



Sea Ice Thickness Assessment:
Oct/Nov 05 (3d) and Feb/Mar 06 (3e)

Snow depth and roughness

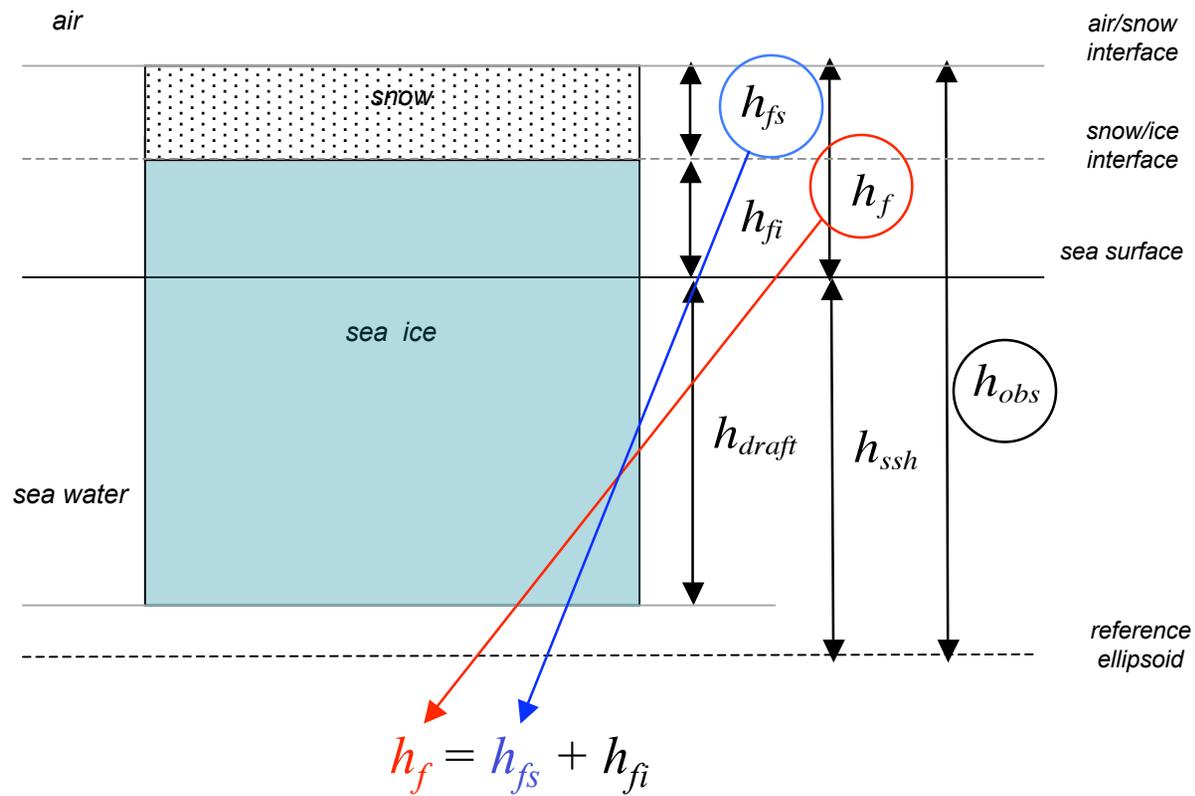
JPL

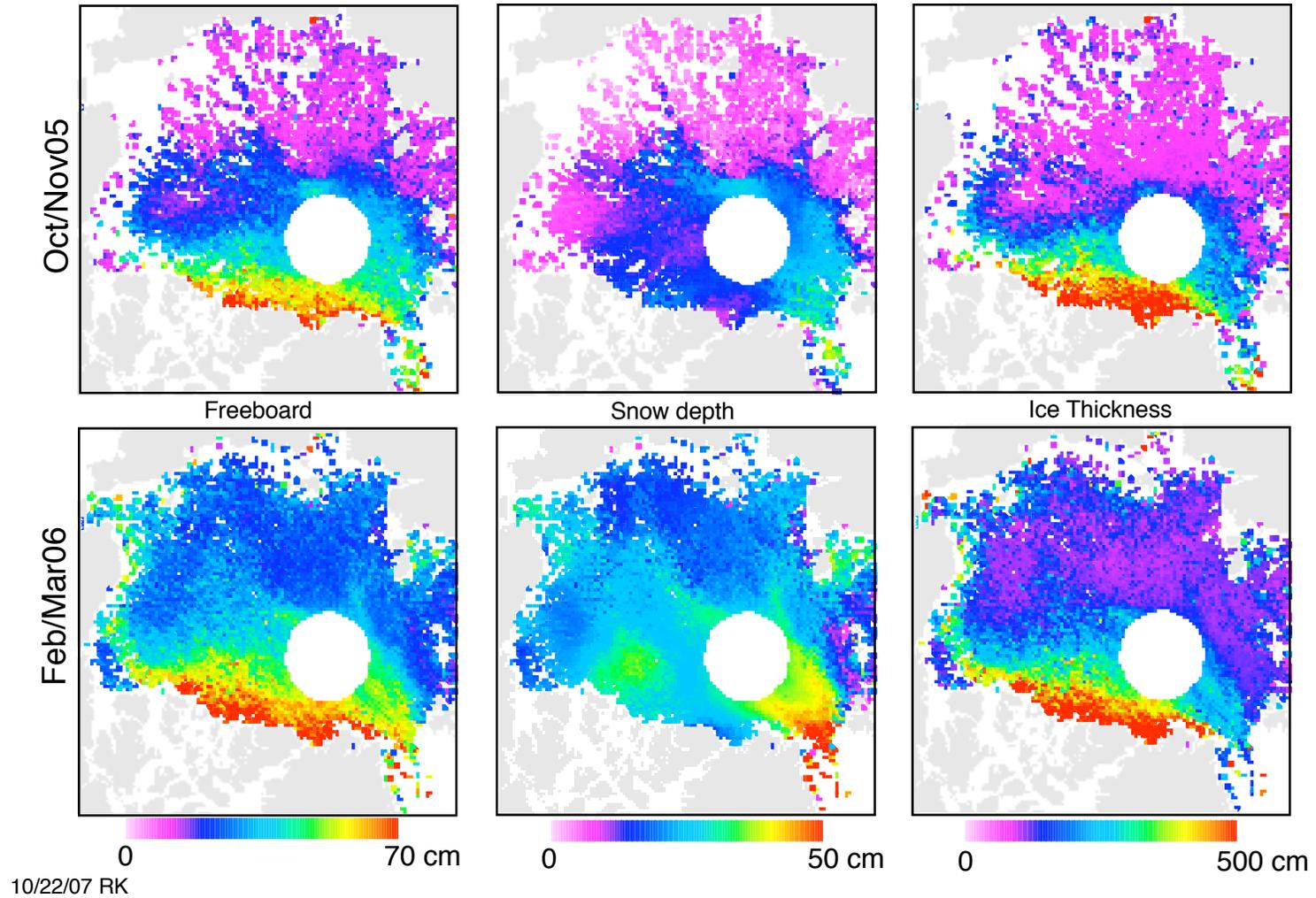
Ron Kwok
*Jet Propulsion Laboratory
California Institute of Technology
Oct 2-3, 2007
ICESat Science Team Meeting*

Photo: N. Untersteiner

