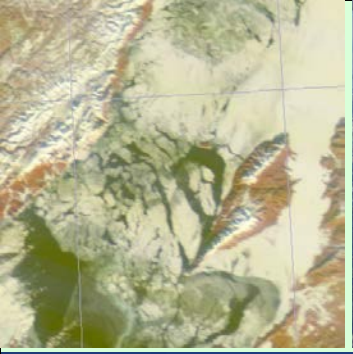




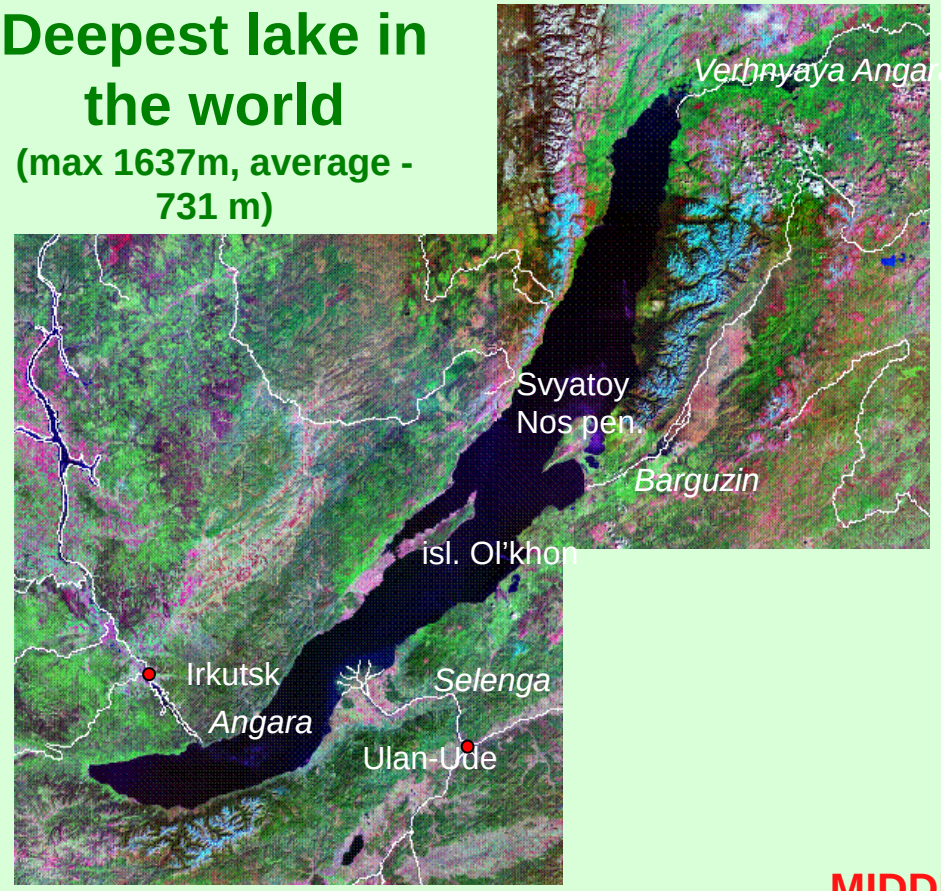
AltiKa data over Lake Baikal

A. Kouraev,
E. Zakharova,
F.Rémy

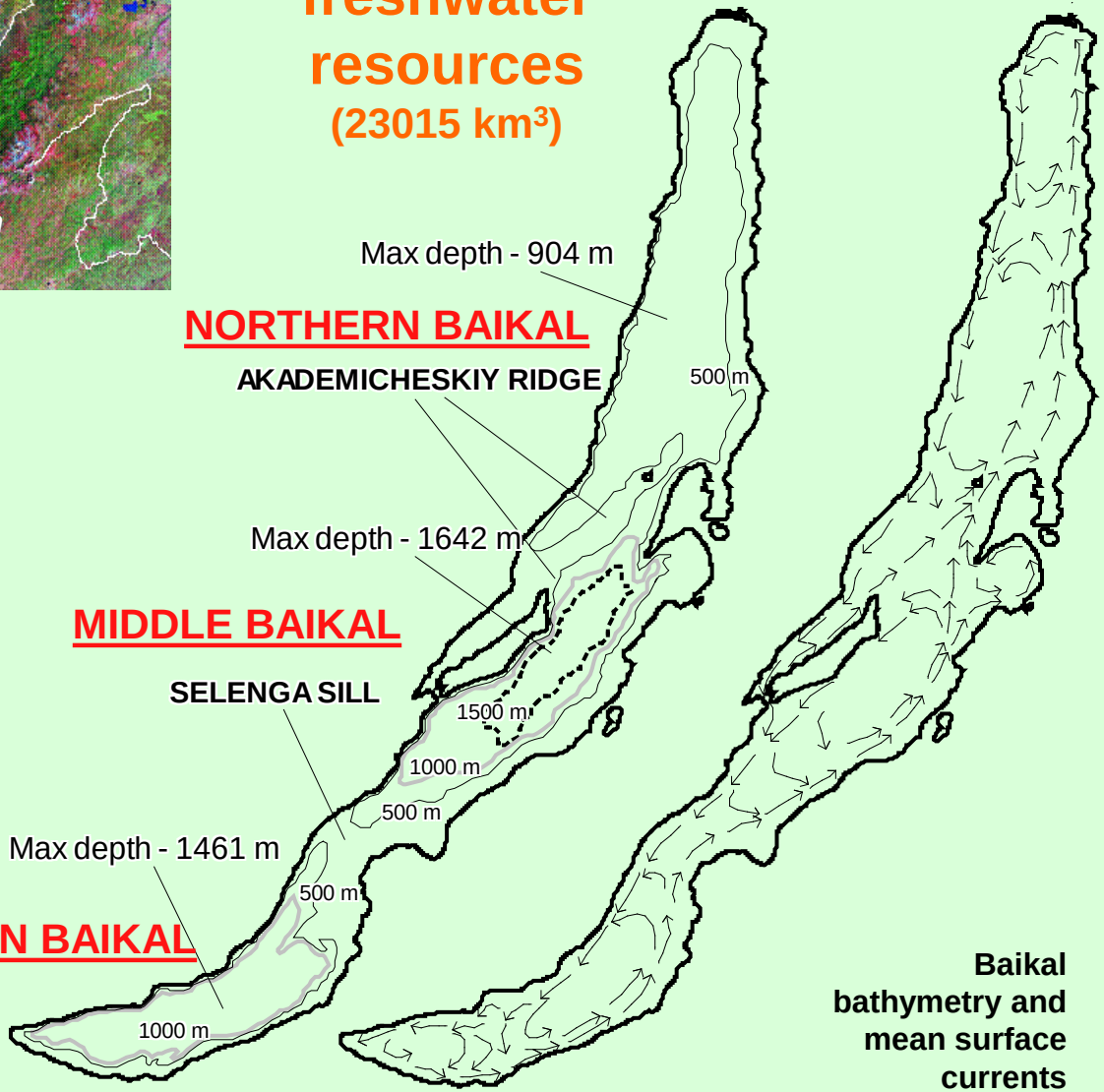
Atelier altimetry and glaciology
Toulouse, 26 June 2014

Lake Baikal

Deepest lake in the world
(max 1637m, average - 731 m)



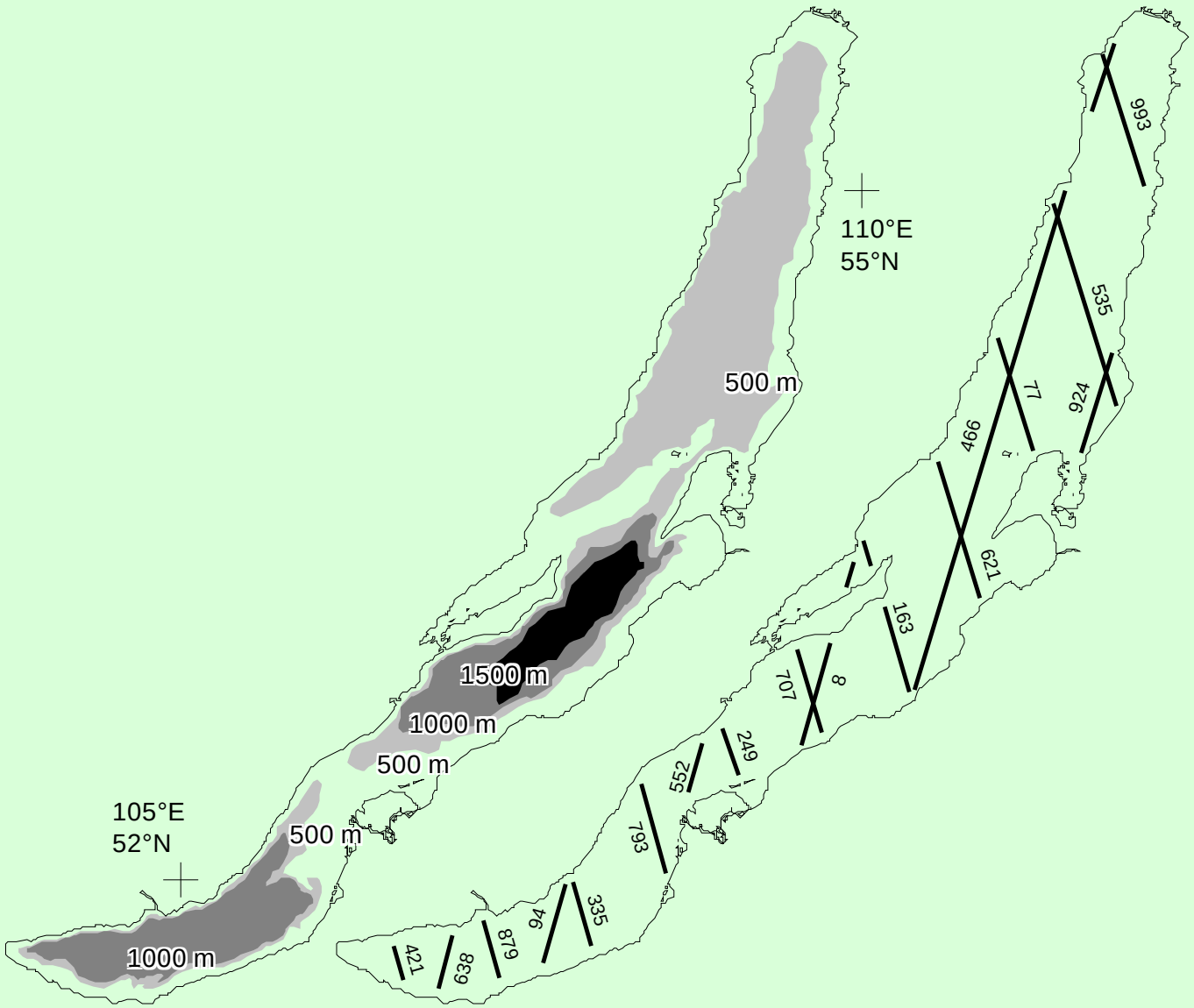
20% of world freshwater resources
(23015 km³)



