Anomalous winter sea ice SAR and scatterometer s_0 and radiometer Tb

A study of the changing snow and sea ice scattering properties during temporary melt

by

R. Tonboe, S. Andersen & L. Toudal

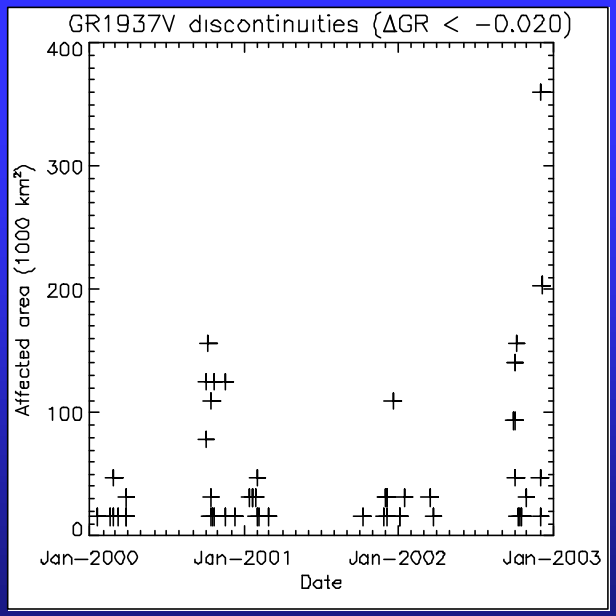
The variable sea-ice emissivity

- temporary melt change the snow and ice properties, significant for Tb and s_0
- have earlier been studied by: Drinkwater et al. 1995; Voss, 2002.
- snow grain size?, ice surface roughness? and formation of ice crusts and layers in the snow.
- After melt the first-year ice emissivity mimic multi-year ice.
- **The ice-concentration estimate is affected during AND after the melt.**

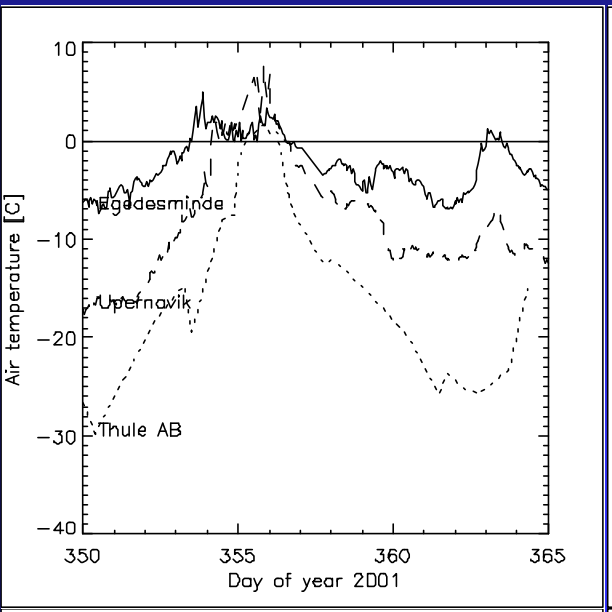
Melt extent and frequency

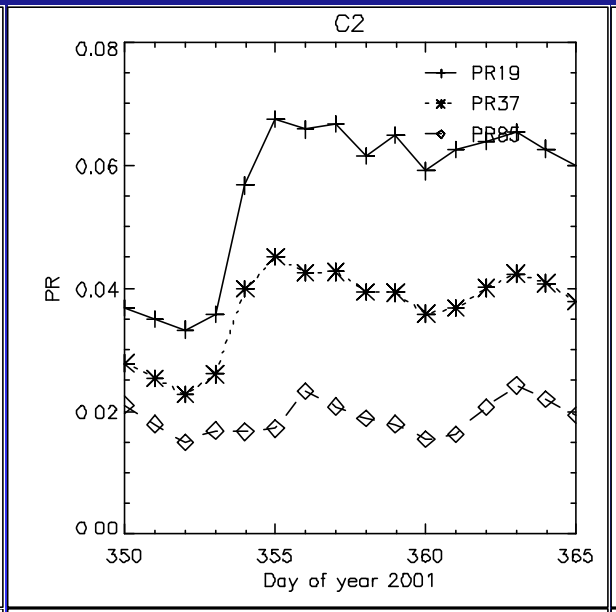
- Ice surface melt is common in in winter especially along the ice edge
- The ice emissivity and backscatter changes are long lived (< 3 months)
- Denmark Strait, Feb. 2001 – Davis Strait, Mar. 2001 – Baffin Bay, Dec. 2001 – Arctic Ocean+Barents Sea, Dec. 2002