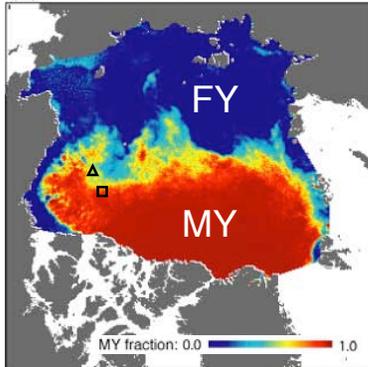


Snow depth, Ice Thickness, and Freeboard

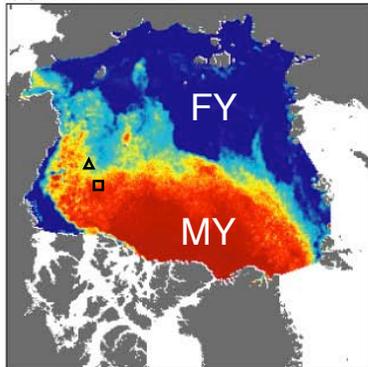




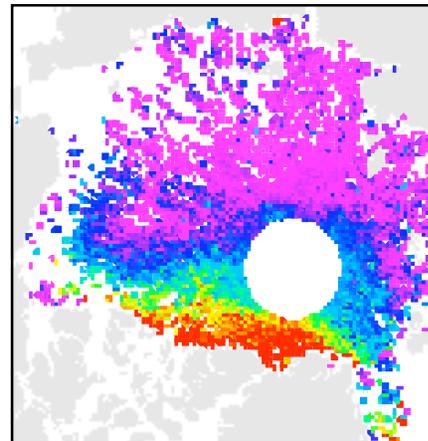
(a) Nov 15, 2005



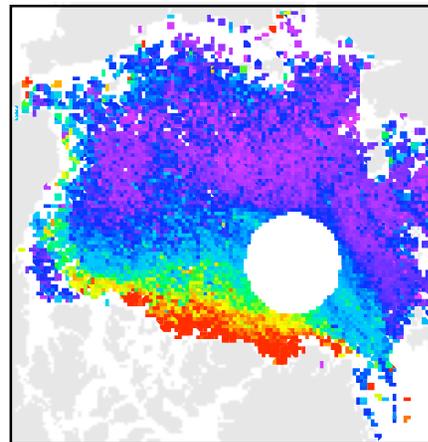
(b) Mar 1, 2006



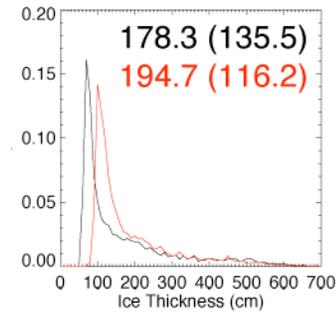
(Kwok, 2007)



