

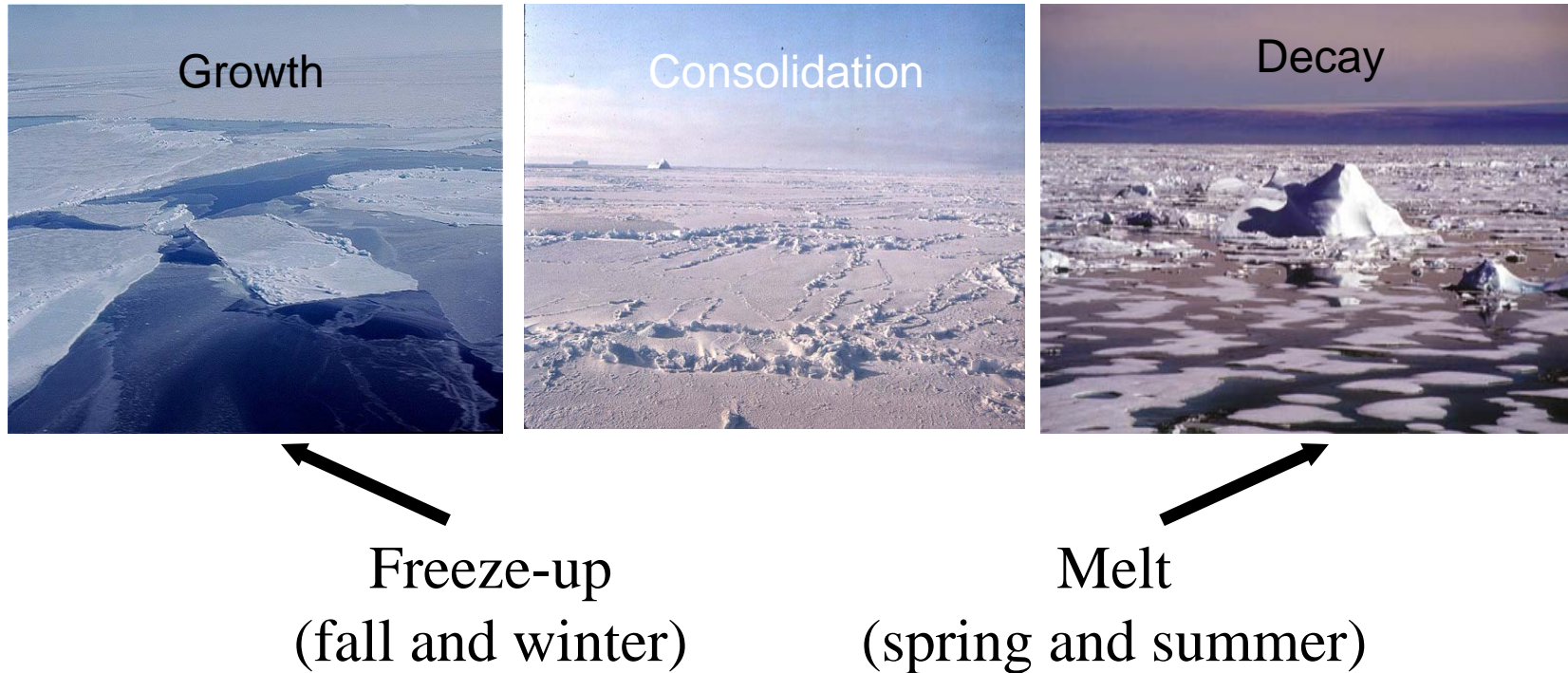
ASCAT Sea Ice Discrimination

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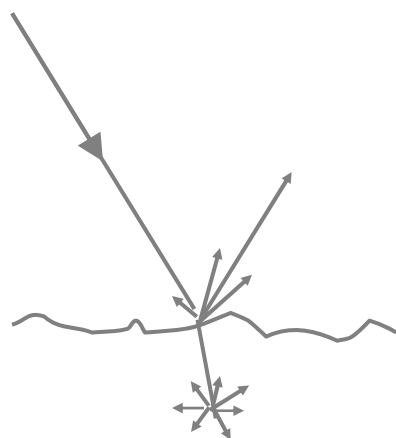
Sea ice scenarios

- Sea ice growth is a process of steady desalination, thickening and deformation of the ice slab, followed by decay in summer.



