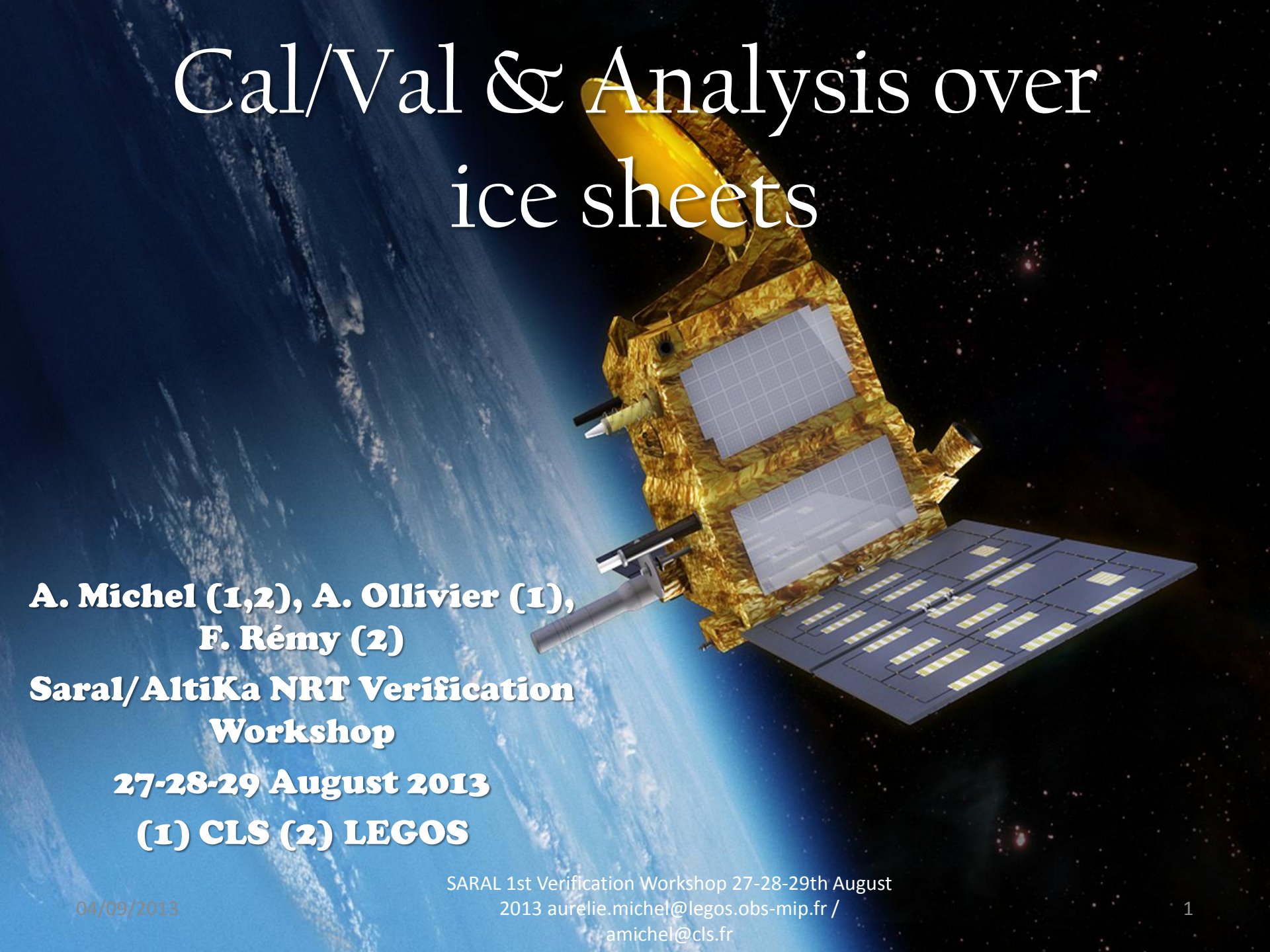


Cal/Val & Analysis over ice sheets

A satellite with a gold-colored body and a large yellow dish antenna is shown in space. The Earth's blue and white clouds are visible in the background, along with a starry space scene.

**A. Michel (1,2), A. Ollivier (1),
F. Rémy (2)**

**Saral/AltiKa NRT Verification
Workshop**

27-28-29 August 2013

(1) CLS (2) LEGOS

04/09/2013

SARAL 1st Verification Workshop 27-28-29th August
2013 aurelie.michel@legos.obs-mip.fr /
amichel@cls.fr

Plan

A satellite with a large yellow parabolic antenna and various instruments is shown in space. The Earth's surface is visible in the background, showing blue oceans and white clouds. The satellite is oriented towards the viewer, with its instruments and solar panels clearly visible.

- Introduction : Scientific objectives and scientific tools
- Global Cal/Val over ice sheets : some results
 - Editing
 - Missing Points
 - Temporal surveys
 - Statistics
 - Perspectives and intermediate conclusion
- Preliminary analysis over Antarctica from first SARAL/AltiKa cycles
 - Comparison with Ku-band Envisat
 - Comparison with Icesat
- General perspectives
- Conclusion

Scientific objectives

Cryosphere is a witness and a player in the world
climate

Estimate volume balance

Contribution to the sea-level rise

Snowpack properties

Get a dense data record = dense monitoring =
accurate analysis

Importance of a continuity in the observations :
altimetry

Scientific objectives : tools from altimetry

A satellite with a large yellow dish antenna and solar panels is shown in space, orbiting Earth. The Earth's surface is visible in shades of blue and white, with a black starry background.