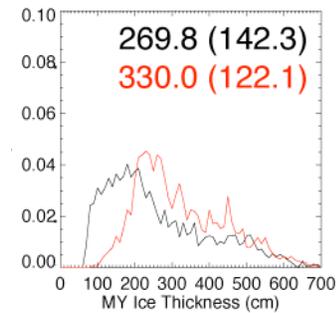
Ice Thickness



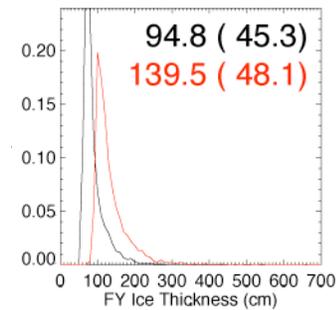
0 500 cm



Overall



MY ice



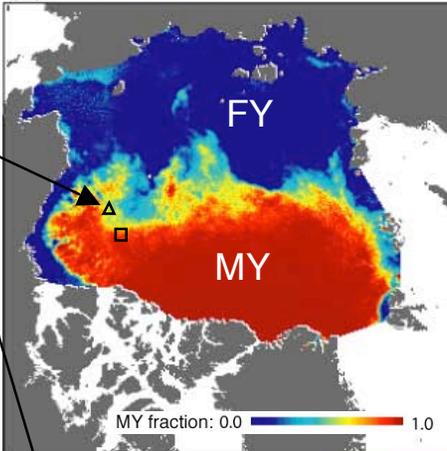
FY ice

— ON05
— FM06

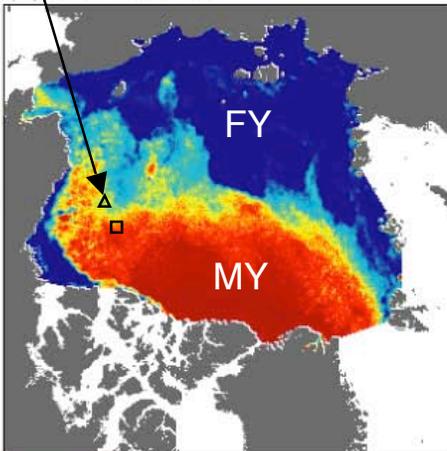
Mooring A - ice draft comparisons



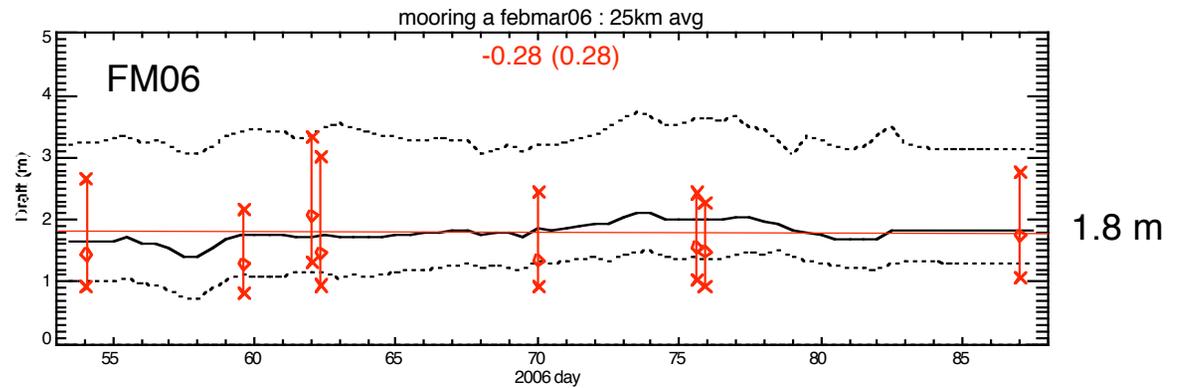
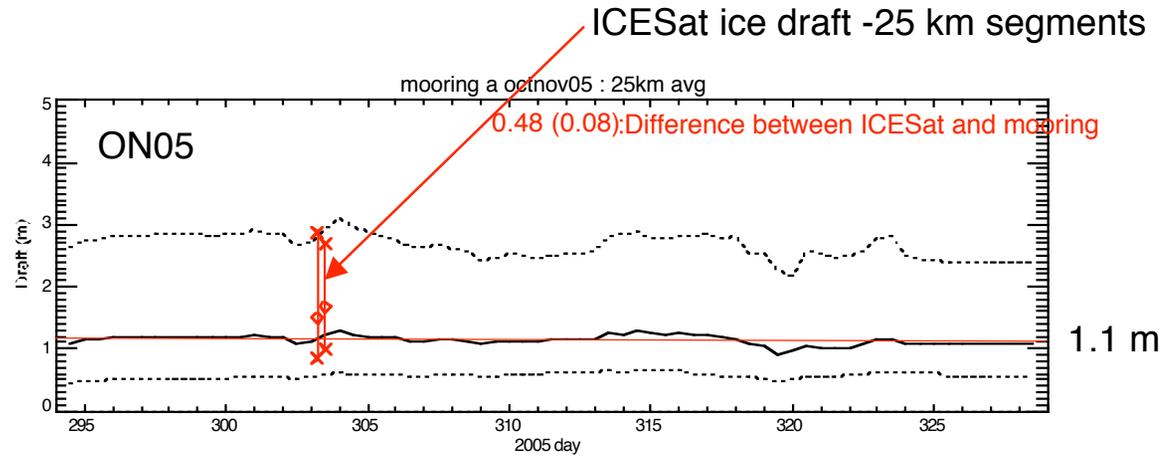
(a) Nov 15, 2005