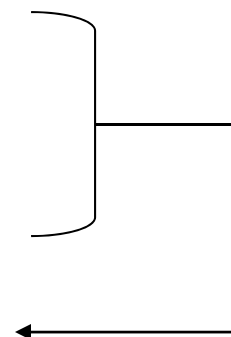
Sea ice detection

- Sea ice detection is routinely performed by microwave *radars* and *radiometers* (unaffected by persistent cloud cover)
- Discrimination with microwave sensors is based on the strong dielectric contrast between **ocean** and **ice**



- Permittivity	High	Low
- Polarization	High	Low
- Anisotropy	High	Low
- Directivity	High	Low

Surface vs. Volume
effects on backscatter



Scatterometer algorithm at KNMI

- Based on distances to empirical ice/ocean backscatter models
- Uses detailed prior knowledge on σ^0 distribution : **GMFs**

1) normalized distance to ice/ocean model $D_{model}(X) = \frac{(X - X_{model})^2}{\Delta X_{model}^2}$

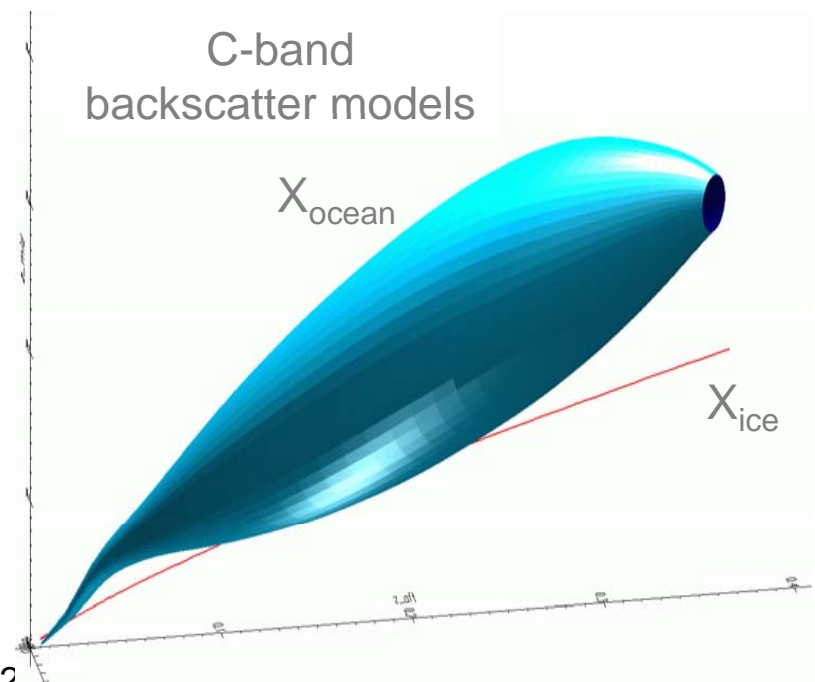