Apprehend a new frequency (Ka-band) and understand the former one (Ku-band)

Adapt the Ice-2 retracking to Ka-band : (J-C. Poisson, D. Blumstein orals)

Ameliorate the waveform analysis : Interaction between the radar wave and the snowpack

Global Cal/Val over ice sheets

- Get efficient tools adapted from ocean altimetry to have a dense validated data set : accurate analysis and long-term monitoring

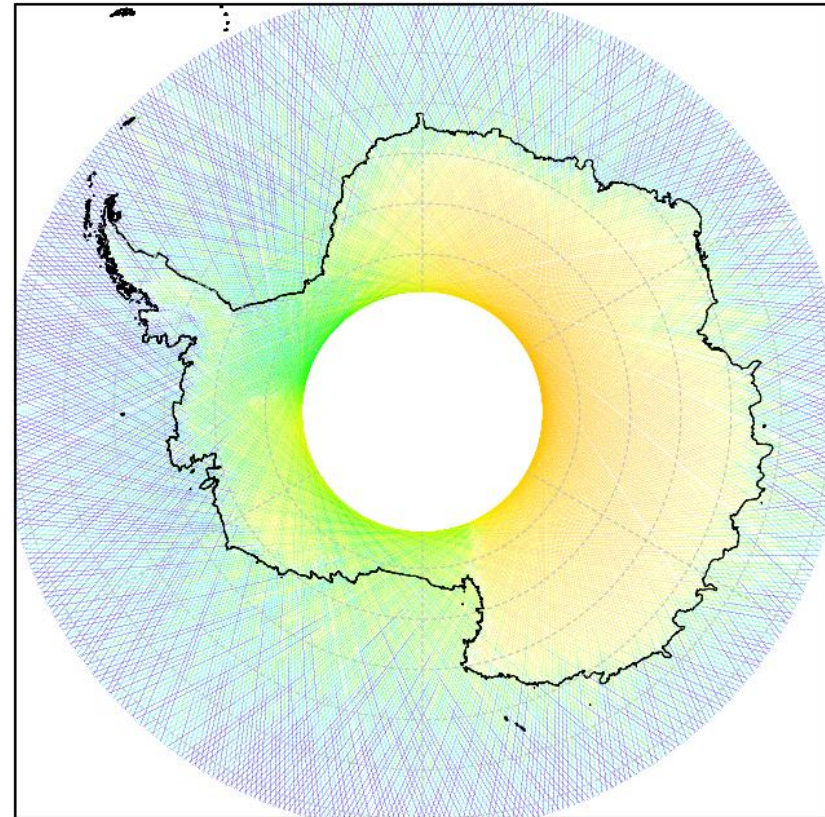
Chain developed (CLS) completed with LEGOS expertise :
Dense processing : for the waveform parameters (Height, Leading Edge, Backscatter, Trailing Edge)

- * Editing parameters (flags, thresholds...)
- * Corrections (Dry troposphere, Wet troposphere, Earth Tide, AGC ...)
- * Others (Tracking Mode, Ascending, Descending Passes...)
- * Maps, Histograms, Statistics : mean, variance, minimum, kurtosis ...

Editing

- We isolate specific areas
- Altimeter height is corrected (instrumental, atmospheric)
- We reject outliers
- We can analyse rejected points
- Ameliorate the validation process

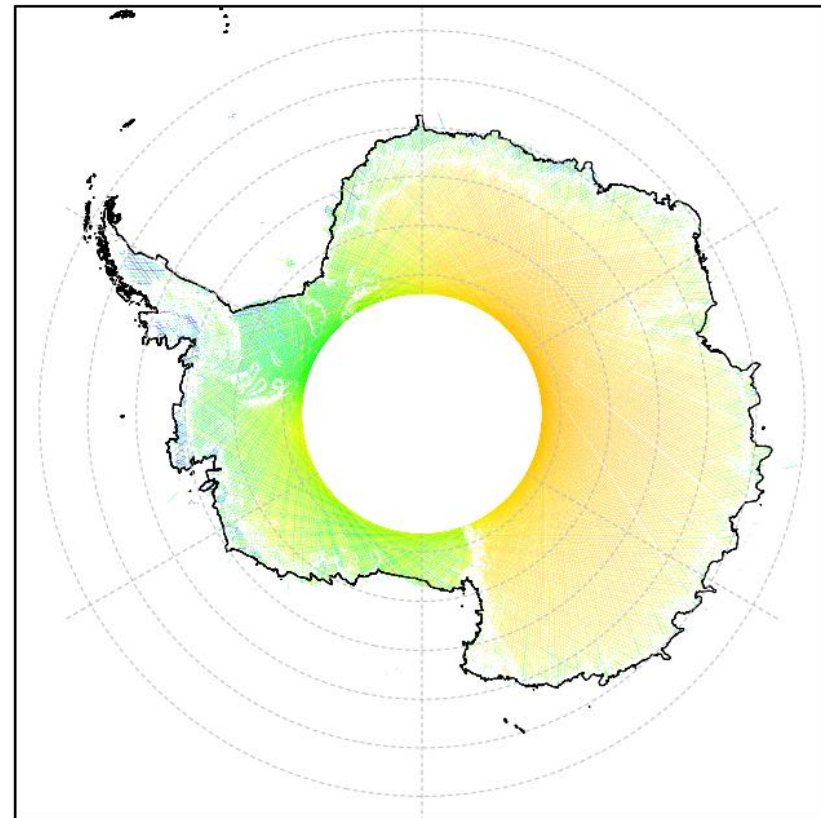
AltiKa Cycle 001 (14/03/2013 / 18/04/2013)



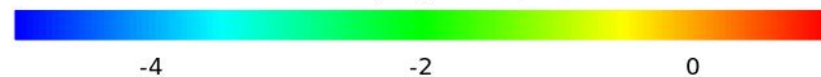
Editing

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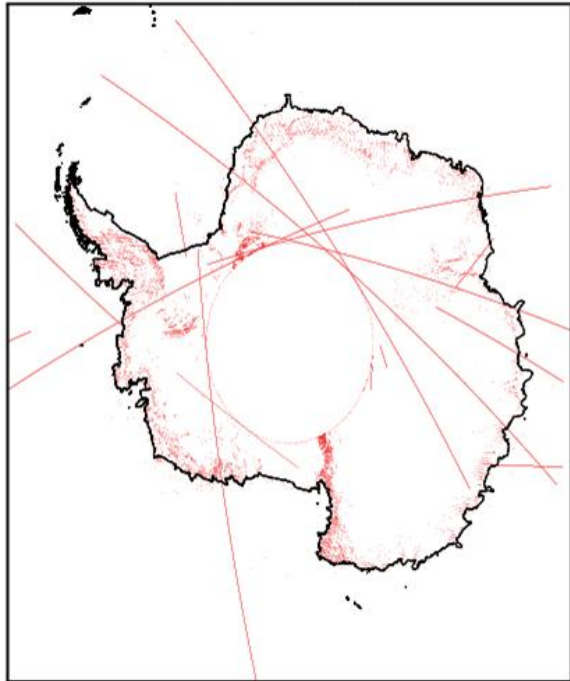
AltiKa Cycle 001 (14/03/2013 / 18/04/2013)



