Data Base & Early Results

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(1) CLS (2) LEGOS

PLAN

- Context & importance of a CalVal tool on ice sheets
  - Context
  - Differences Ocean/Land ice : need for a specific chain
- Aims of a dedicated validation chain
  - Presentation of the chain/diagnosis
  - Editing step
- Results & Preliminary Analysis
  - Comparison with Envisat : focus on Antarctica
  - Greenland
- Conclusion, Perspectives, Discussion

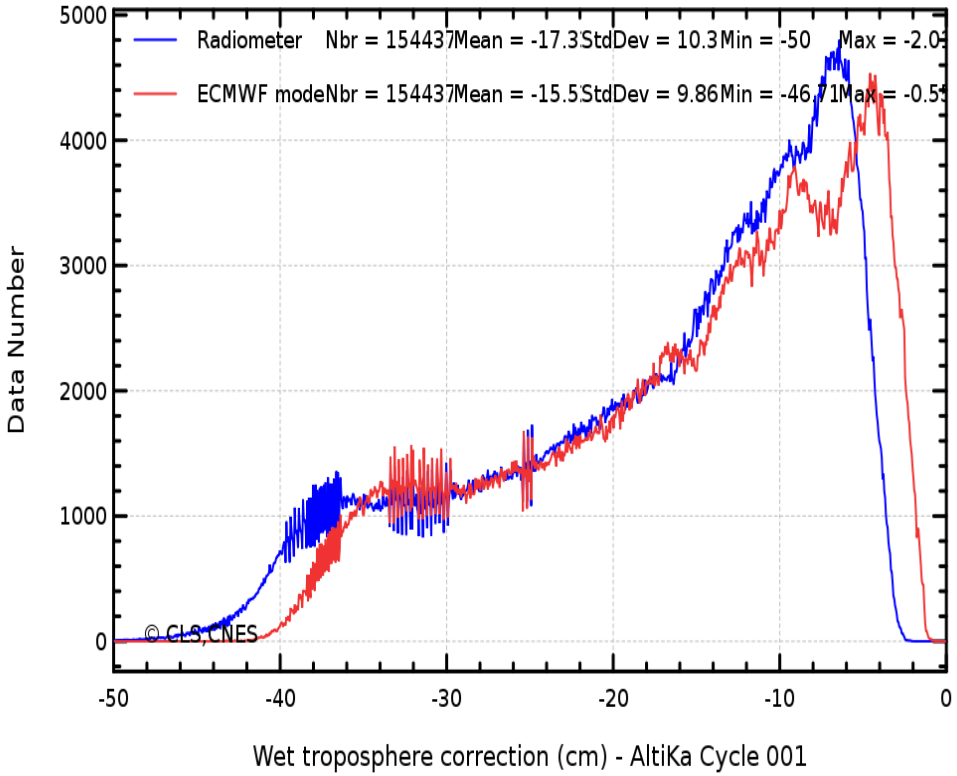
I/ Context

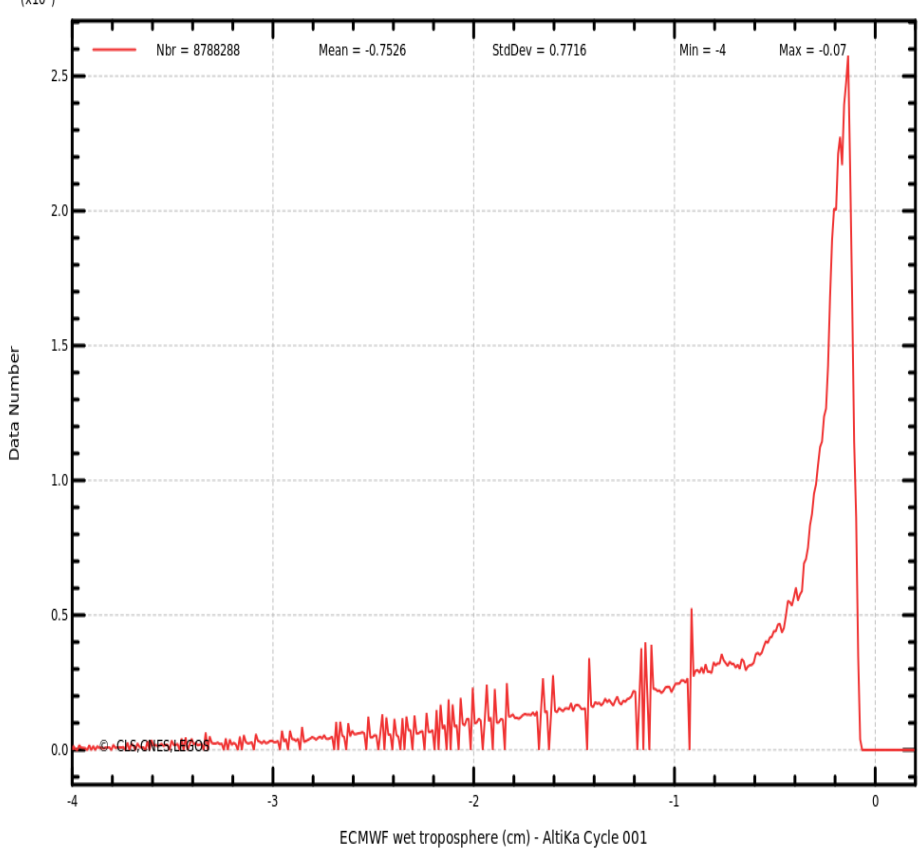
- Importance of a continuous altimetric survey over ice sheets, (Rémy & al, 2013)
- SARAL/AltiKa : innovative caracteristics, a need to process as the data is provided
- Peachi (project Prototype for Expertise on Altimetry near Coast Hydro and Ice) including a 40Hz data base (Interim Geophysical Data Record)
- Efficient performance assesment tools on other altimetric missions over ocean (CLS)
- Expertise over land ice (LEGOS)