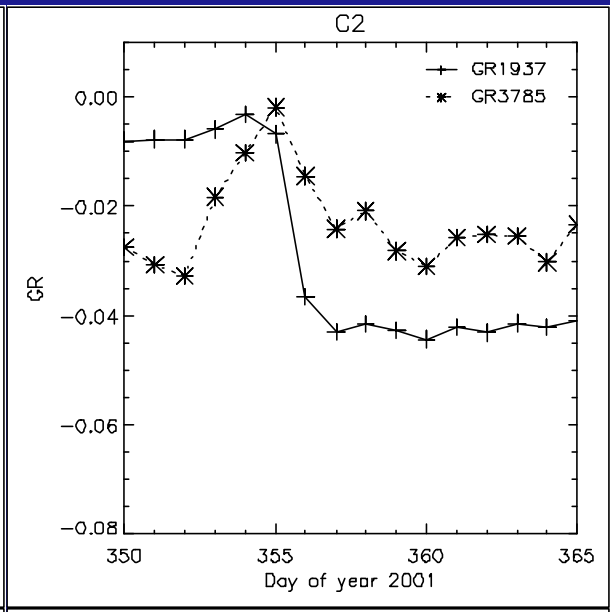
Melt events in the Arctic 2000-2002 on a 125km grid.

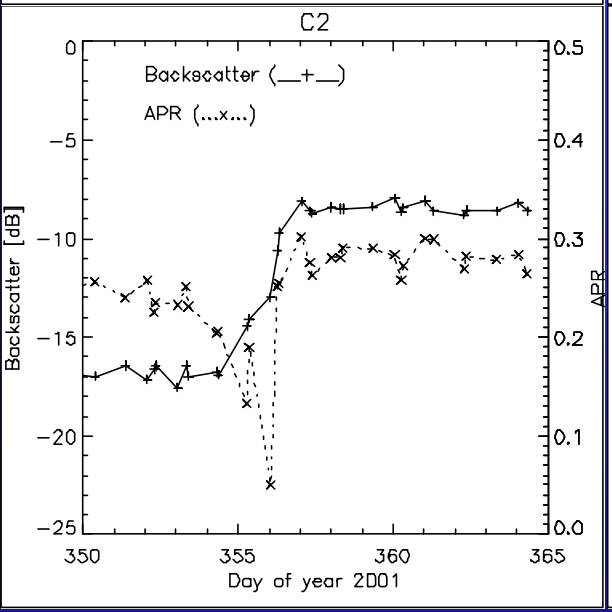


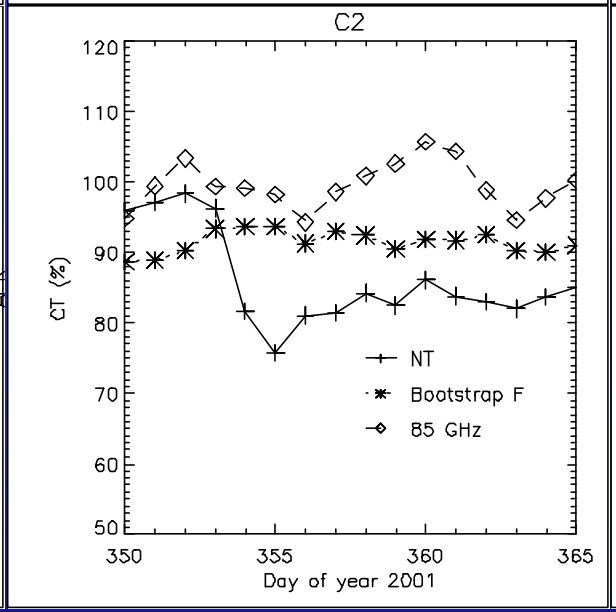
Temporary melt in Baffin Bay December 2001