Wet Troposphere (cm)

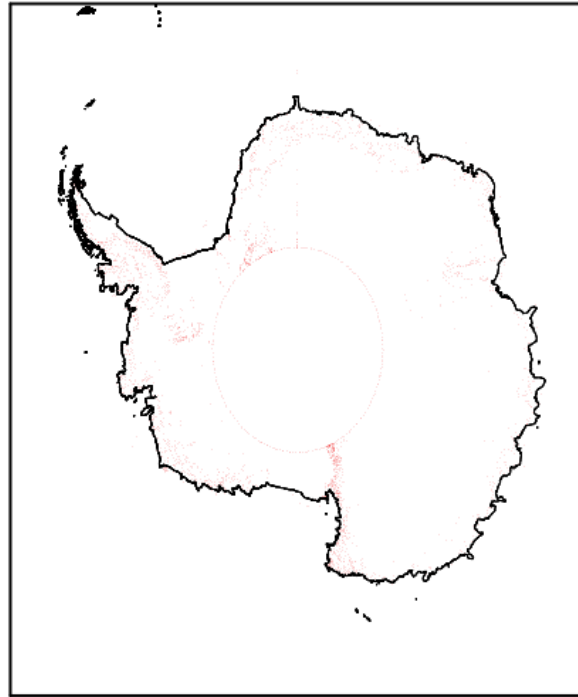


Missing points



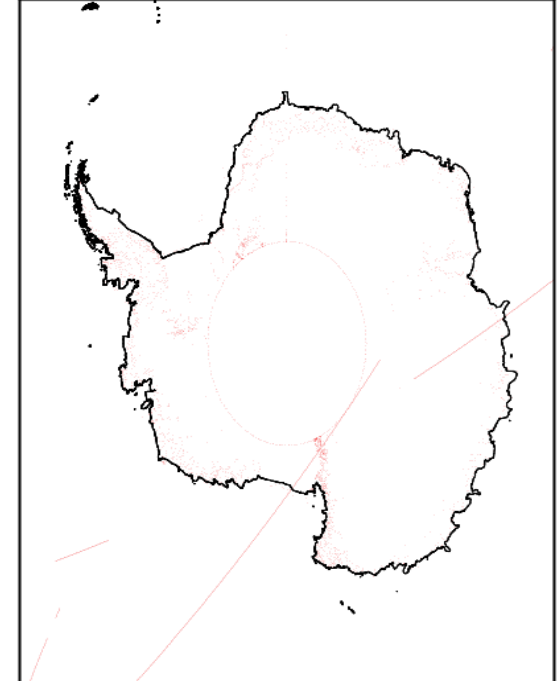
Missing Measurements

Cycle 1 (DEM mode)