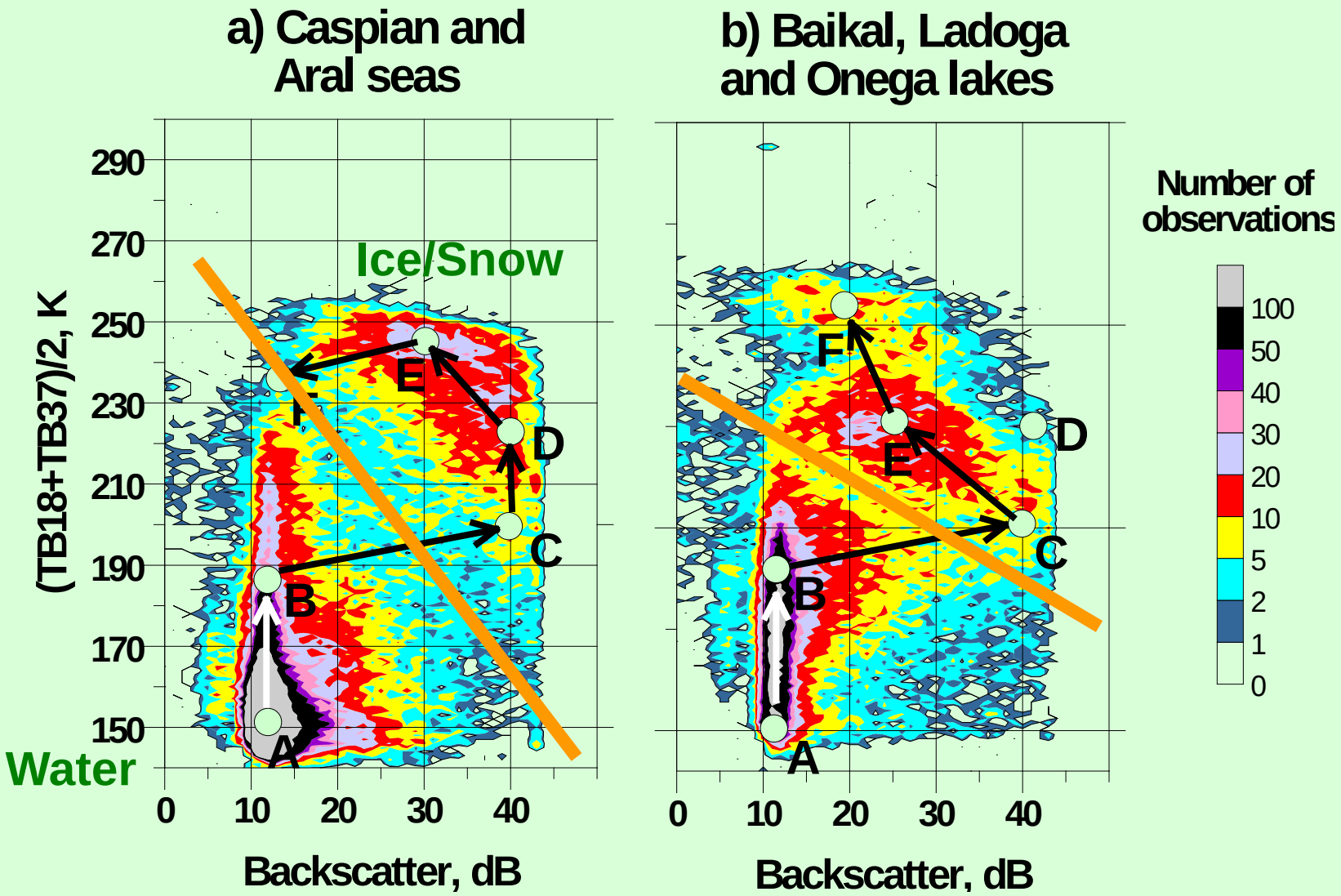
Three main parts, specific limnological regime and currents