(b) Mar 1, 2006

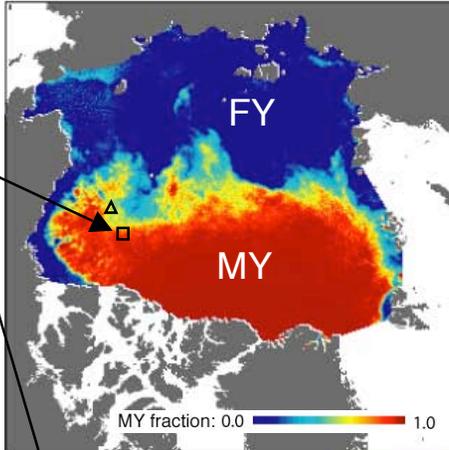


(Kwok, 2007)

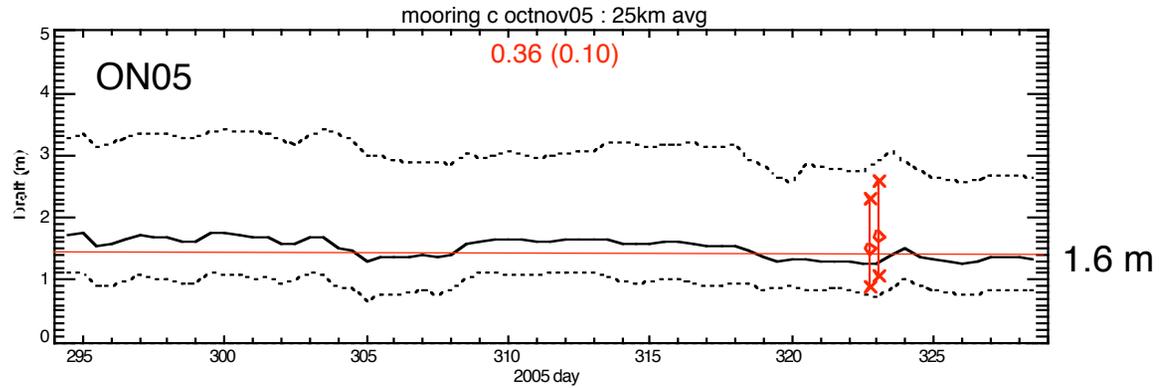


WHOI mooring ice draft data provided by R. Krishfield.

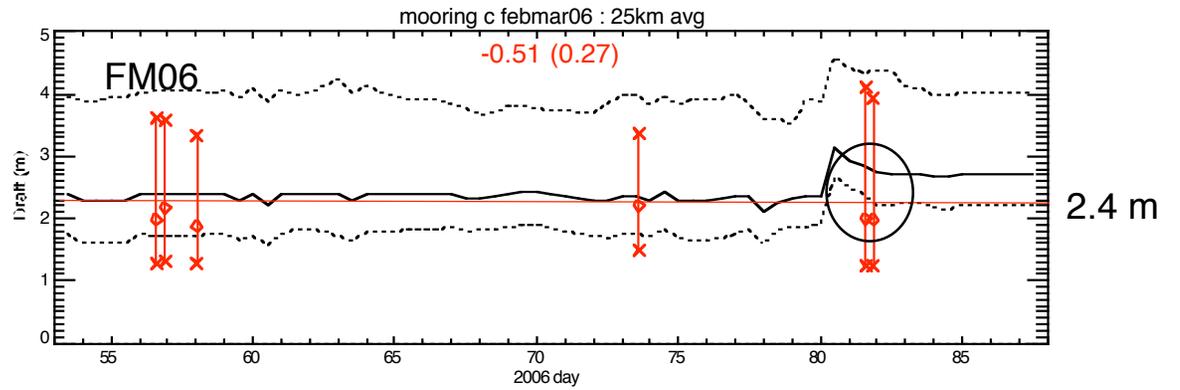
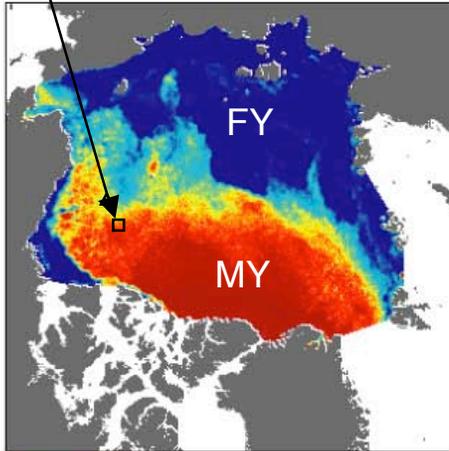
(a) Nov 15, 2005