Missing Measurements

Cycle 2

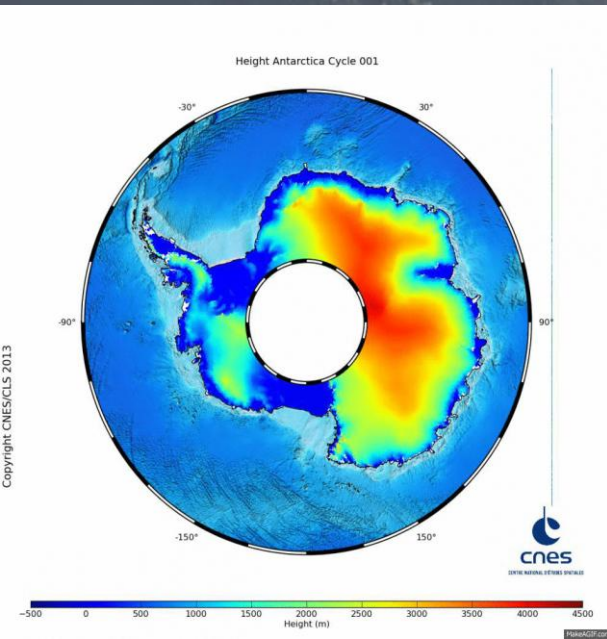


Missing Measurements

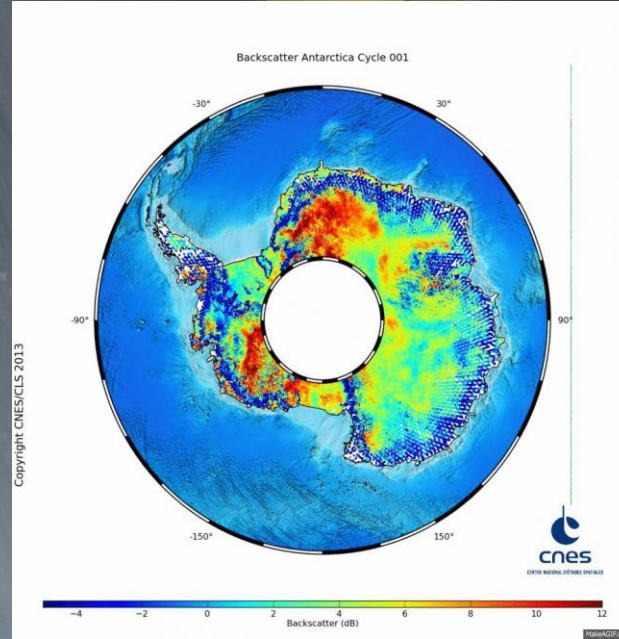
Cycle 3

→ Efficient coverage from SARAL/AltiKa

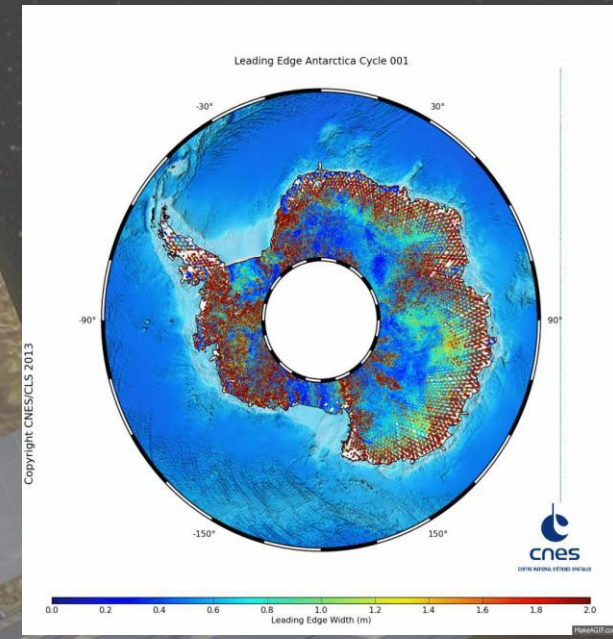
Temporal survey : Antarctica



Height



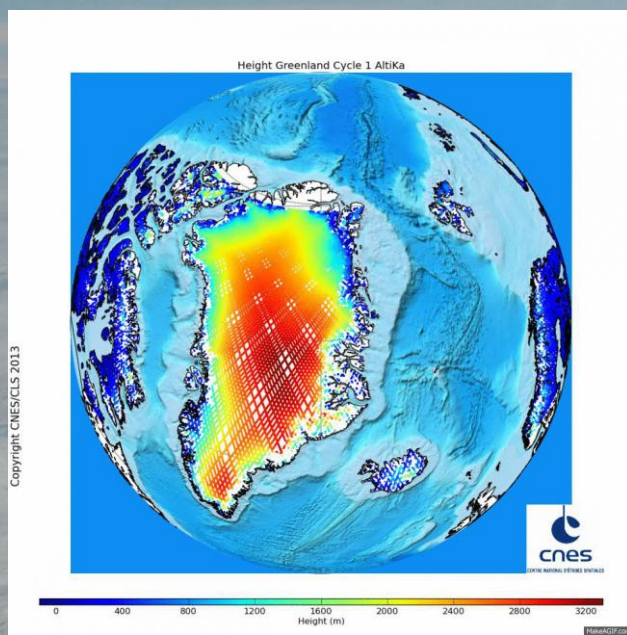
Backscatter



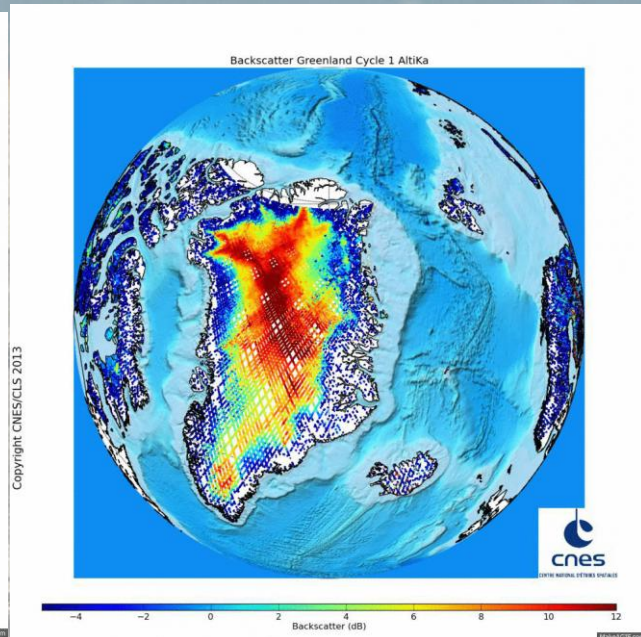
Leading Edge
Width

- Geographical, geophysical, instrumental analysis
- Maps for corrections as well