Baikal bathymetry and mean surface currents

Altimetric coverage



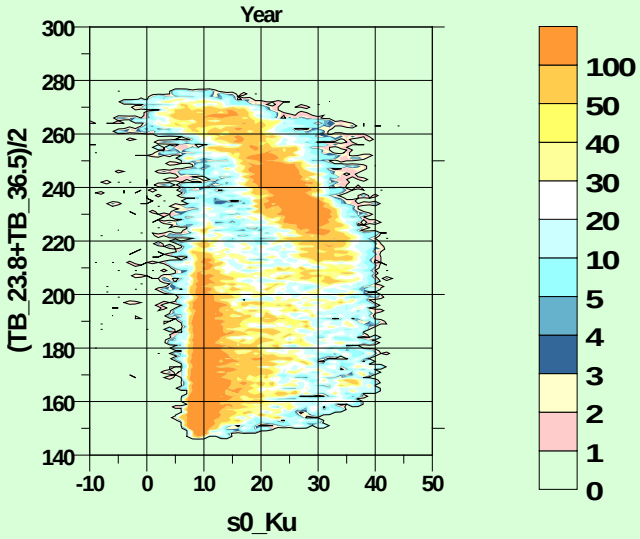
Altimetry method

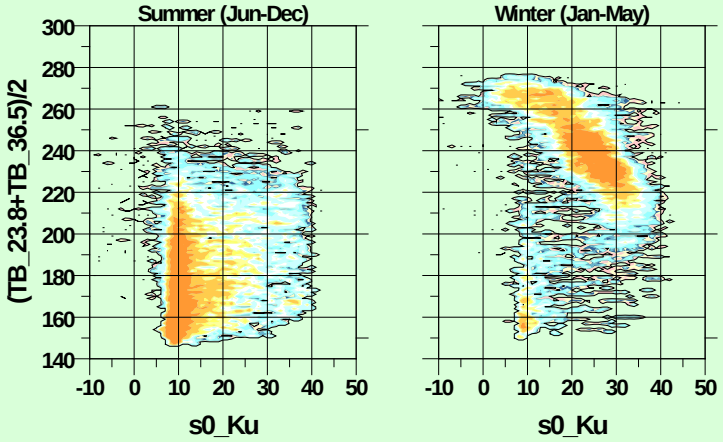


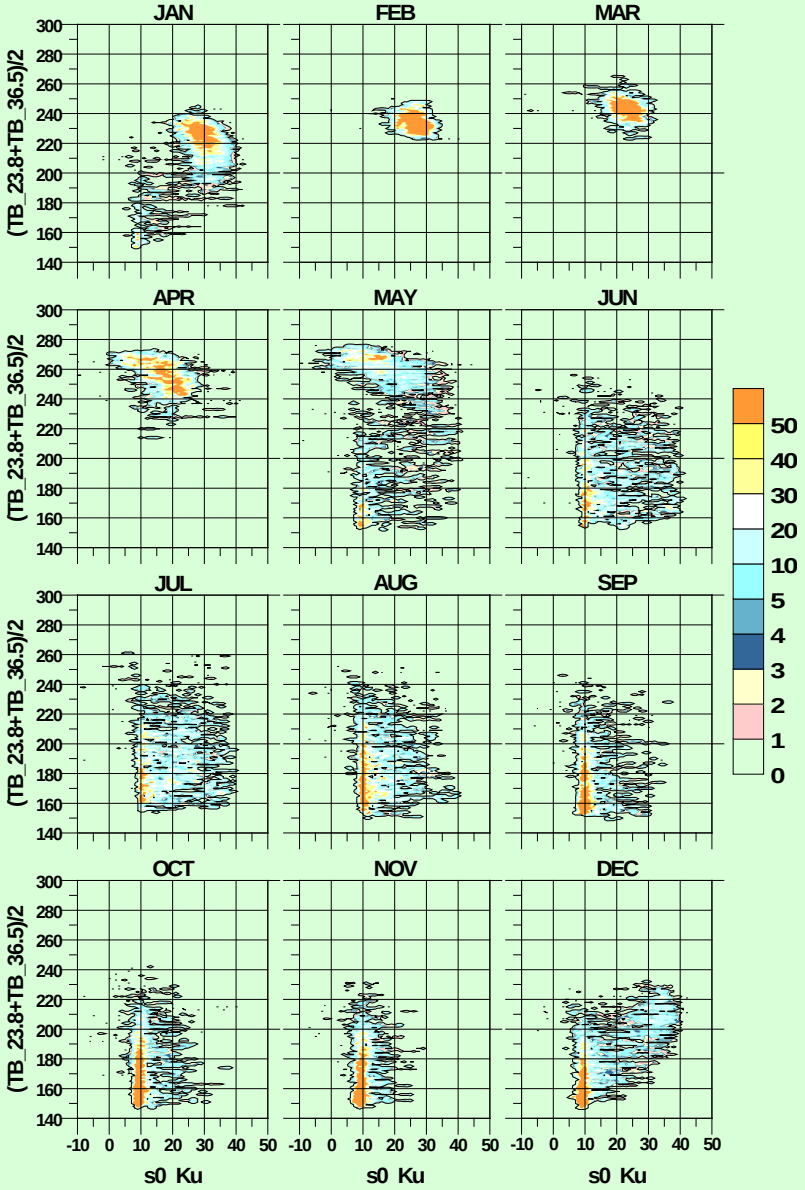
Schematic representation of the temporal evolution of T/P observations in the space of backscatter vs. TB/2. Schema is overlaid on two-dimensional histograms (total summed values) for Caspian and Aral seas (a) and Baikal, Ladoga and Onega Lakes (b)