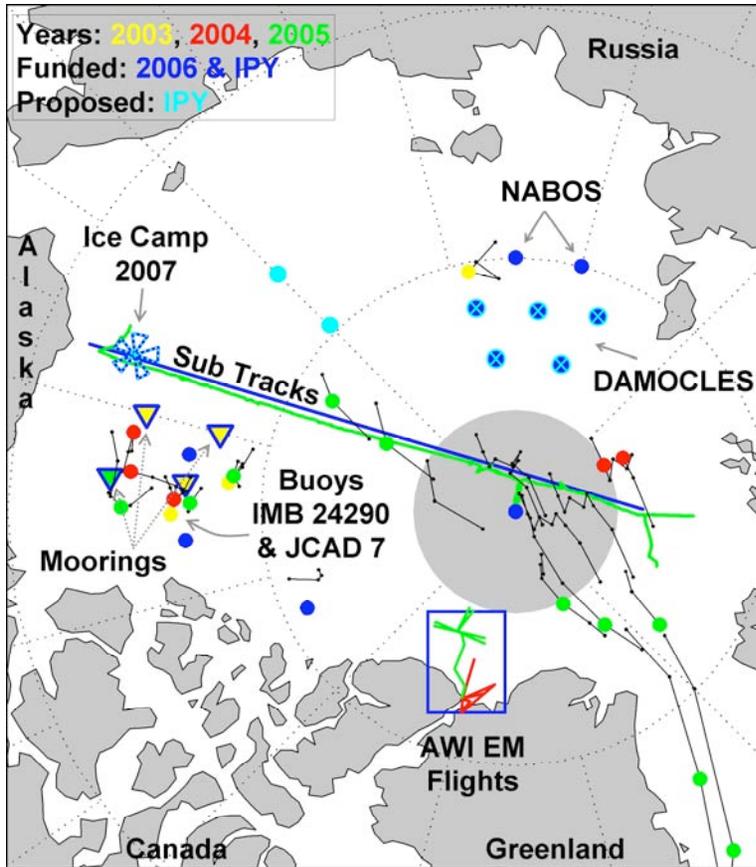
C



(b) Mar 1, 2006



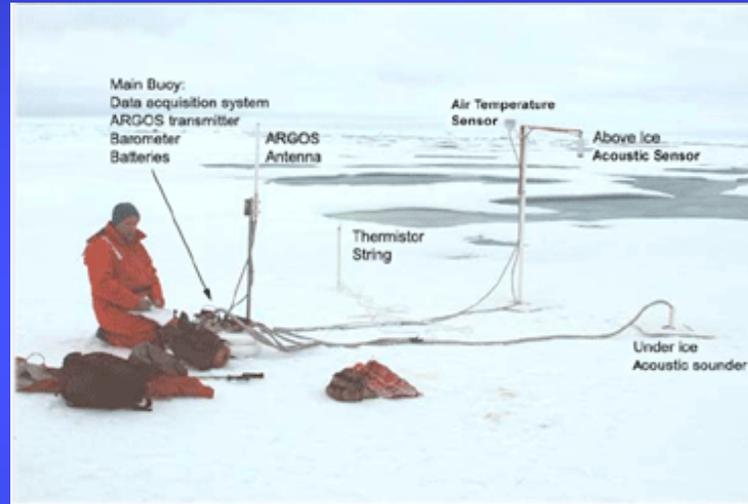
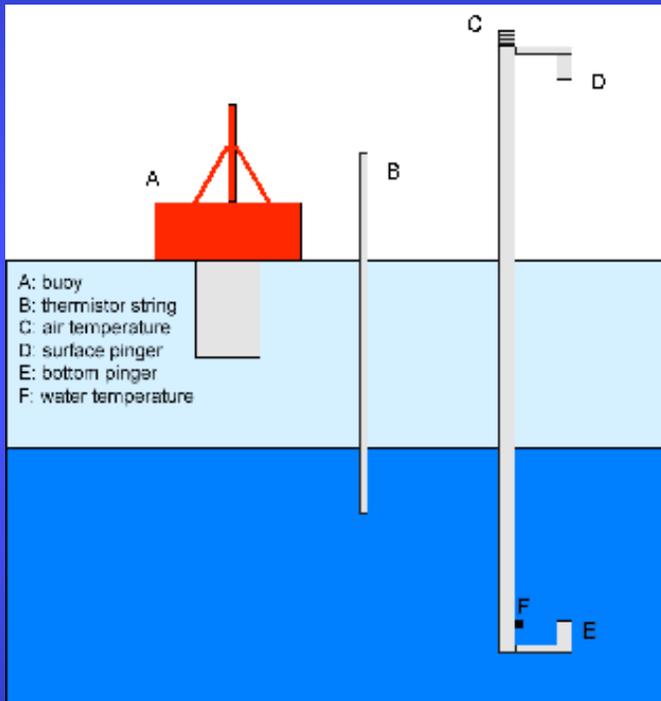
(Kwok, 2007)



- Assessment of Sea Ice Thickness Estimates Obtained from Satellites Using Submarines and Other In Situ Observations (Co-I)

- (Ignatius Rigor, UW; Mark Wensnahan, UW; R. Kwok, JPL; J. Zwally, GSFC)

Ice mass balance buoys deployed by CRREL



Measurements:
 Thickness, snow depth, ice temperature profile, surface pressure, air/water temperature.