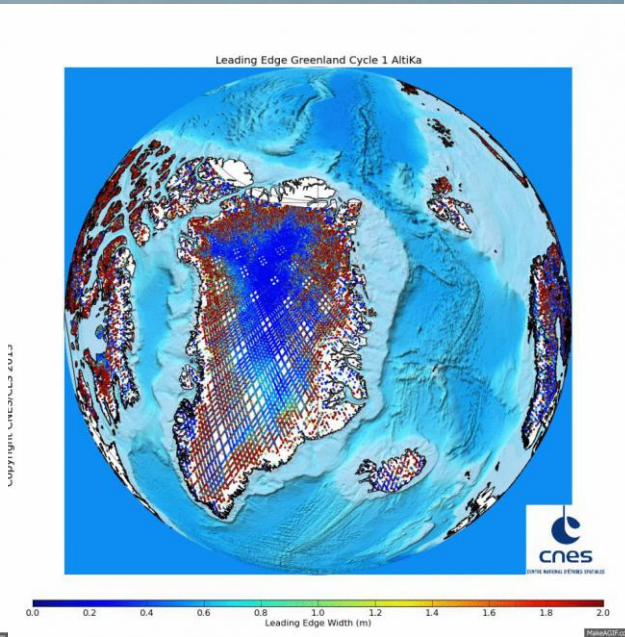
Temporal survey : Greenland



Height

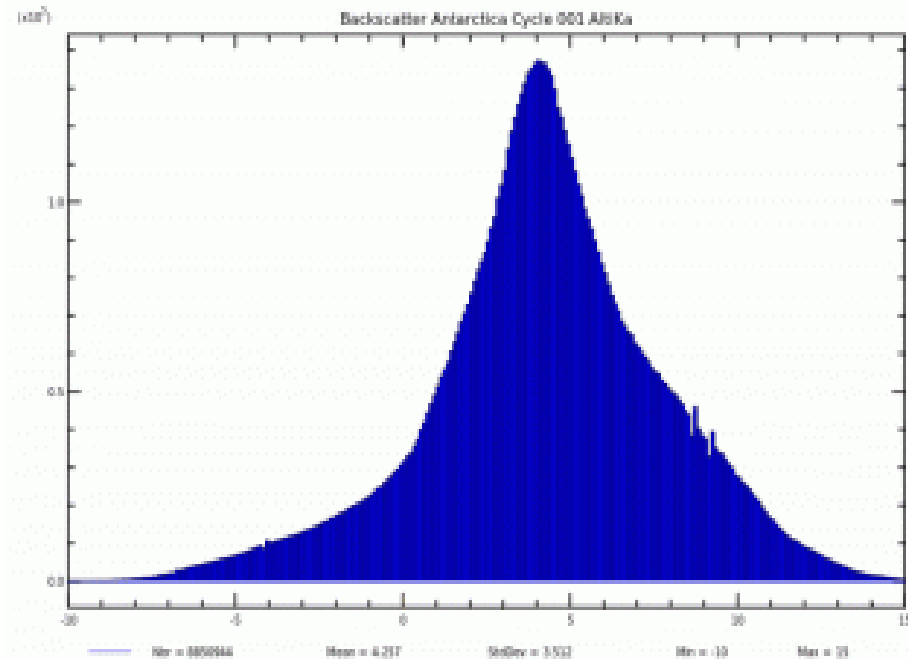
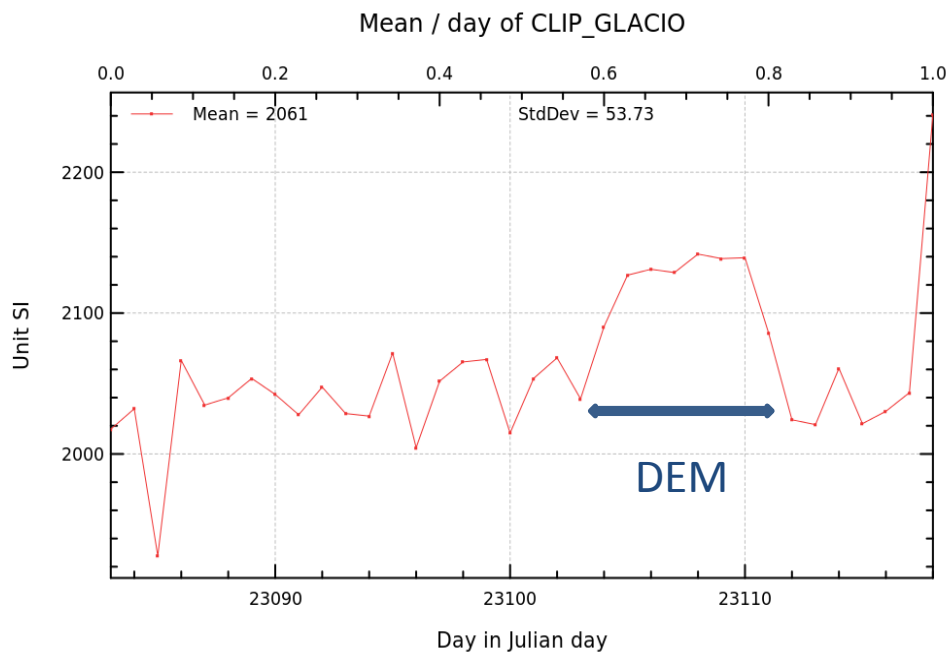


Backscatter



Leading Edge
Width

Statistics



Seasonal variability observable eventually or instrumental events noticeable (illustrated)

No large variability throughout the first 5 months : even for the leading edge width

- But also moments by cycles, by pass, differences between cycles...

Perspectives for the « Ice Cal/Val »

- Residuals with Envisat : → maneuver the 29th of July 2013 (2.5km before, 1.5 km nowadays)
- Crossovers (F.Remy presentation)
- Thanks to methods from ocean altimetry, we have an efficient monitoring

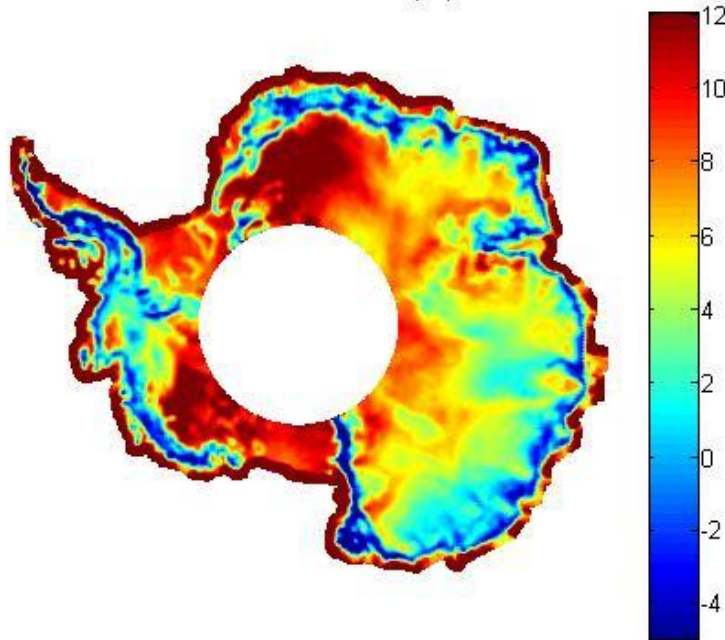
Analysis of first SARAL/AltiKa cycles

Envisat Icesat comparisons : focus on Antarctica

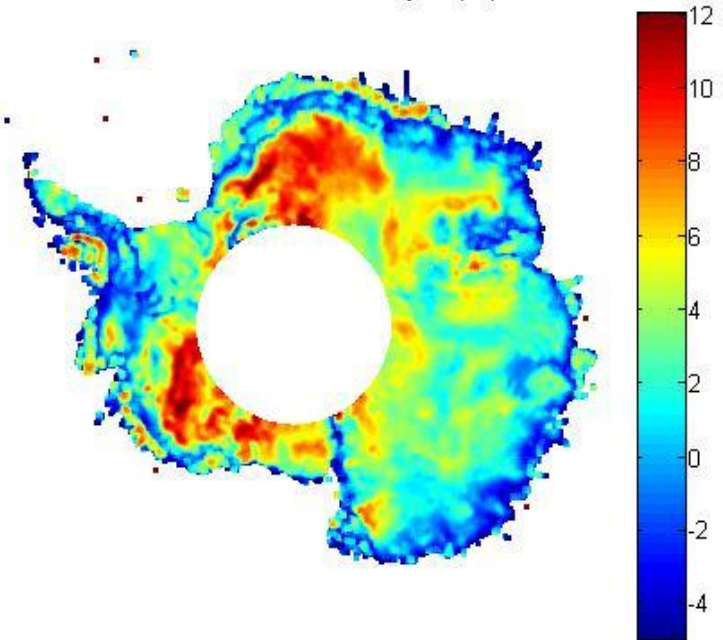


Comparison with Ku-band

Backscatter Mean Profile (dB)