2) chi-square probabilities

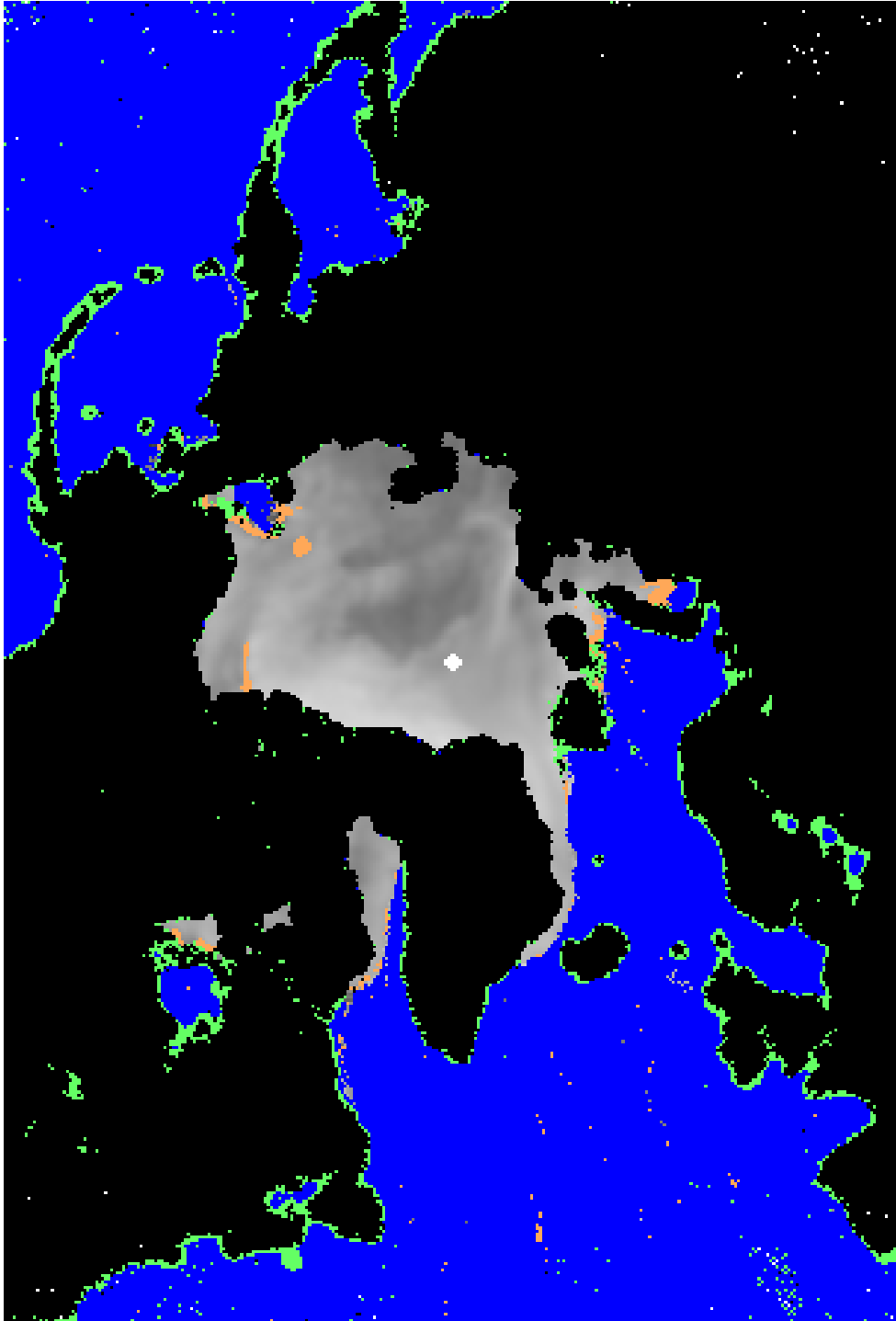
$$p(X | ice) = f(D(X))$$

$$p(X | ocean) = g(D(X))$$

3) Bayesian combination

$$p(ice | X) = \frac{p(X | ice)}{p(X | ice) + p(X | ocean)}$$





ERS algorithm

Blue: water

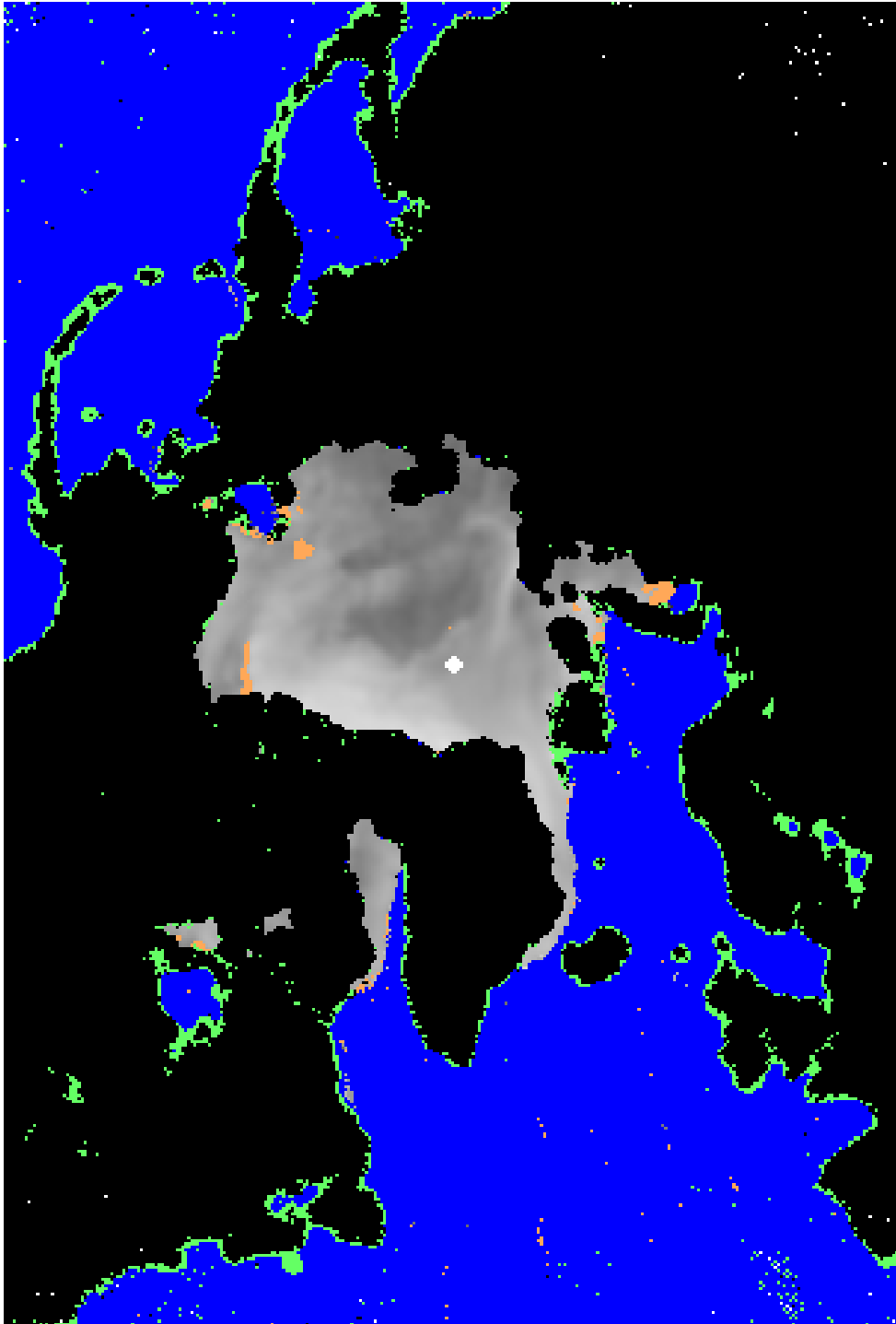
Grey: sea ice age

Land/no data

Other: undetermined
classes

- North pole