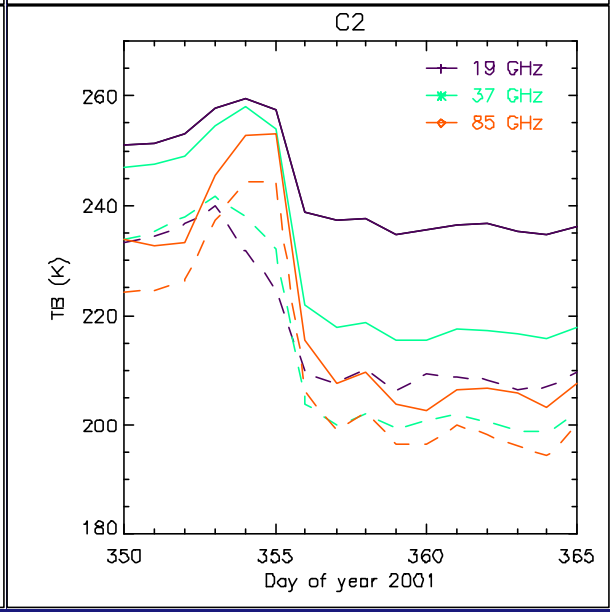




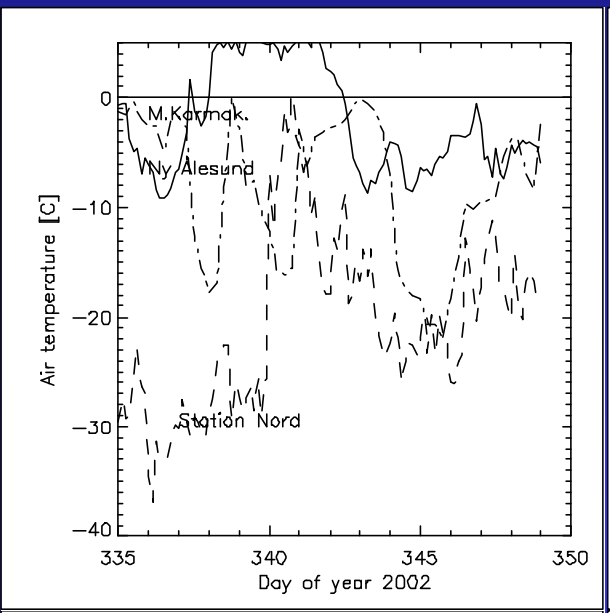


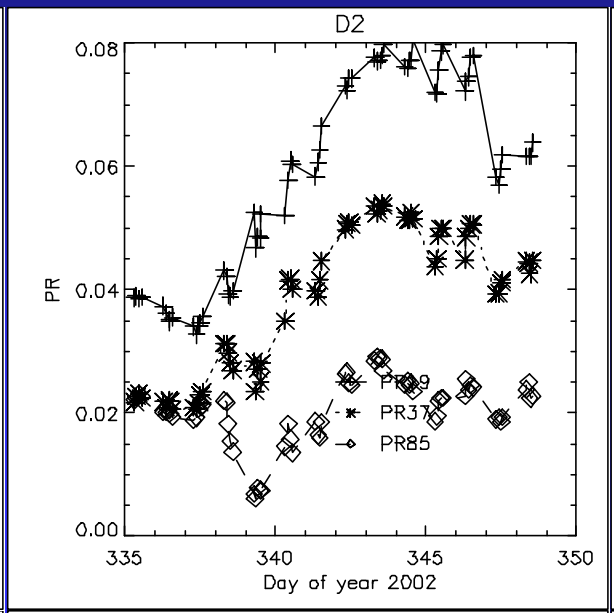


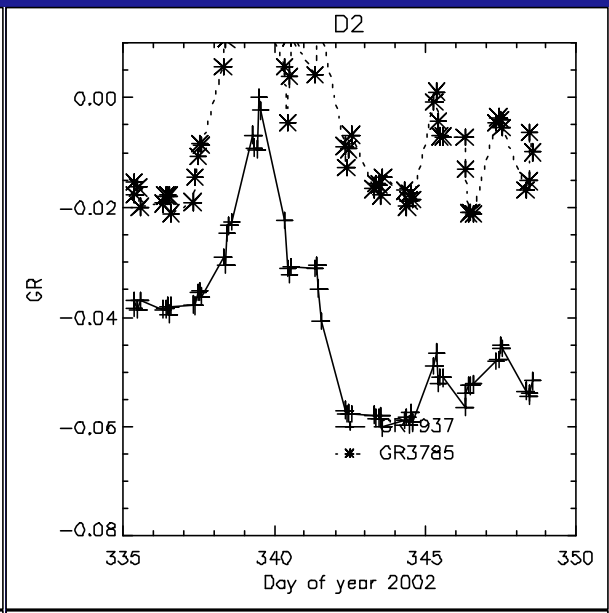