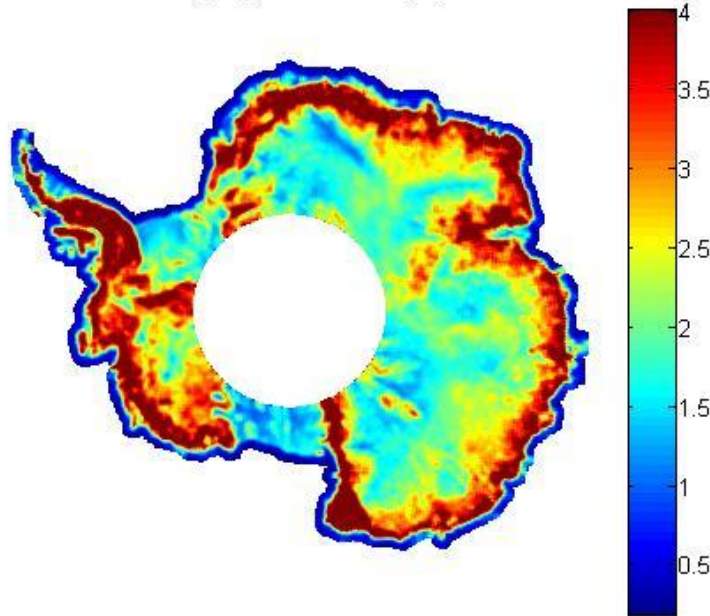
Backscatter for the Saral 2nd cycle (dB)



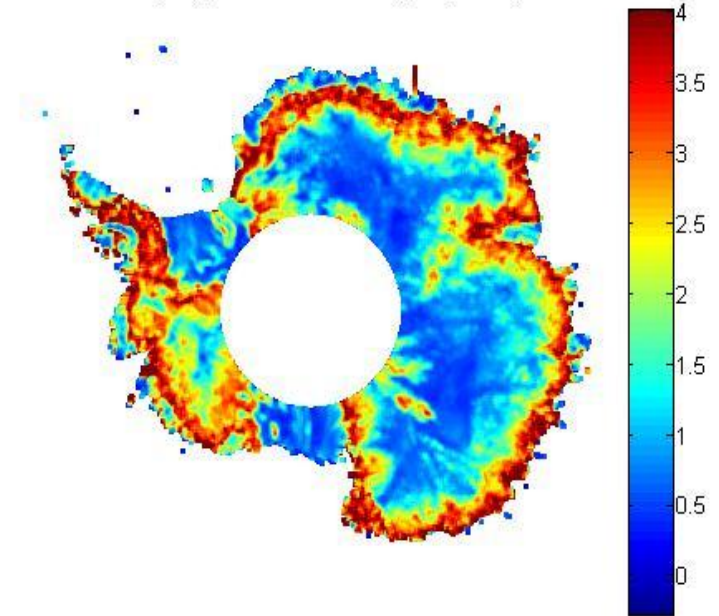
- Probably less subsurface echo ... but also a different surface echo...

Comparison with Ku-band

Leading Edge Mean Profile (m)

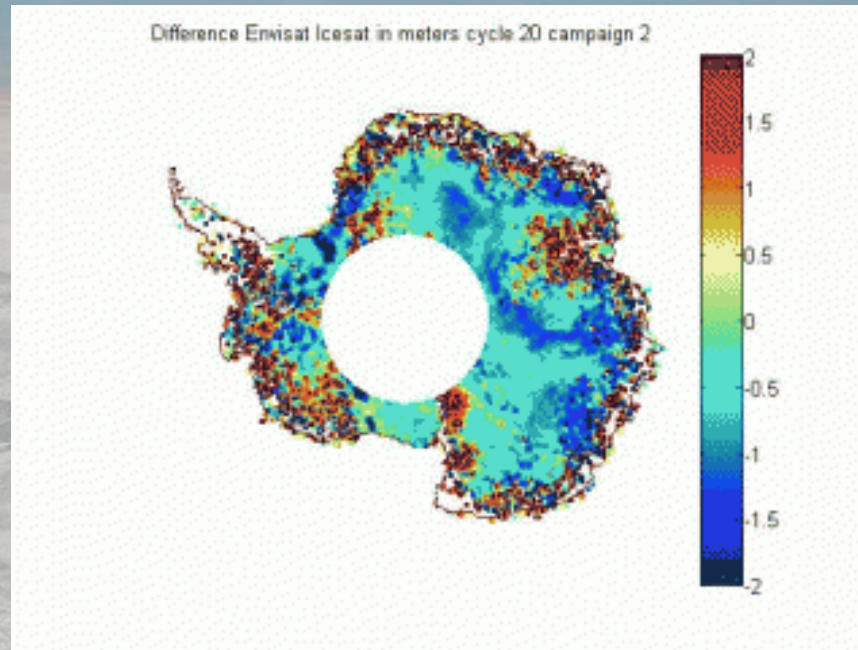


Leading Edge Width Saral 2nd cycle (meters)