Lake Baikal - ENVISAT

LAKE BAIKAL: 2D histograms
(number of observations), ENVISAT data, Ice2

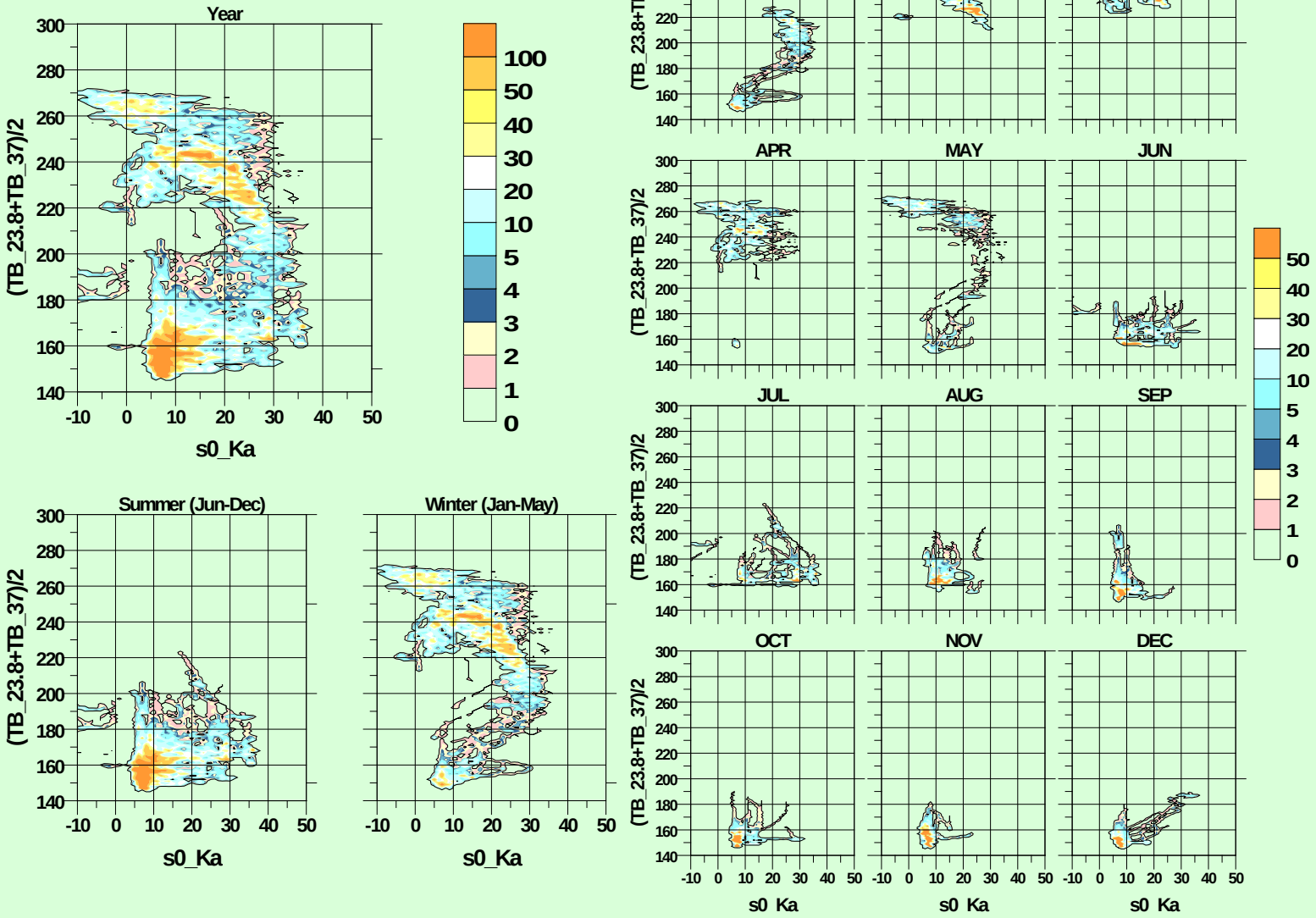




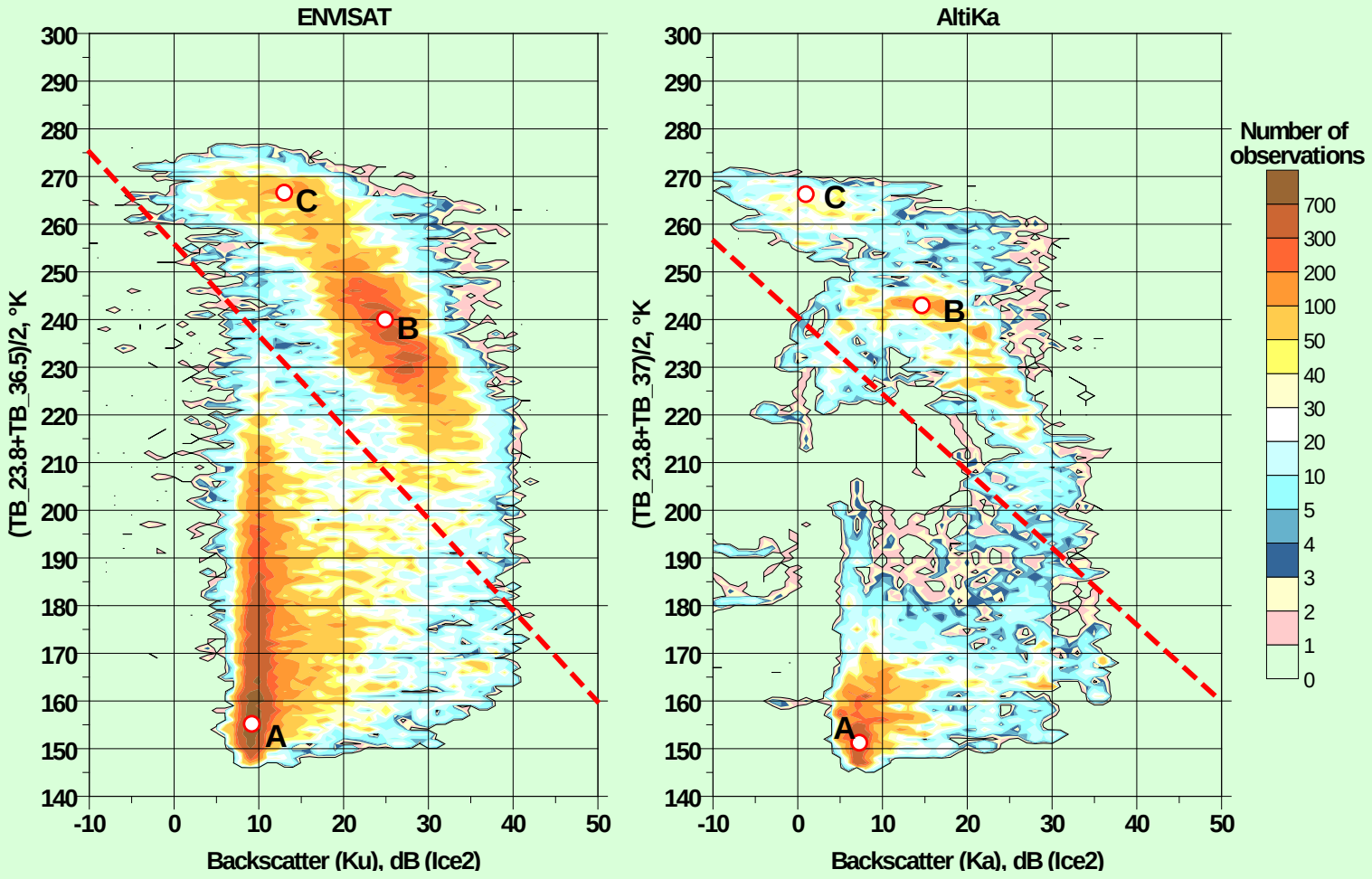


Lake Baikal - AltiKa

LAKE BAIKAL: 2D histograms
(number of observations), AltiKa data, Ice2



AltiKa vs ENVISAT

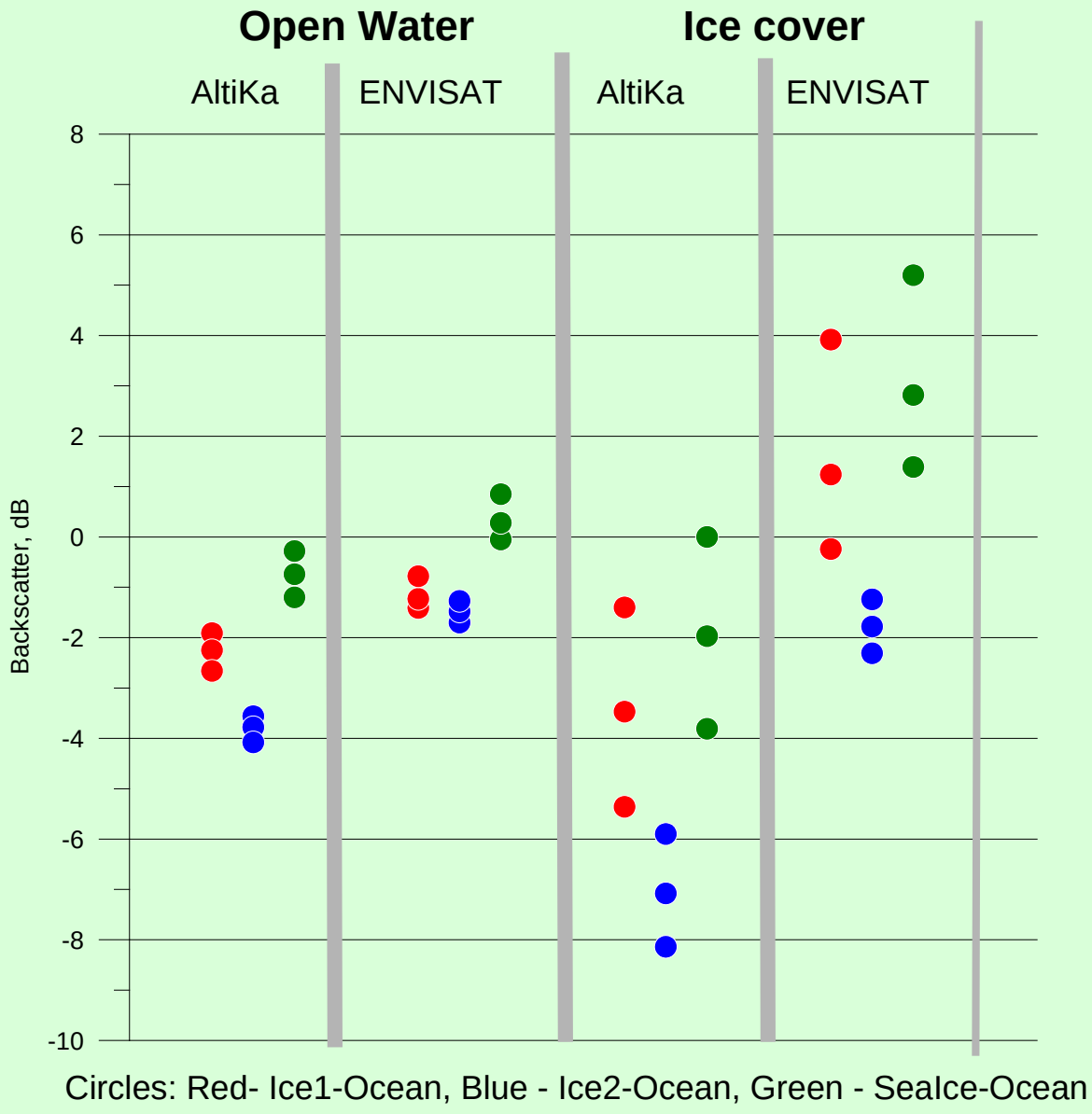


A (open water): smaller sigma, TB is more centered

B (ice): smaller sigma, slightly higher TB

C (old ice, snow): smaller sigma

Statistics of Sigma from 4 retrackers



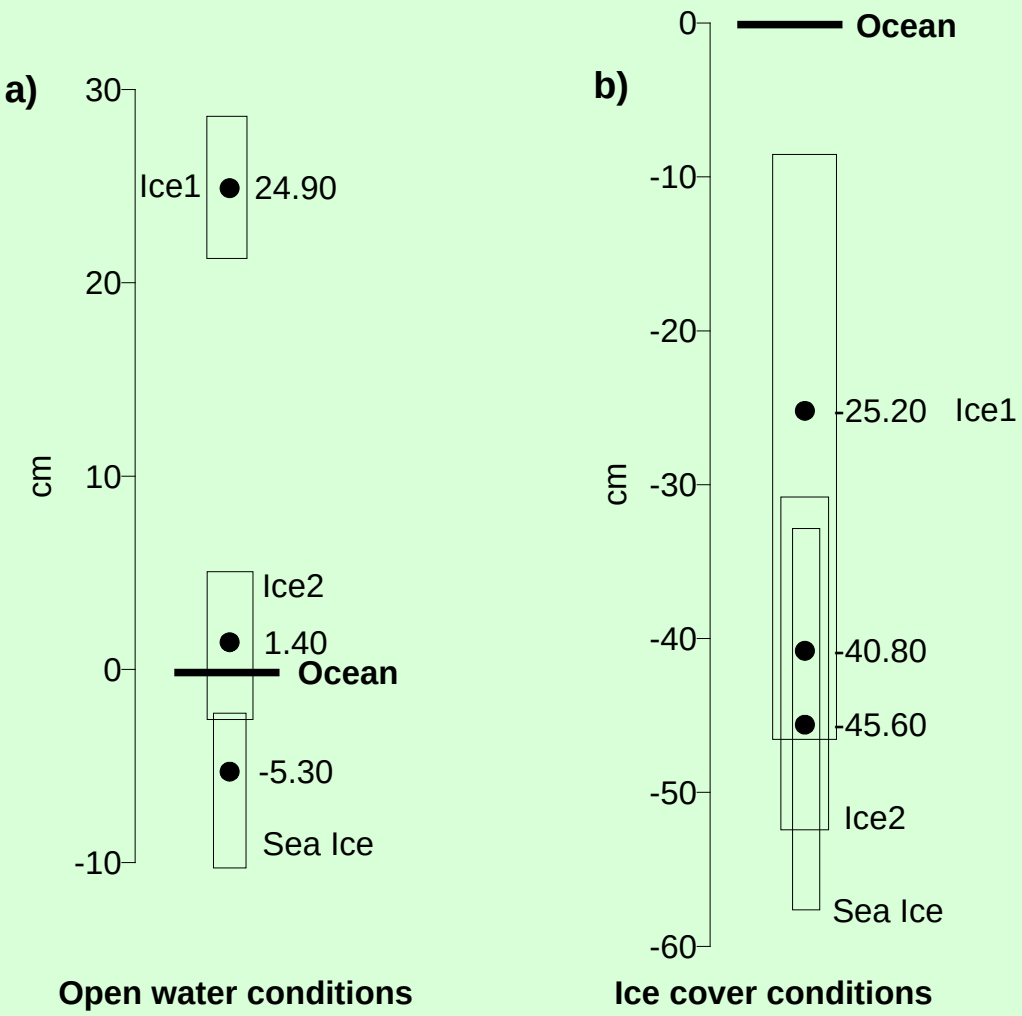
Reference: values from Ocean retracker, 1Q, Median and 3Q

Decrease of Ice1, Ice2 and SeaIce in AltiKa

More spread for ice cover than for water (heterogeneity)

Ice2 ice cover - more spread for AltiKa (better sensitivity for difference surface types?)