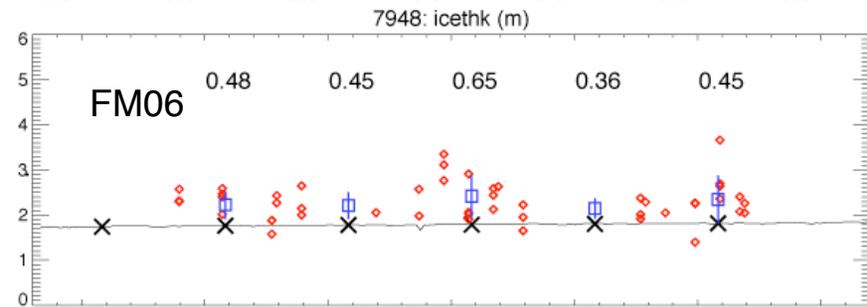
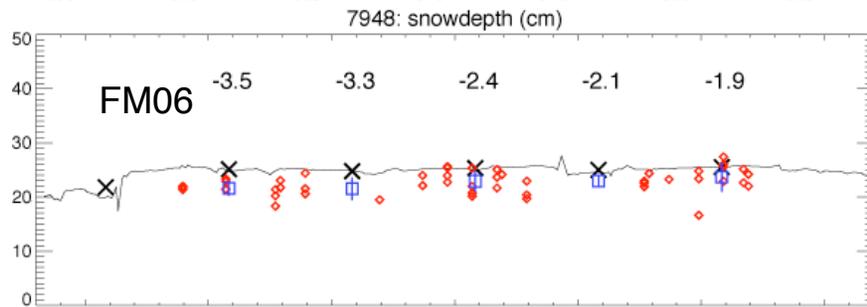
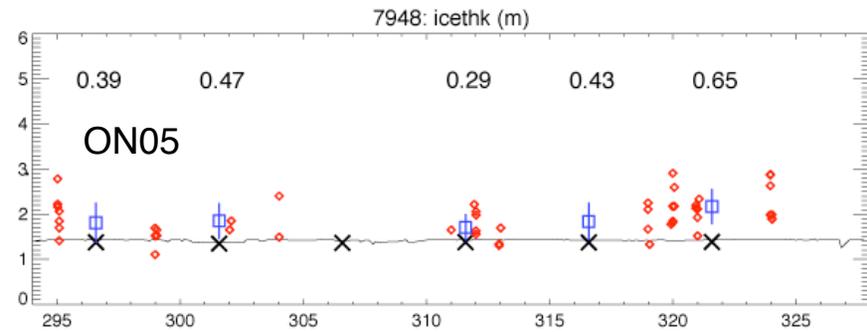
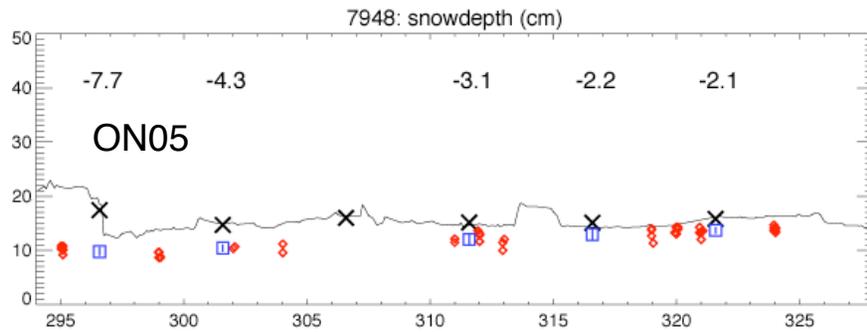