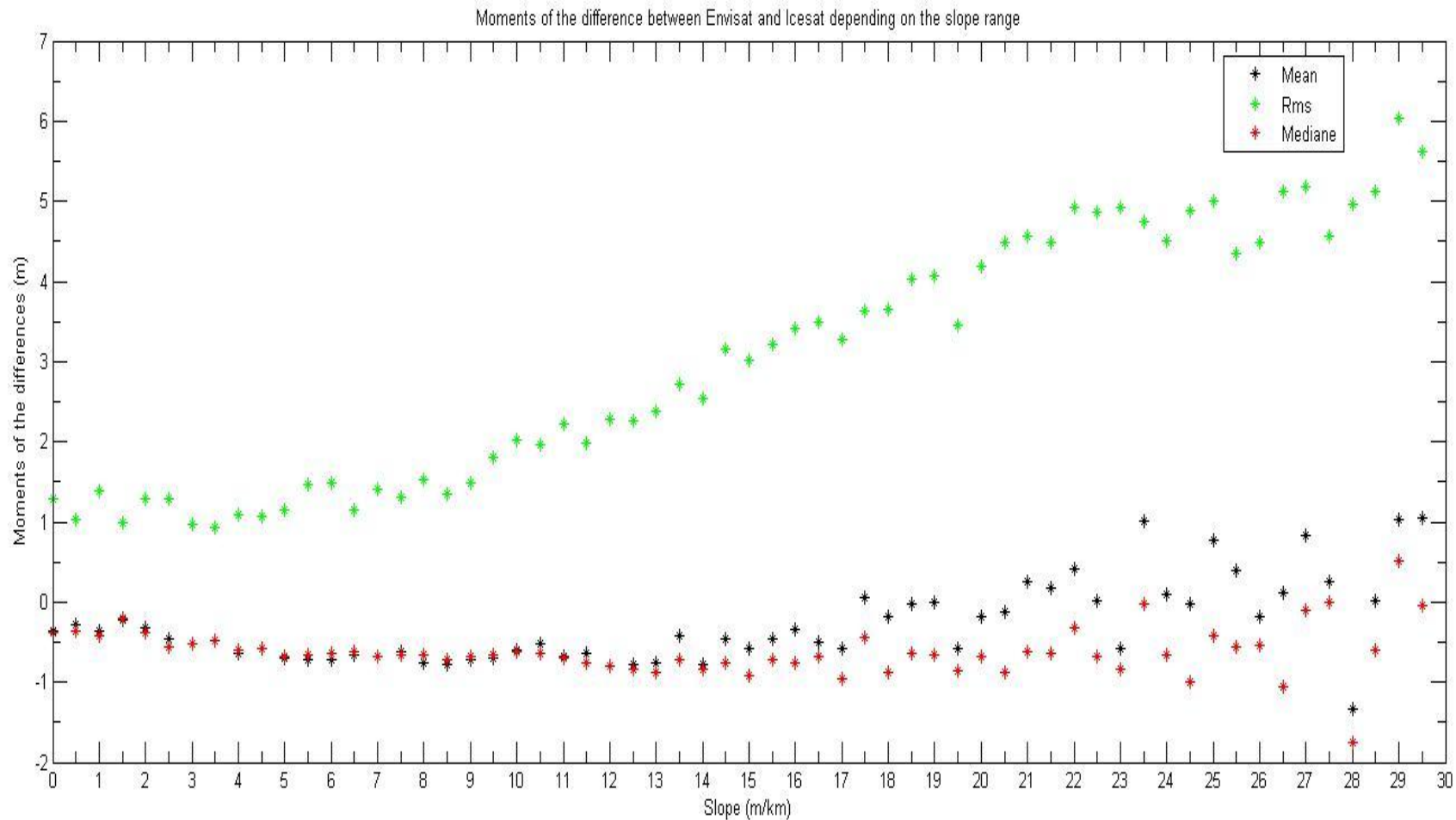
- About 1m lower → Less penetration effect