Influence of ice on altimetric range estimation



Position of sea level (cm) for Ice1, Ice2 and Sea Ice retrackers relative to Ocean retracker for open water and ice cover conditions. Black points - median values, lower and upper limits of boxes correspond to 1st and 3rd quartiles

Kouraev et al., 2008

Aral Sea: ice conditions

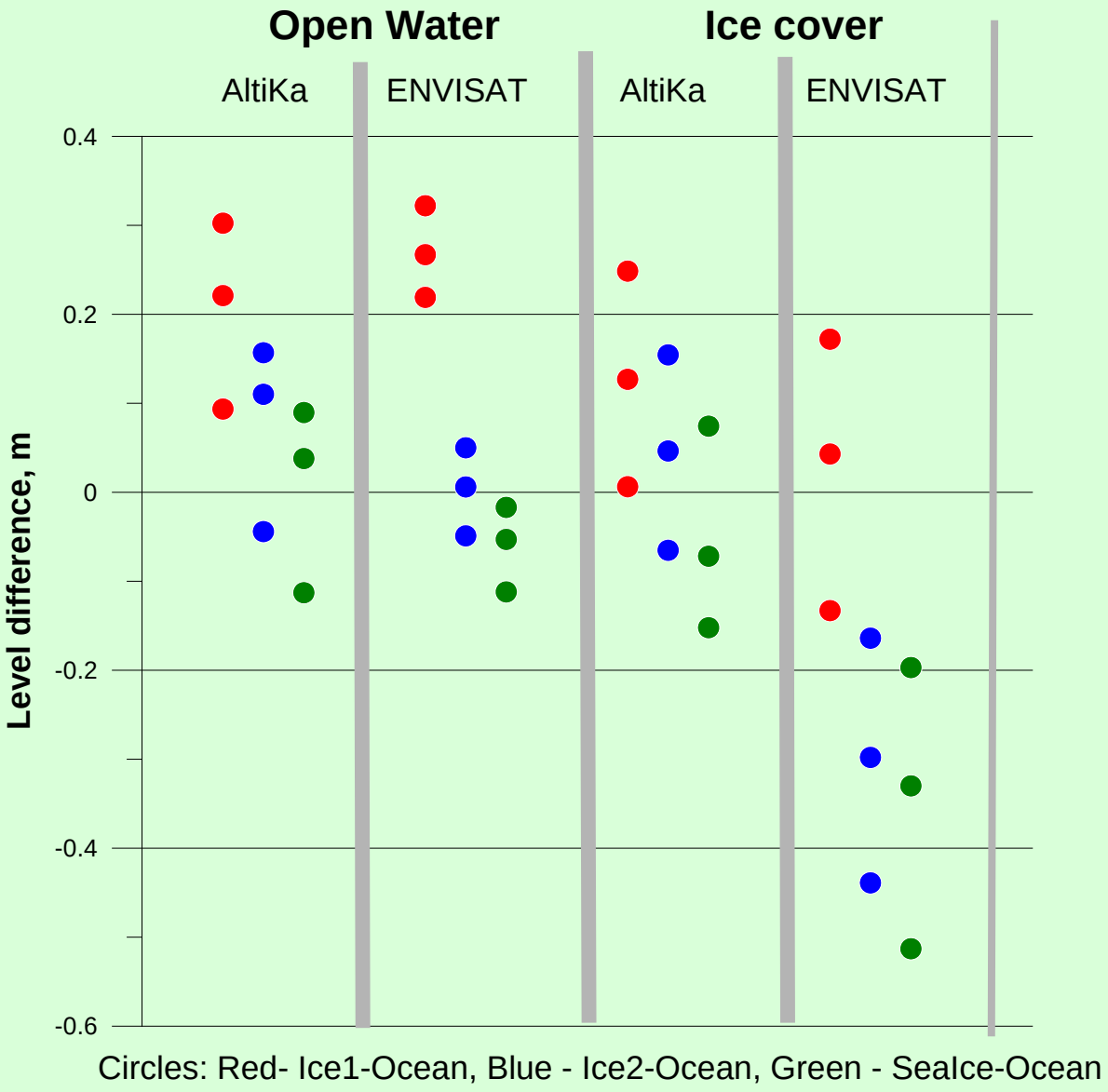
ENVISAT retrackers: Ocean, Ice1, Ice2, Sea Ice

Ocean retracker: too high when ice is present

Correction (40-45 cm) for Ocean retracker

Important for T/P, Jason-1, GFO time series (Hydroweb etc)

Statistics of level from 4 retrackers



Reference: values from Ocean retracker, 1Q, Median and 3Q

Open water: more spread for AltiKa (1 vs 8 years?)

More spread for ice cover than for water (heterogeneity)

Ice cover: less spread for AltiKa, and less bias for Ice2 and SeaIce (MLE4 vs Ocean?)

SARAL/AltiKa

Ku-band 13.575 GHz=**2.2 cm**

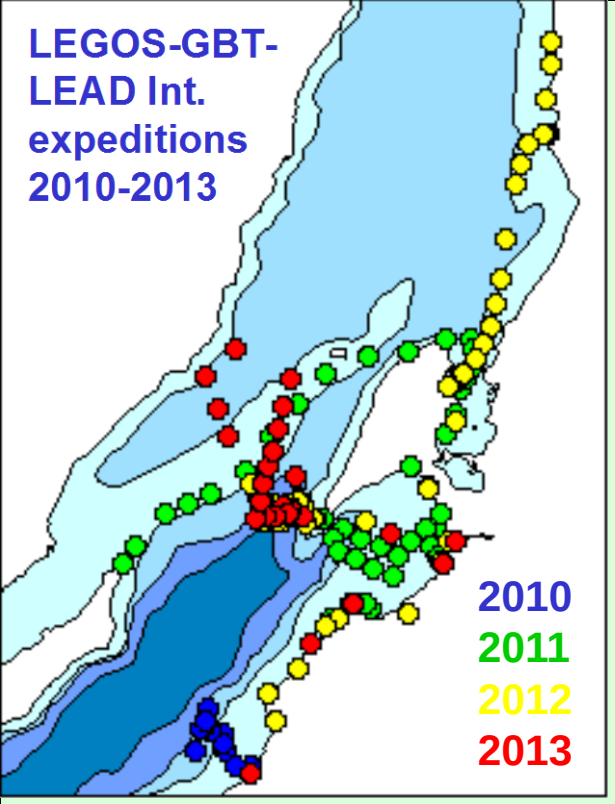
2.32cm

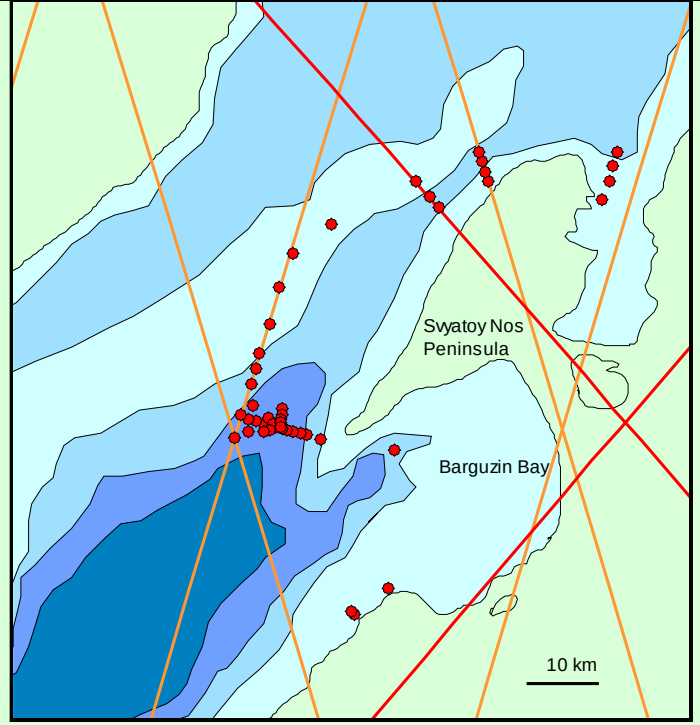
Ka-band 35.75 GHz=**0.84 cm**

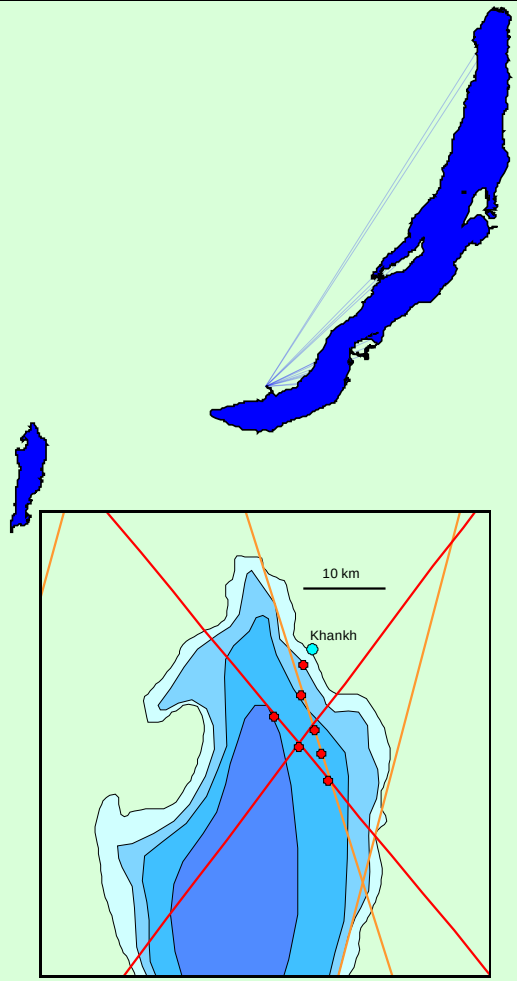
1.624 cm

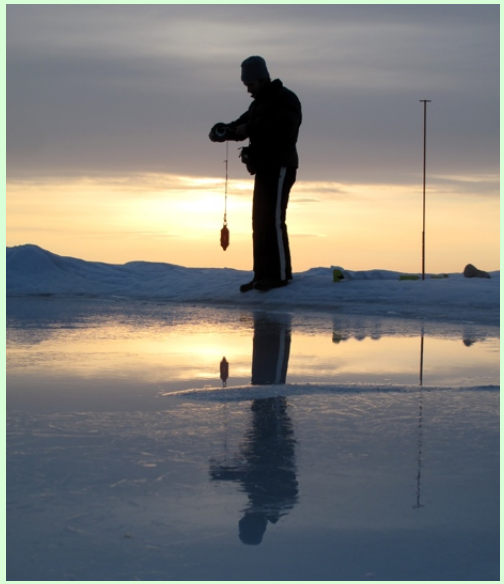
New frequency, new phenomena
less penetration, better spatial resolution

How does ice structure influence altimetric signal?