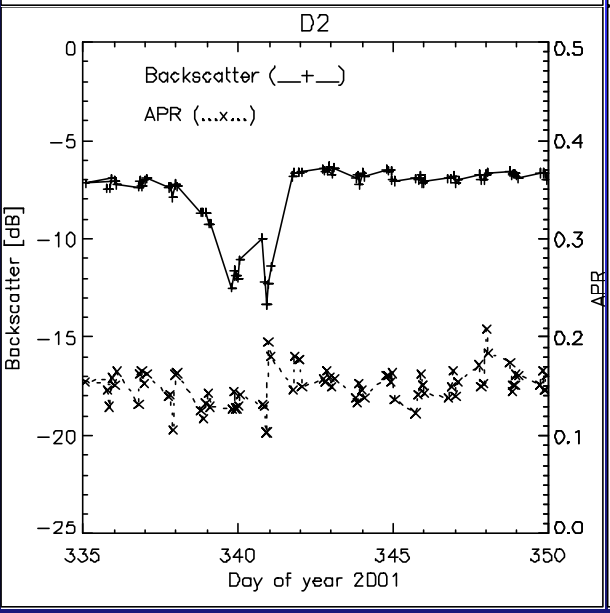


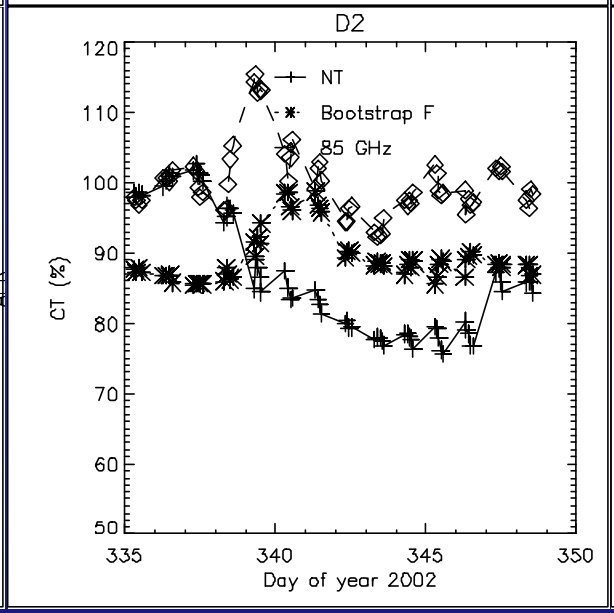
Temporary melt in the Arctic Ocean December 2002