Envisat/Icesat difference evolution

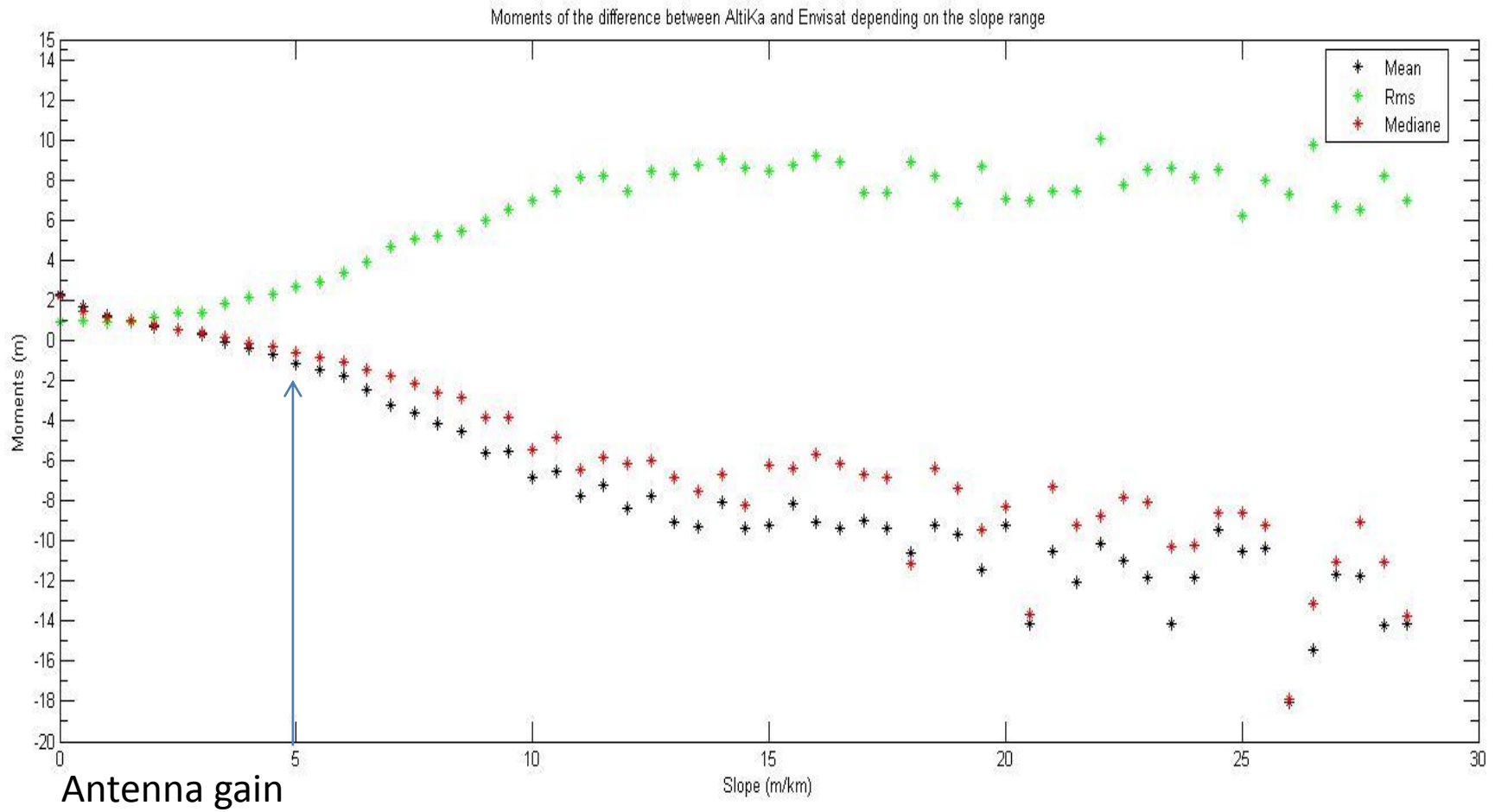


- → large variability = geophysical ongoing studies

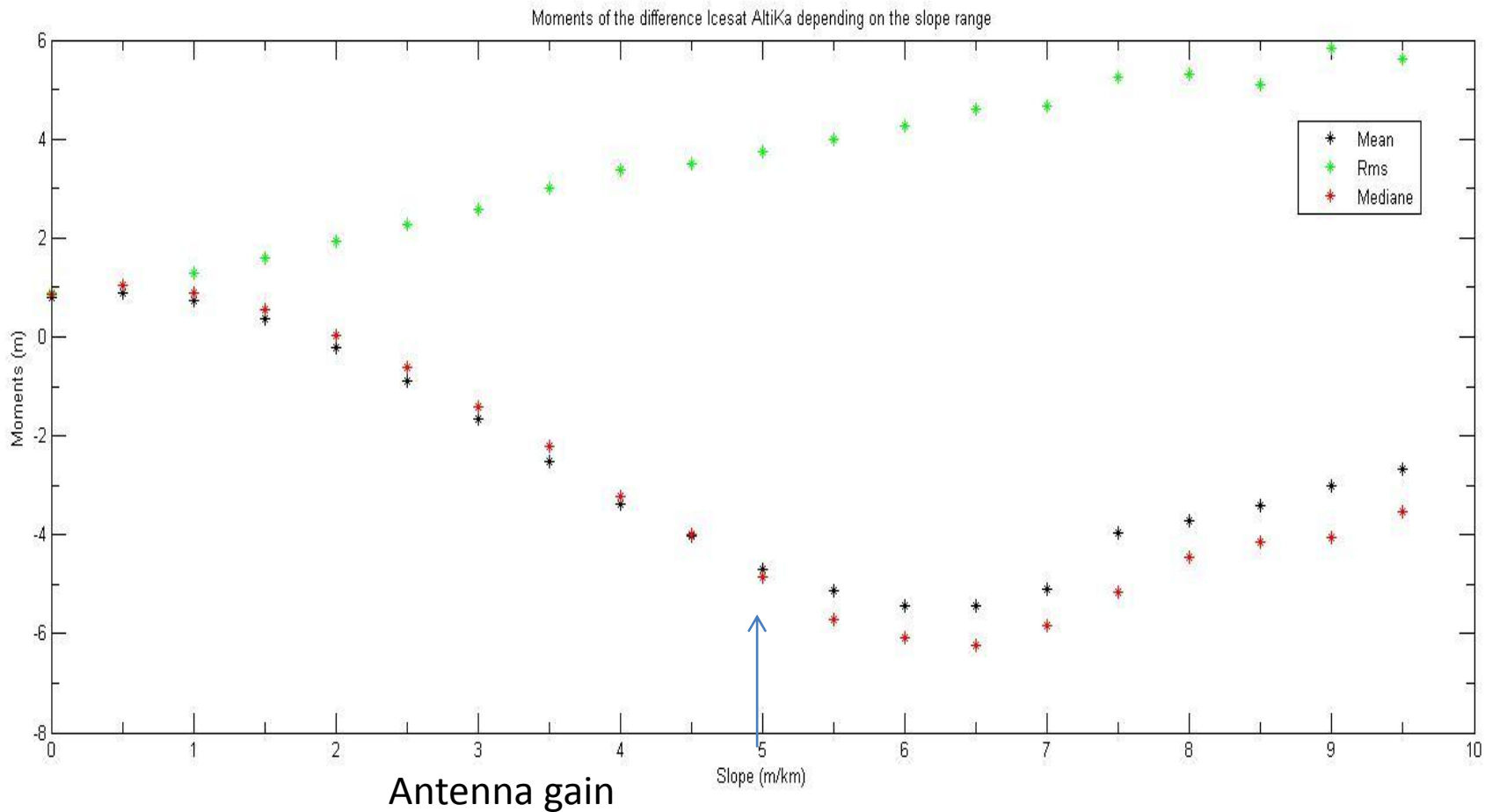
Envisat/Icesat



AltiKa / Envisat



Icesat / AltiKa



Premilinary analysis

- Coherence at the first order between scales :
 $H_{Env} < H_{Ice}$, $H_{Env} < H_{Ka}$, $H_{Ka} < H_{Ice}$
- Importance of the slope effect with the antenna aperture
- Study the difference AltiKa/Envisat temporally and link it with the waveform parameters (over Antarctica with Envisat/Icesat article in prep)


Global perspectives

A satellite is shown in space, with the Earth's surface visible in the background. The satellite has a large yellow dish antenna and several solar panels. The background is a dark space filled with stars.

- Develop the finer scale resolution
- Monitor the SARAL/AltiKa data as long as it is provided
- Comparison with other missions (Cryosat)
- Other surfaces (sea ice, river ice?)

Conclusion

- Optimized tool for altimetry analysis and algorithms enhancement (PEACHI project)
- Optimized for ice sheets studies
- The ongoing analysis done with AltiKa will allow us to understand Ku-band as well



Thanks for your attention

Questions ?