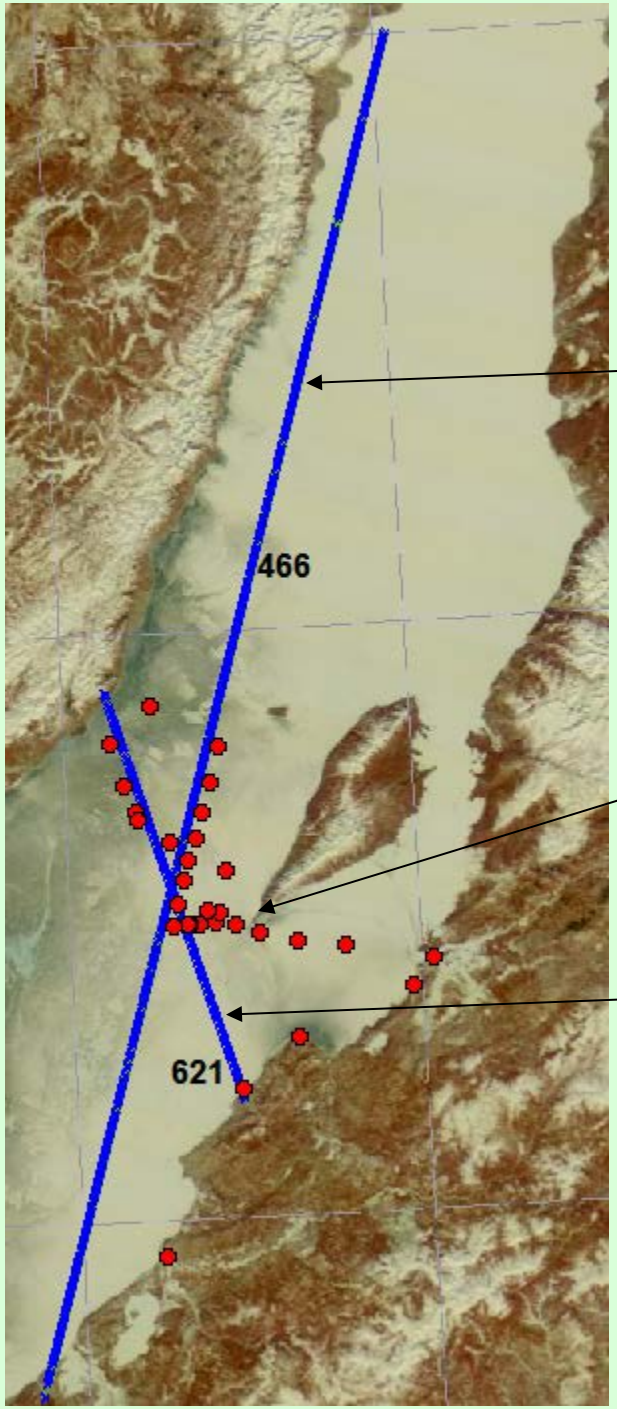

LEGOS-GBT-
LEAD Int.
expeditions
2010-2013
2010
2011
2012
2013


Svyatoy Nos
Peninsula
Barguzin Bay
10 km


10 km
Khankh



Launch 25 Feb, data since 13 March 2013



30 Mar 13

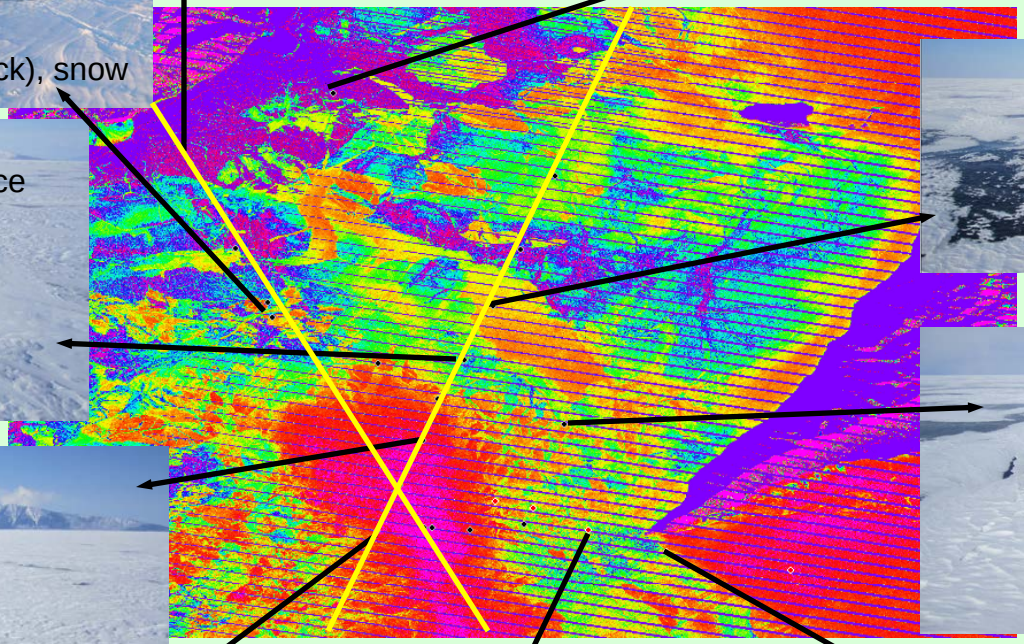
In situ 2-4 Apr 13

4 Apr 13

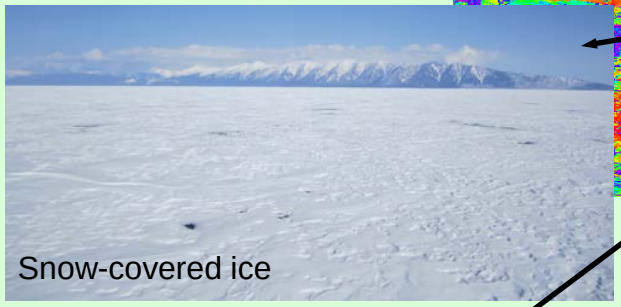
Smooth, mostly clear ice

Rough, hummocky (1 cm thick), snow

Smooth; congelated pancake ice

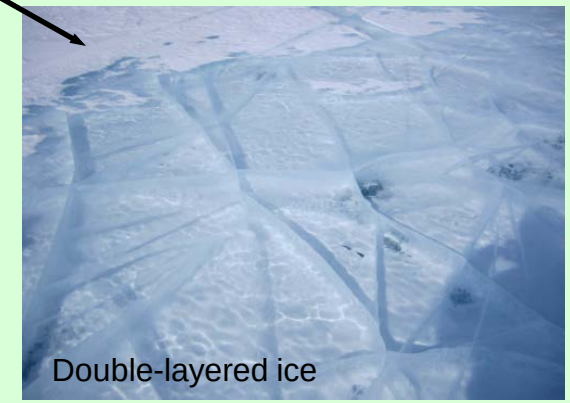


Snow, small patches