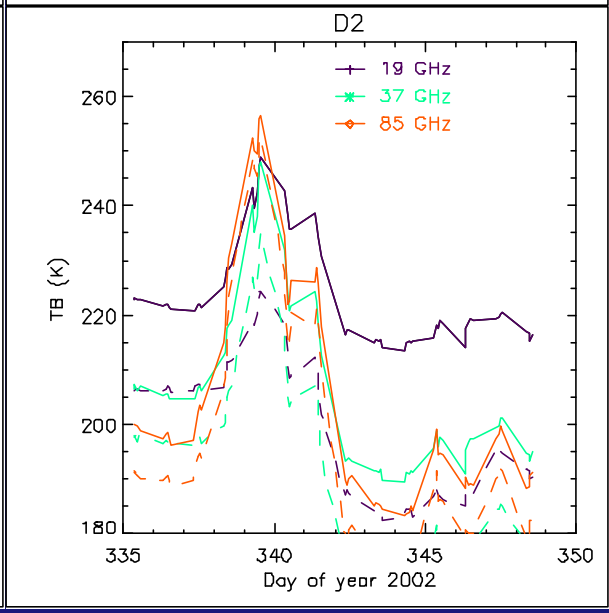








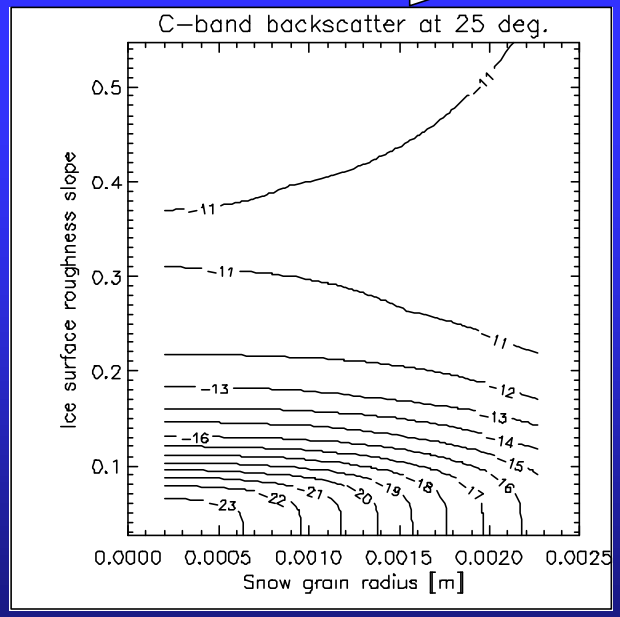




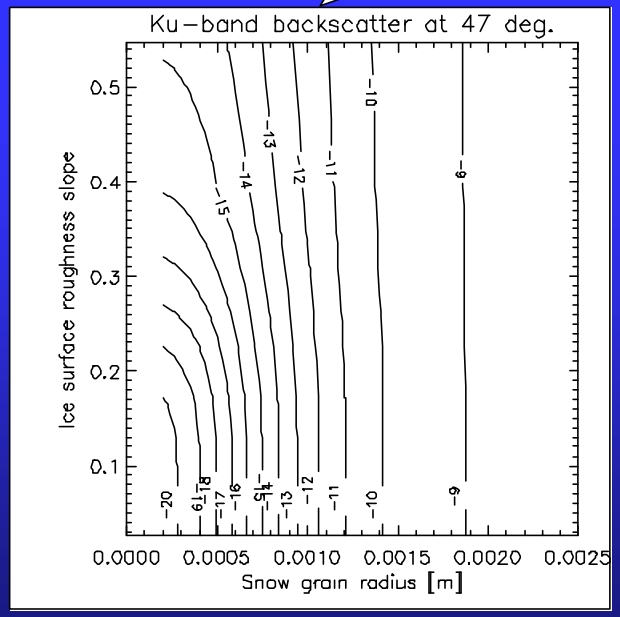
Microwave signature modelling

- Radar backscatter at C- and Ku-band: Radiative transfer model.
- Radiometer brightness temperature at SSM/I frequencies: MWMOD.

C-band (Radarsat) FY ice s_0 at IA 25°- Level ice 15cm snow layer



Ku-band (SeaWinds) FY ice s_0 at IA 47° - Level ice 15cm snow layer



Conclusions

- Temporary melt change snow grain size, ice surface roughness and form ice layers.
- Boot-strap and 85GHz are least sensitive to the emissivity changes.
- Detection is possible using GR, s_0, HIRLAM or combinations.
- IOMASA report before 2004.
- Paper to Remote Sensing of Environment before 2004.