Comparison with mass balance buoy



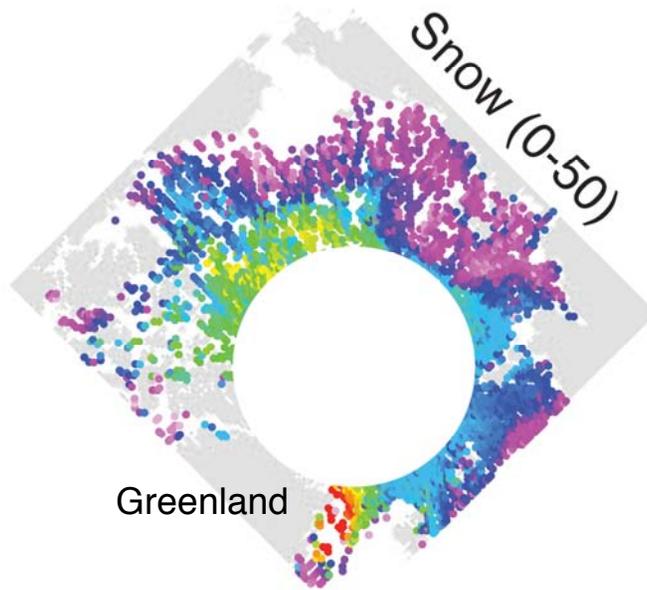
Snowdepth

Thickness



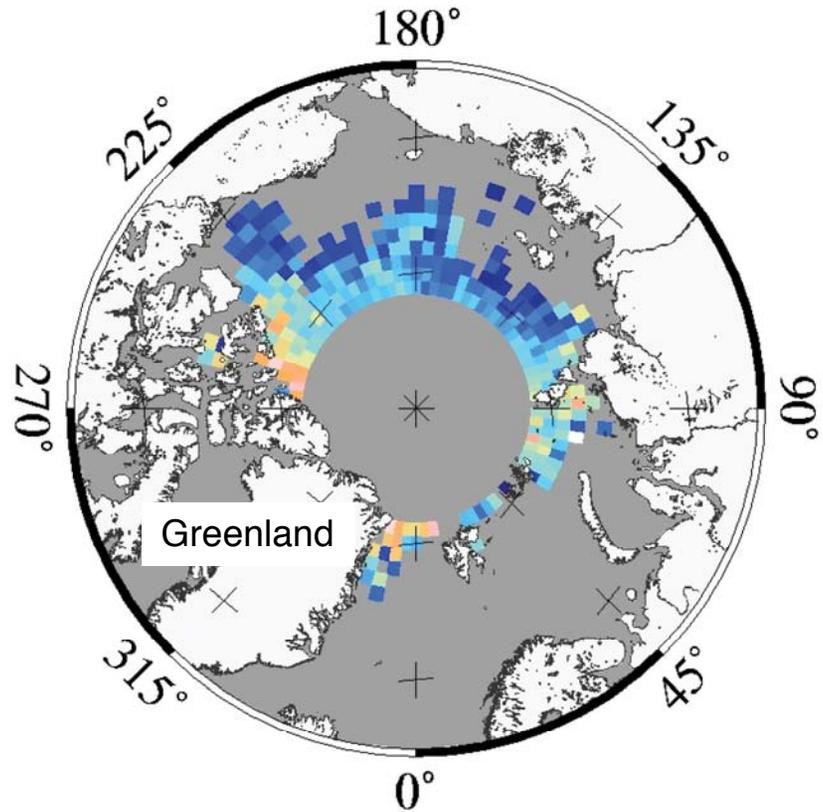


ECMWF Snow Depth vs (ICESat - Envisat) freeboard diff



Greenland

ECMWF snow depth



Greenland

ICESat - Envisat freeboard
(Farrell, 2007)



Deconvolution of waveforms with Weiner Filter



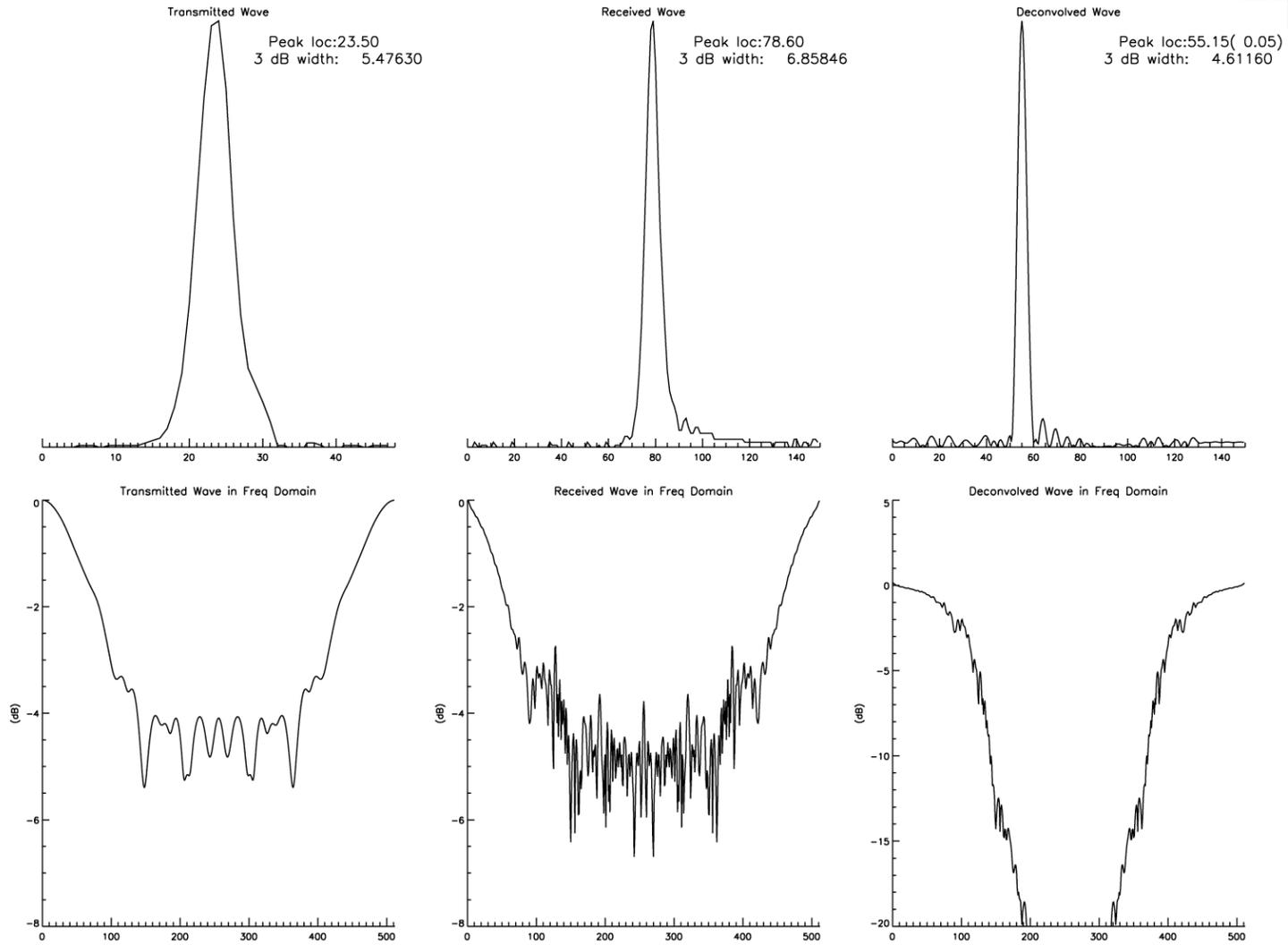
$$W(f) = \Phi(f) \frac{S_r(f)}{S_t(f)}$$

