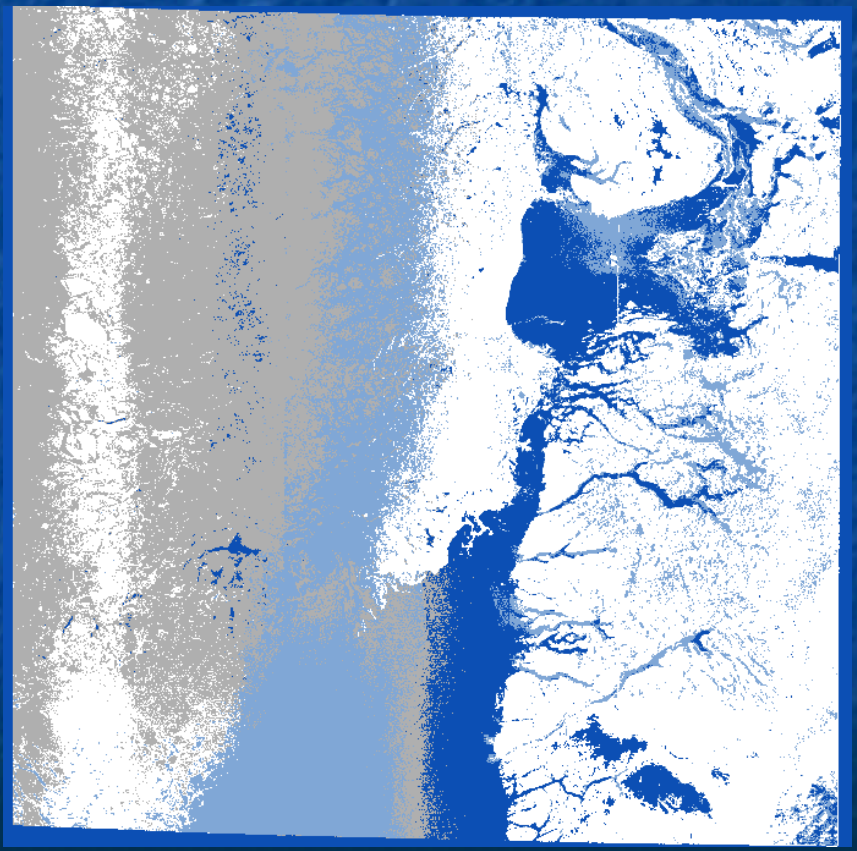




Incidence as feature

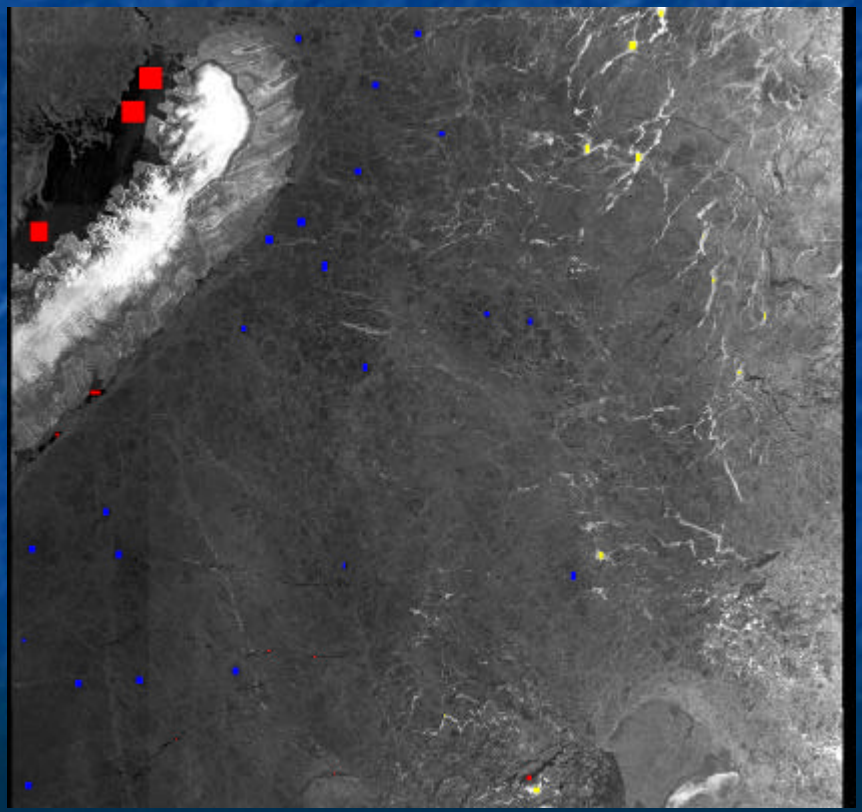
- Using incidence as feature seems to add to confusion

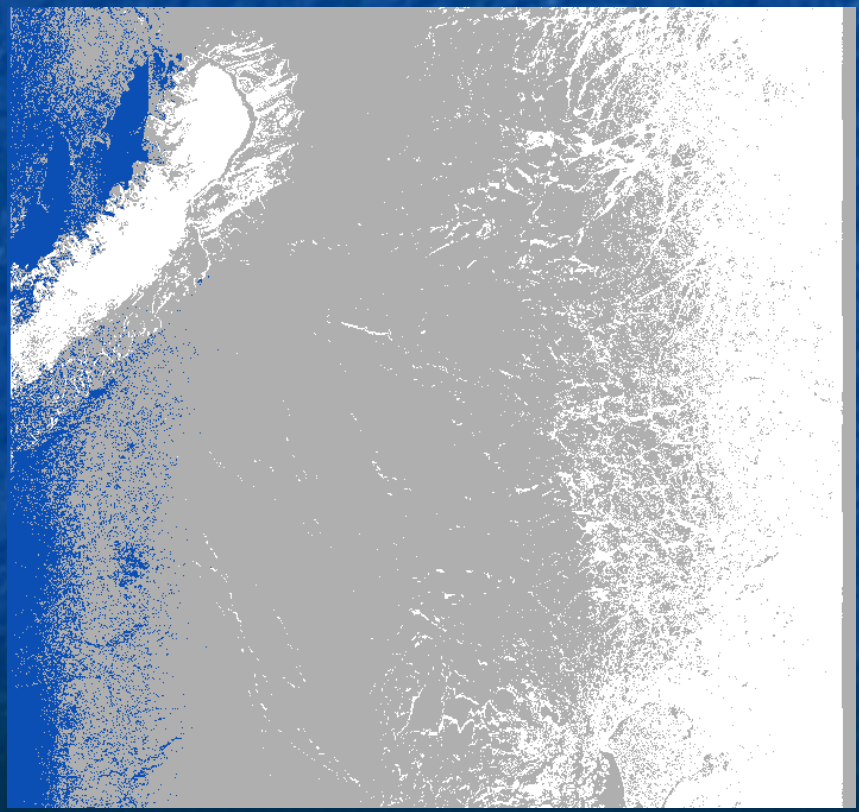




Effect of range correction

- Envisat data not range corrected
- Large uncertainties compared to RSAT





Effect of texture

- Range dependence can it be resolved? (e.g. Dierking et al.)
- Rec. accuracy generally raised by adding texture but classified image sometimes seems noisy
- Some tuning of texture computation therefore envisaged

SAR plans

- Process DMI data backlog for Baffin Bay
- In view of poor Envisat supply, buy Radarsat data
  - Less temporal and spatial coverage
  - May alleviate planning of manpower for classification
- Verify positive influence of range correction
- Investigate texture computation parameters