of clear ice



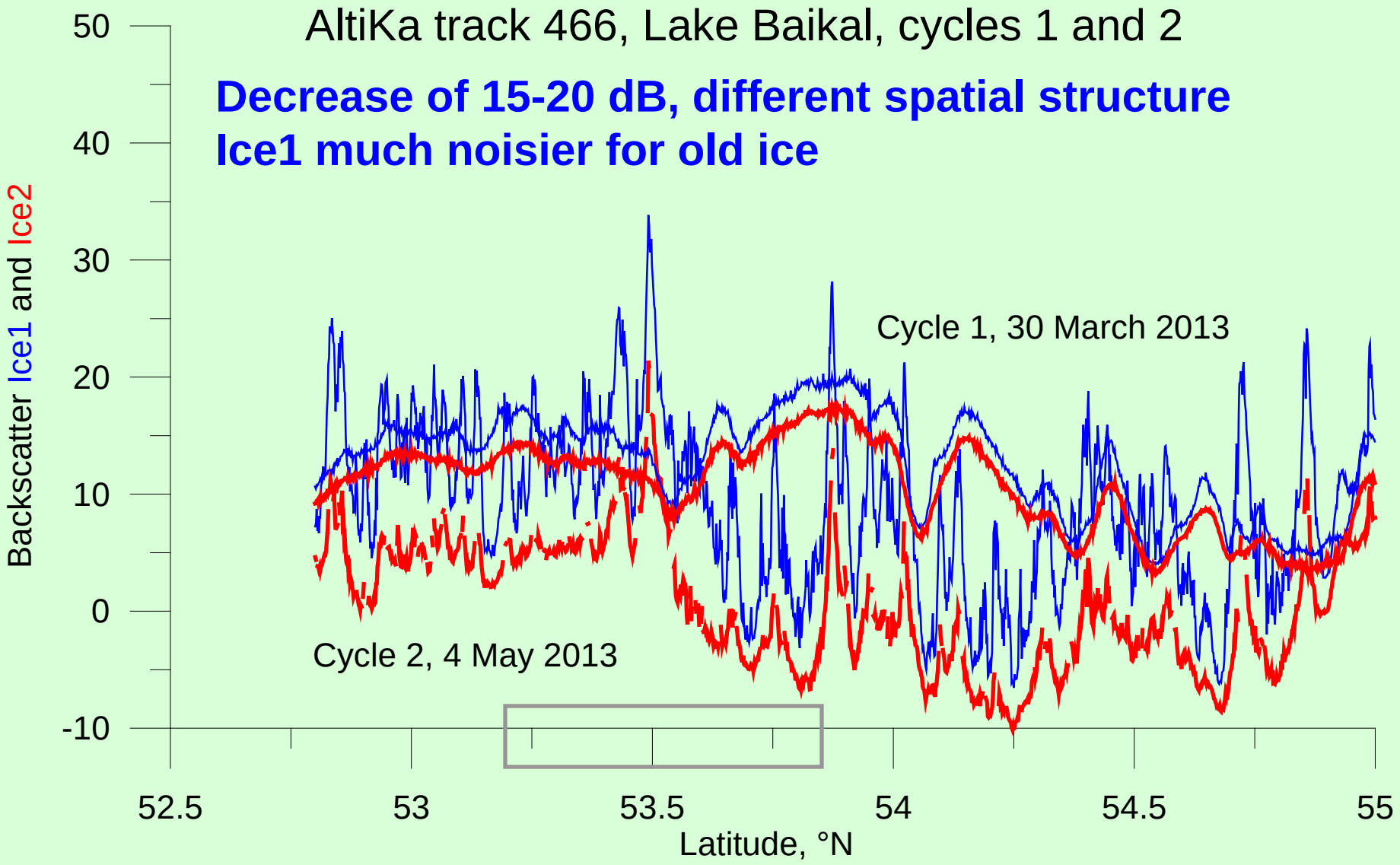
Snow-covered ice

Snow, small patches
of clear ice

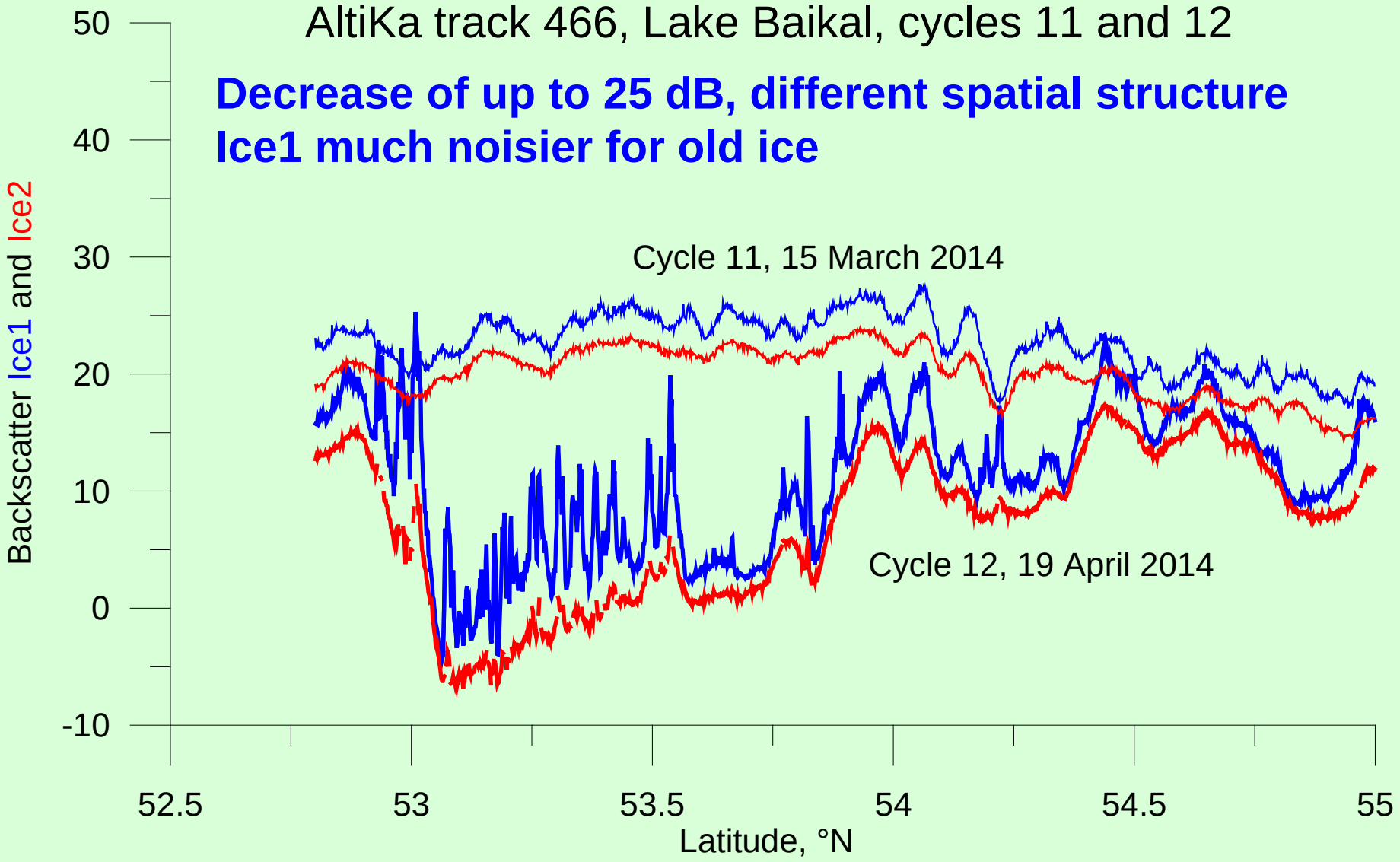


Double-layered ice

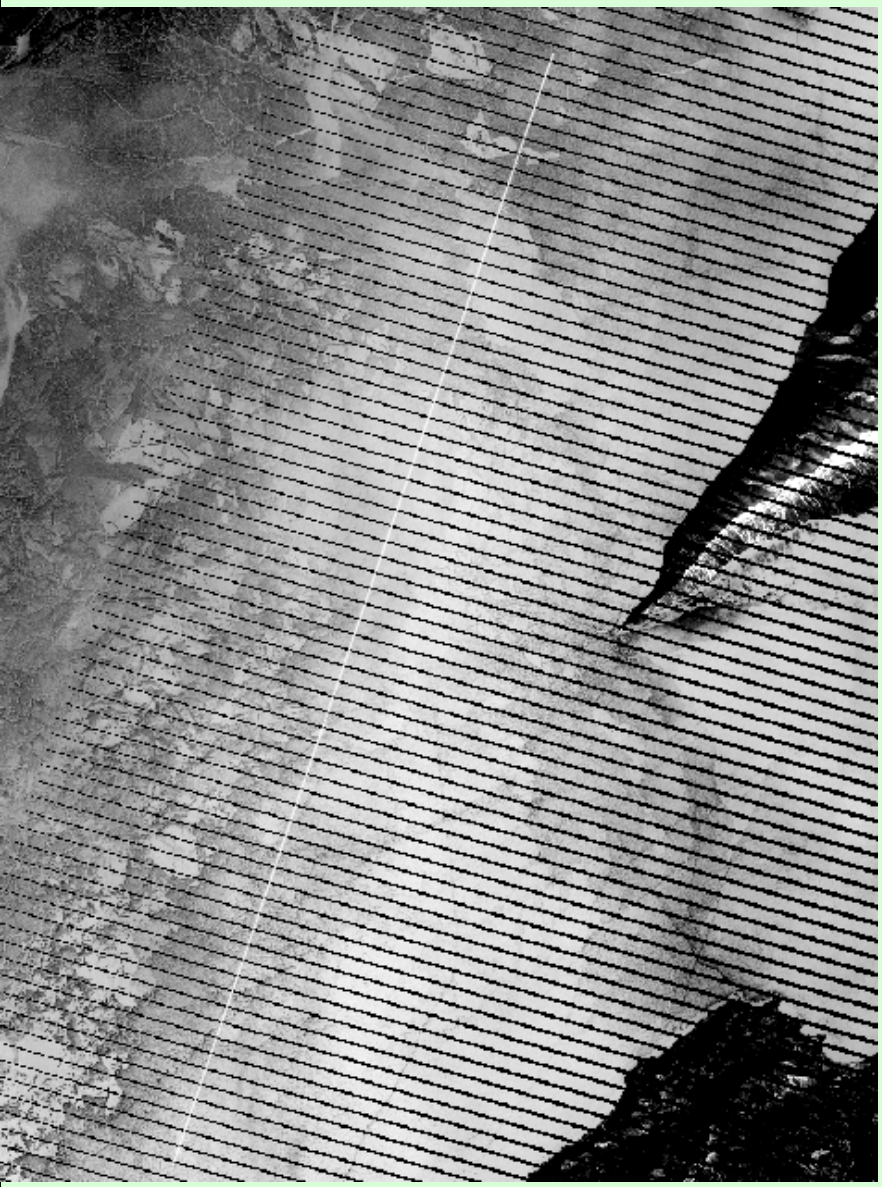
Backscatter changes in spring 2013

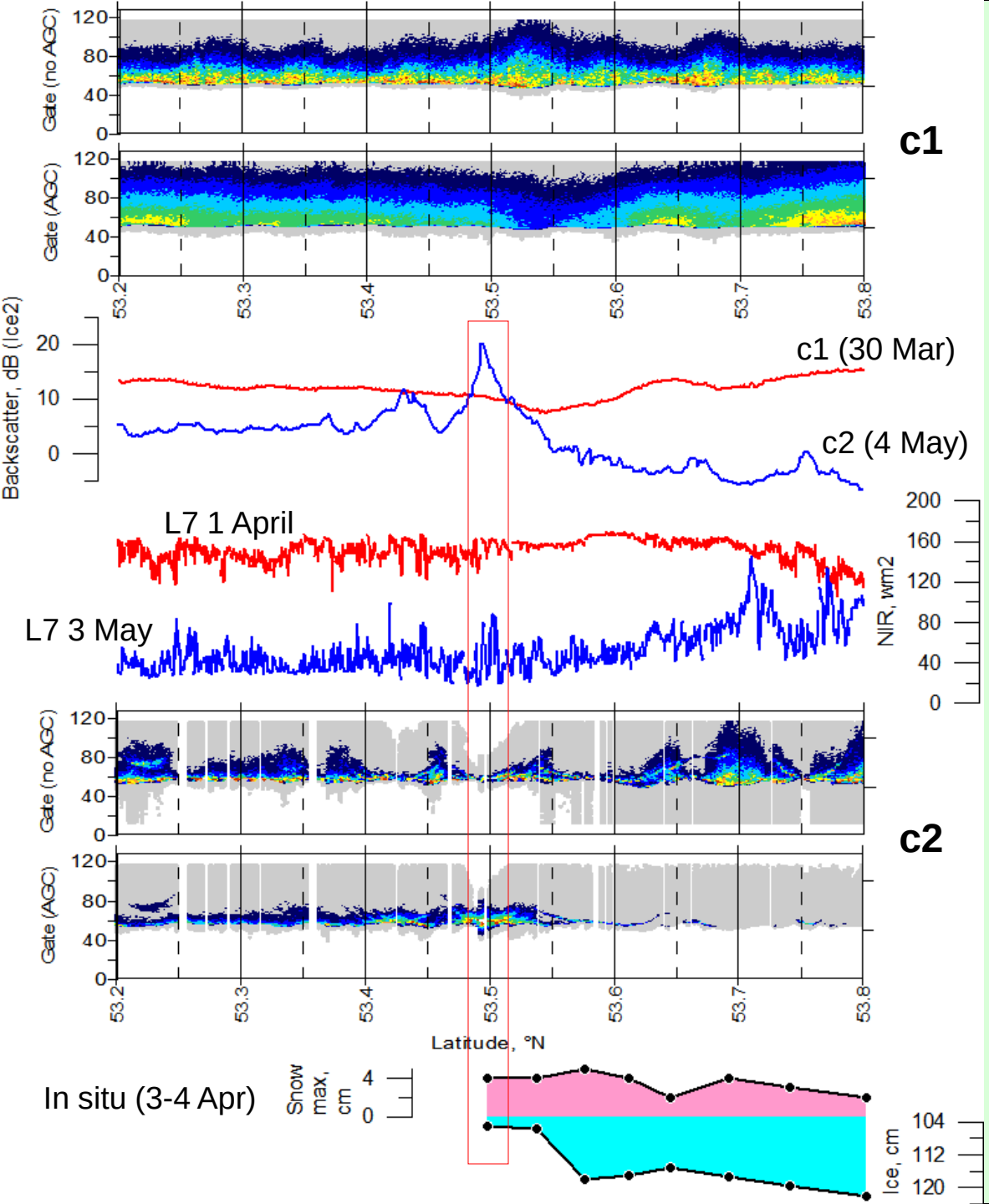


Backscatter changes in spring 2014



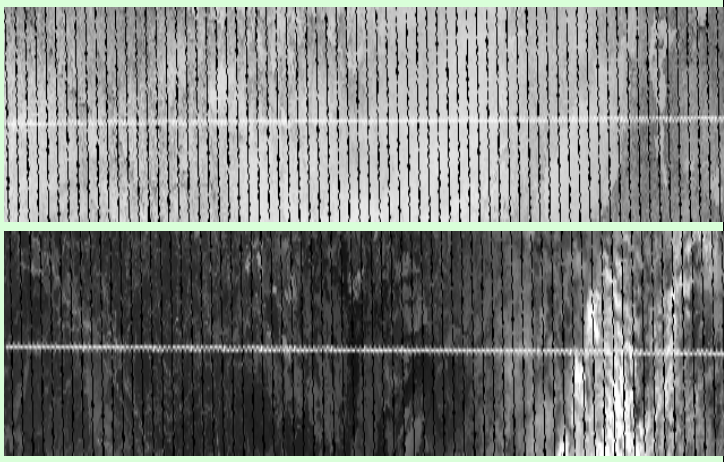
Landsat 7, 1 Apr and 3 May 2013, NIR





Some clouds present

Decrease in backscatter, decrease in NIR range