- 2007 11 26 11:00

May 2010



ASCAT 25-km

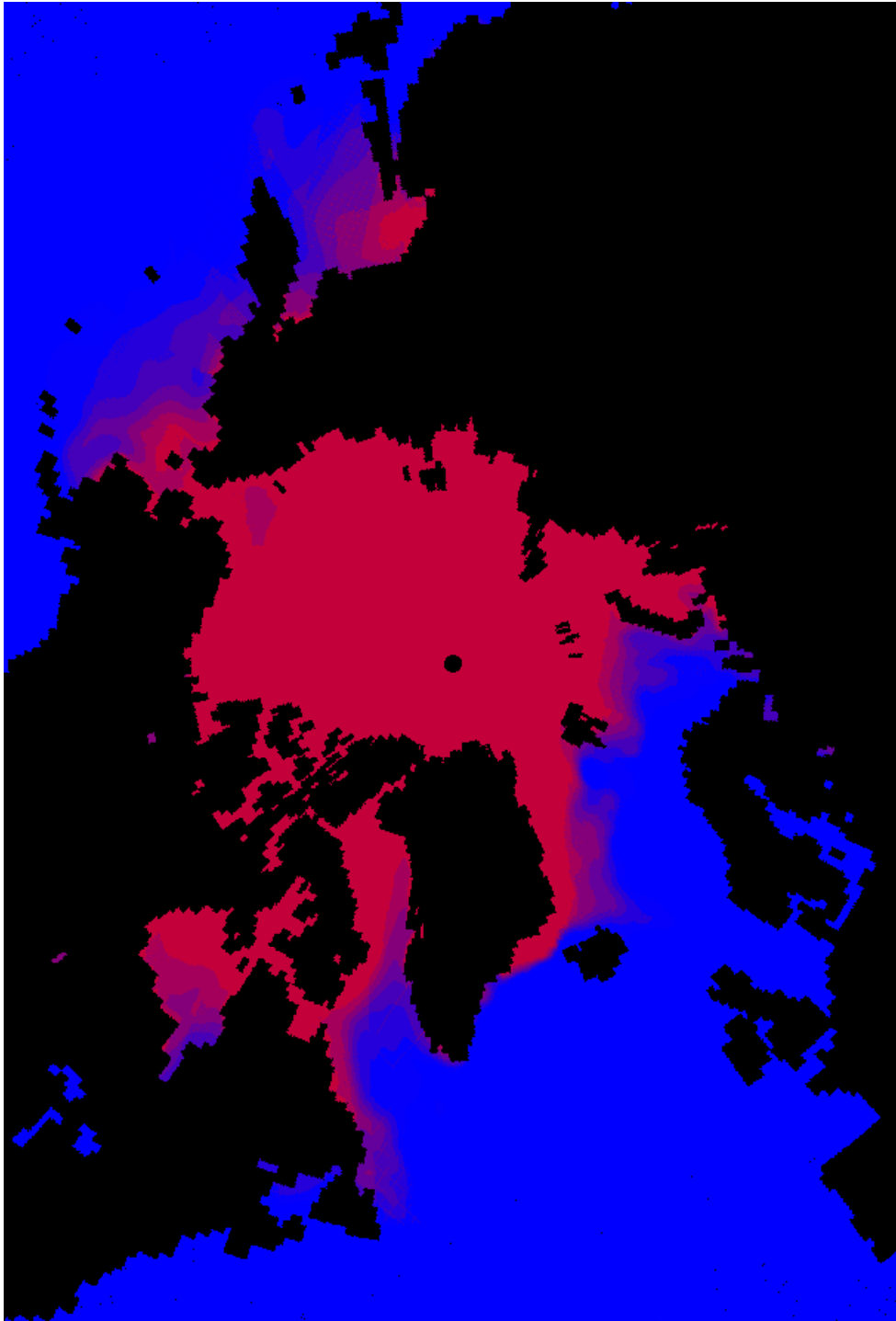
Blue: water

Grey: sea ice age

Land/no data

Other: undetermined
classes

- North pole
- 2007 11 26 11:00
- Modest improvement
- Scattered sea ice points



ASCAT 25 km

Blue: water

Red: ice

Land/no data

- North pole
- 2007 11 26 11:00

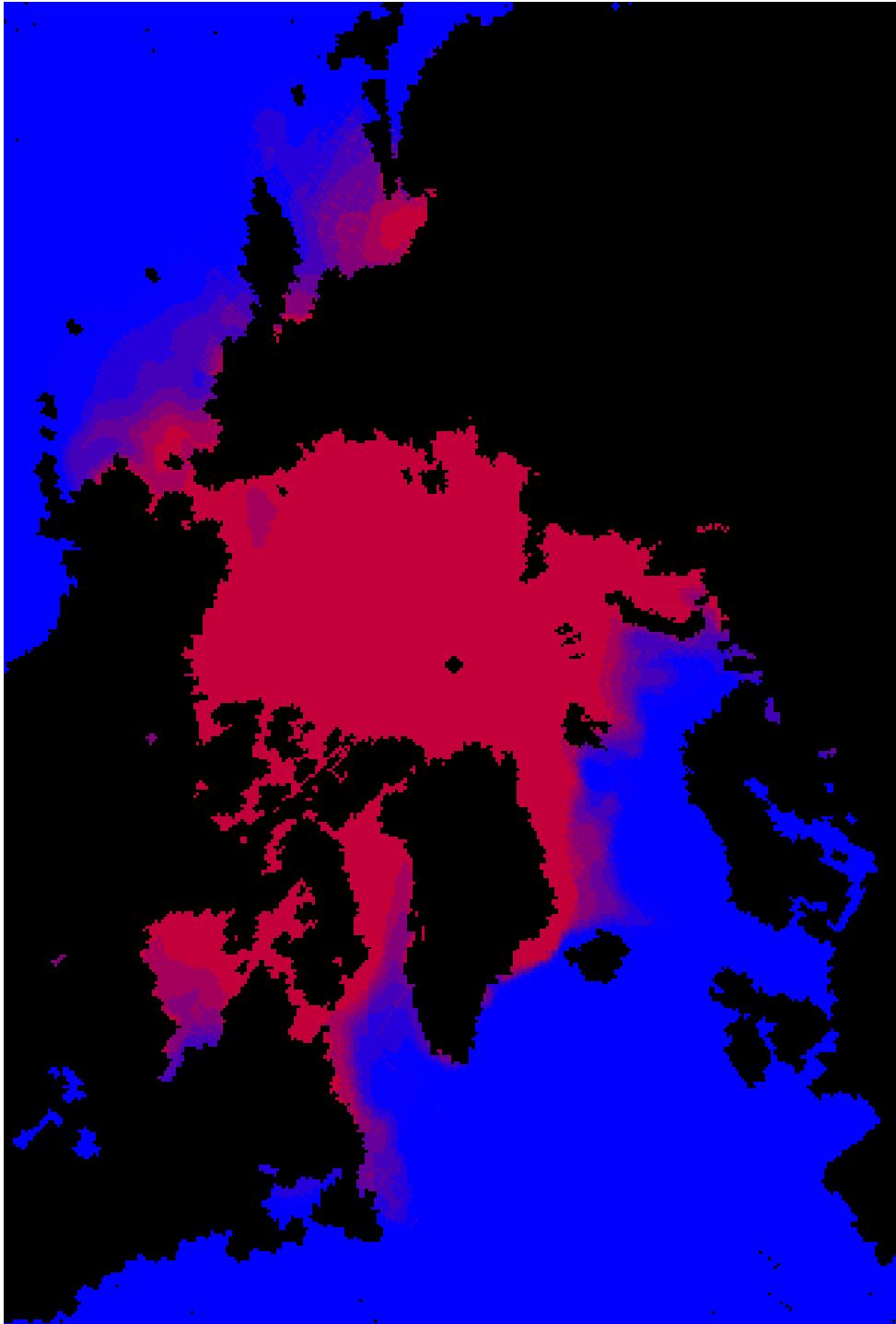
ASCAT 12.5