$W(f)$ - surface spreading of
Transmitted waveform

$$\Phi(f) = \frac{|S_r(f)|^2}{|S_r(f)|^2 + \sigma_N^2}$$

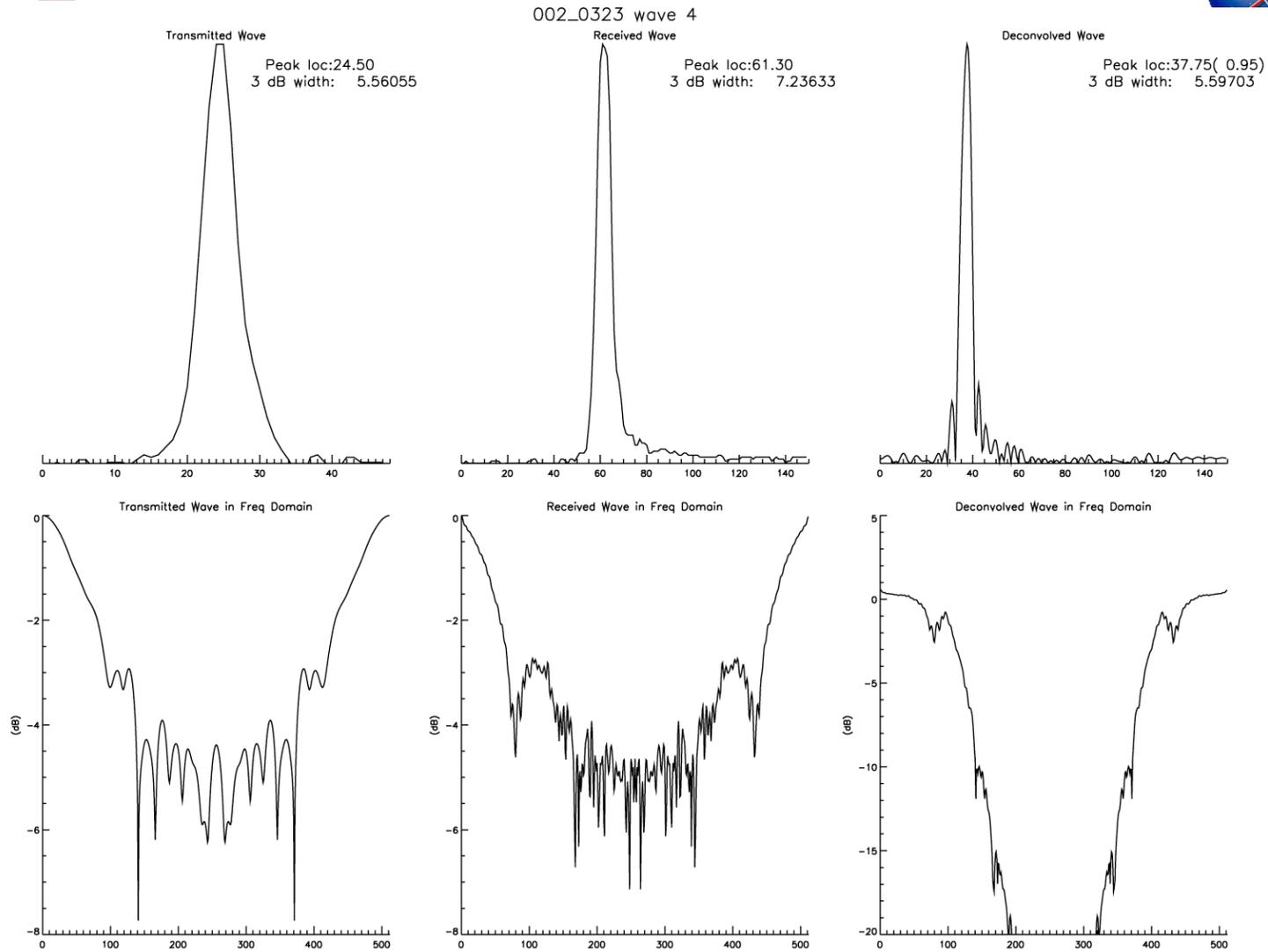


Waveform deconvolution to obtain surface roughness





Waveform deconvolution to obtain surface roughness





Width of spreading function surface roughness