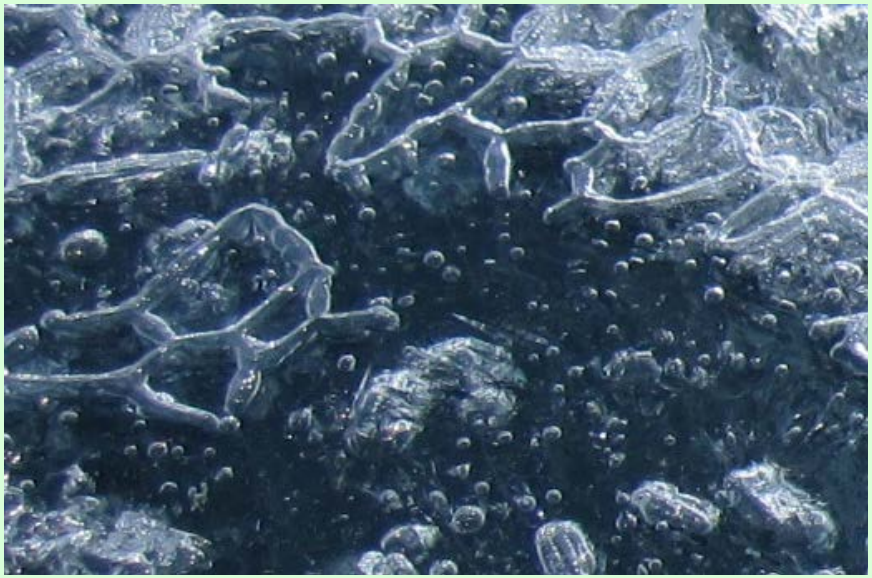
Dark ice (southern part of 3 May image) - stonger backscatter, peak on frozen lead (ice is also thinner)

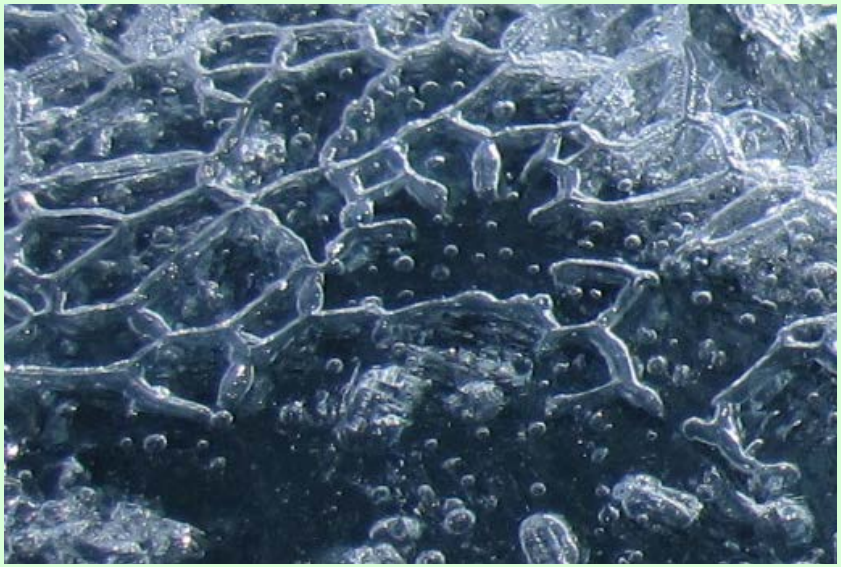

Going down to
micro scale

Air channels

Air channels formation in 9 min

Influence on albedo and waveform





Air channels and bubbles

Needle ice on surface (3 cm)

Relation between ice structure and altimetric signal

Needle ice on below (12 cm)

Ice crust hanging in the air