Blue: water

Red: ice

Land/no data

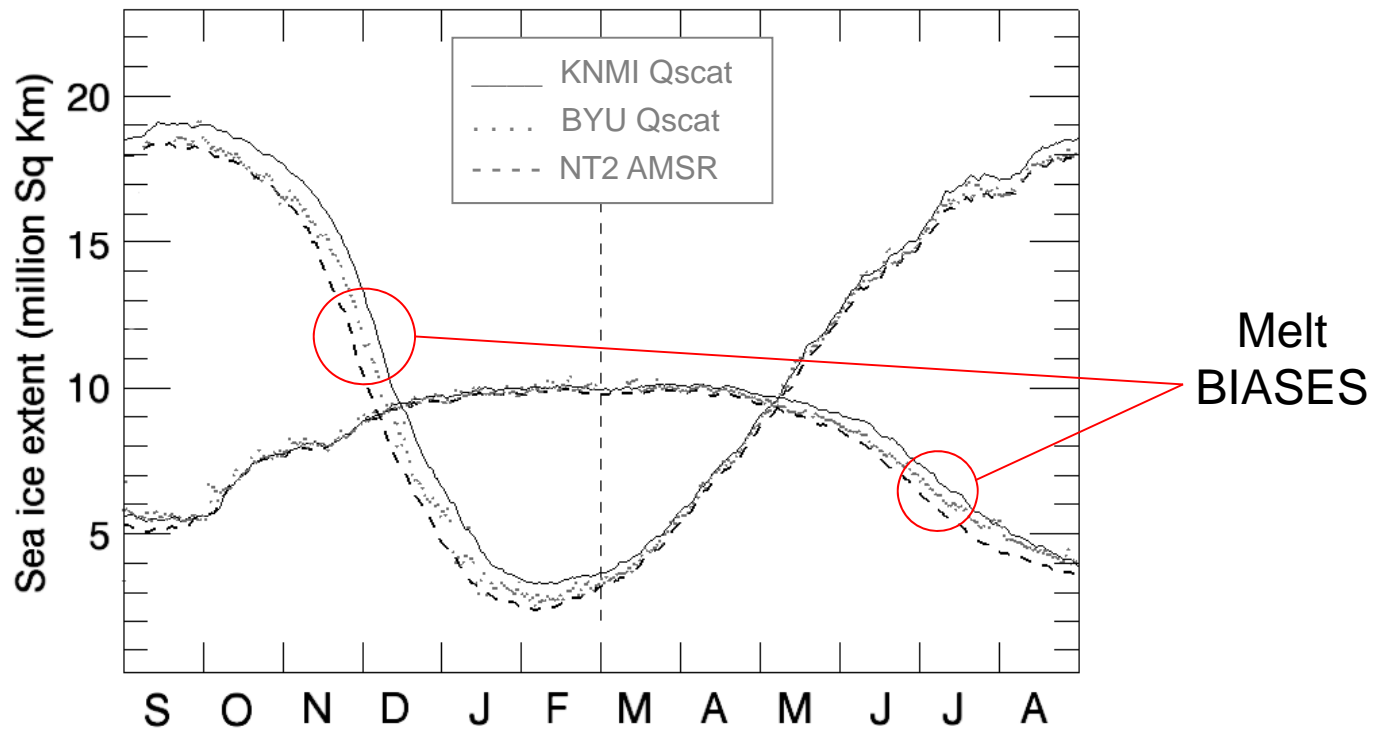
- North pole
- 2007 11 26 11:00



May 2010

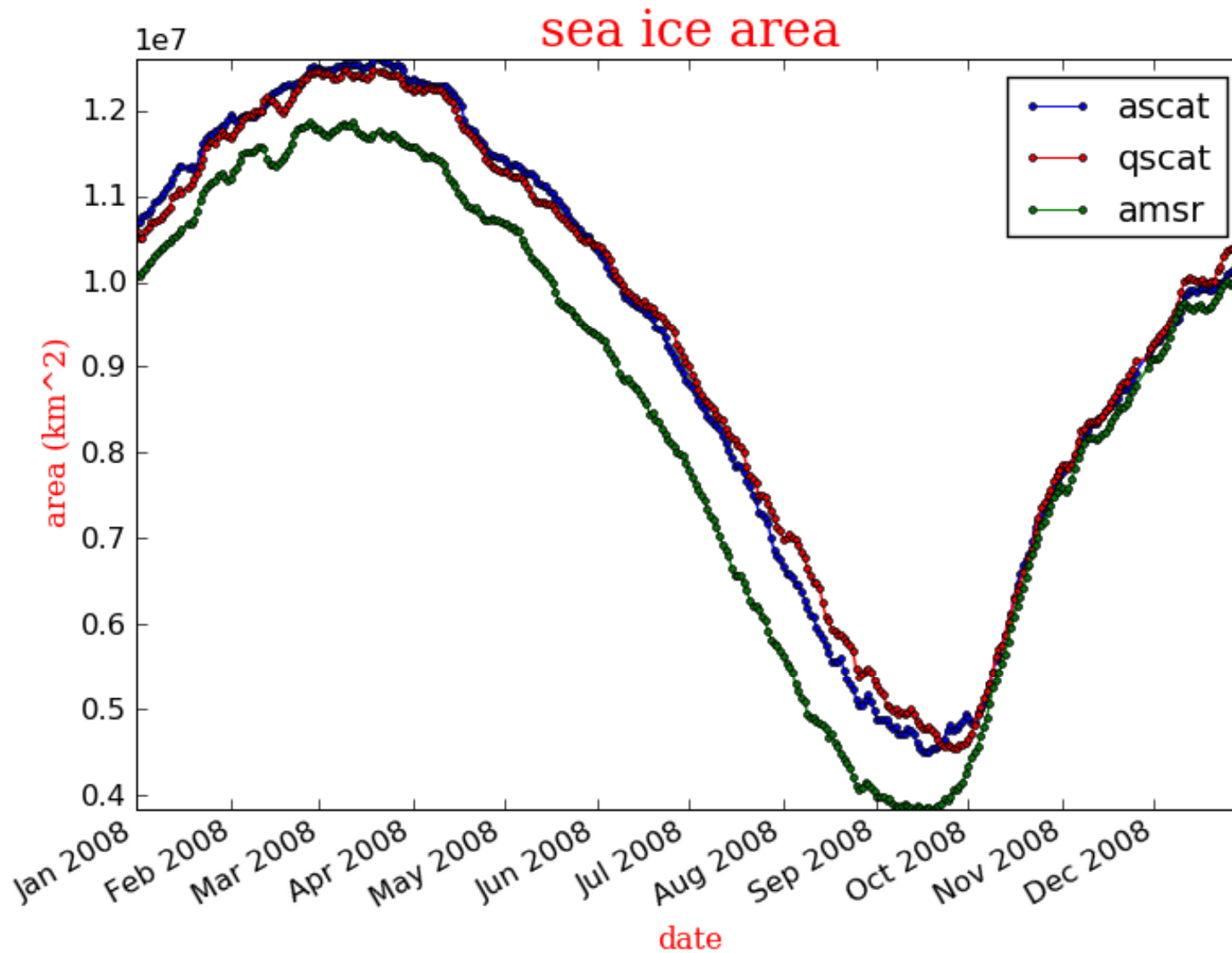
Validation

KNMI QSCAT vs. BYU SIRF QSCAT vs. NASA T2 AMSR



- Good agreement during freeze-up season (fall-winter)
- Large biases during melt season (spring-summer)

ASCAT ice detection



Conclusions

- ASCAT now uses SST contour to flag sea ice
- Bayesian algorithm run experimentally in routine operation at KNMI for internal evaluation
- Instrument maps of sea ice extent and ice brightness are generated on a daily basis and pre-operationally
- New algorithm agrees with KNMI QSCAT sea ice over all seasons (see Boulder OVWST)
- New algorithm proves also sensitive to low concentration, water saturated and rapidly forming sea ice.
- ASCAT KNMI Bayesian approach continues most inclusive sea ice detection algorithm to date:
 - Quantifies summer errors in passive microwave extents
 - Overcomes spring errors in previous radar algorithms
- ASCAT though less discriminating than QuikScat, more tedious aliasing problem with need for more prior