I/ Differences Ocean/Land ice

- Waveform parameters over land ice : completely different geophysical meaning:
  - Leading Edge Width / Sea Wave Height
  - Trailing Edge Slope
  - Backscatter
  - Topography / Sea Surface Height, Sea Level Anomaly
- Not the same ranges for corrections as over ocean
- 10 times larger signal in space and time, 10 times less precise, not the same objectives, not the same error budget

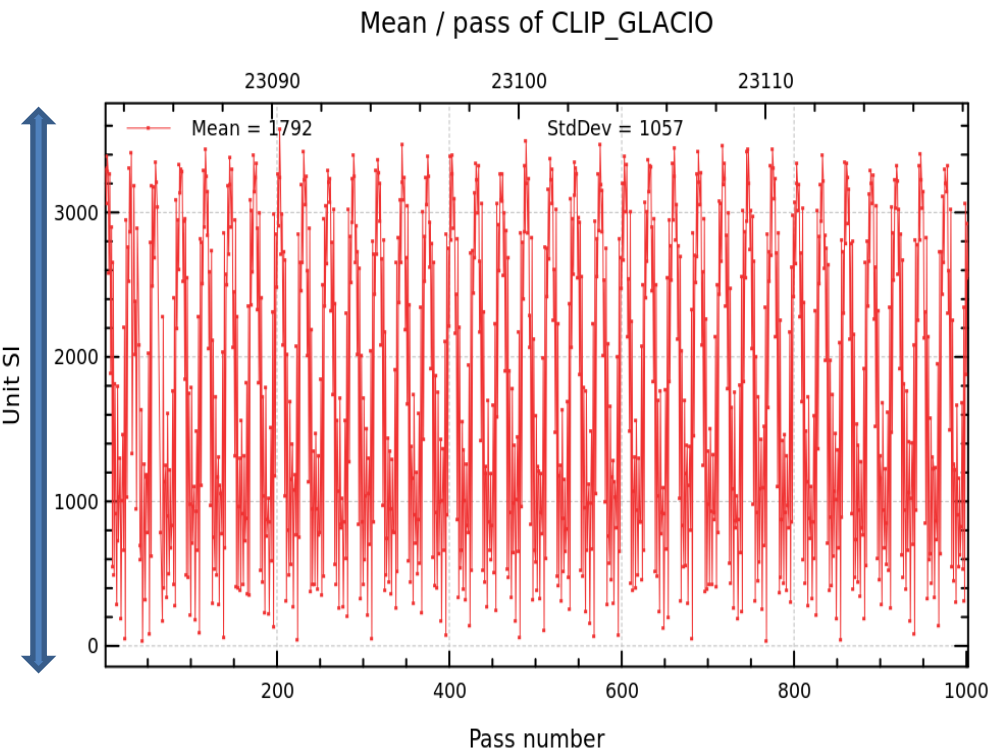
➔Need to get developed a specific validation chain over land ice

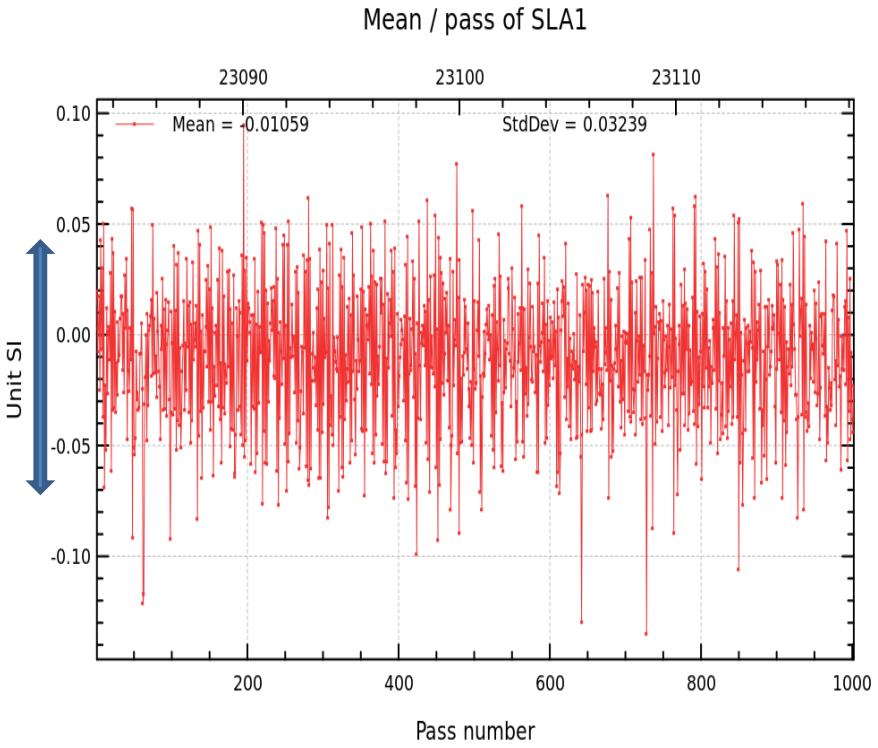




Wet troposphere

- Large variability over ocean as assessed by the left-hand histogram : 50cm
- Very low values over land ice (right histogram, 4cm)





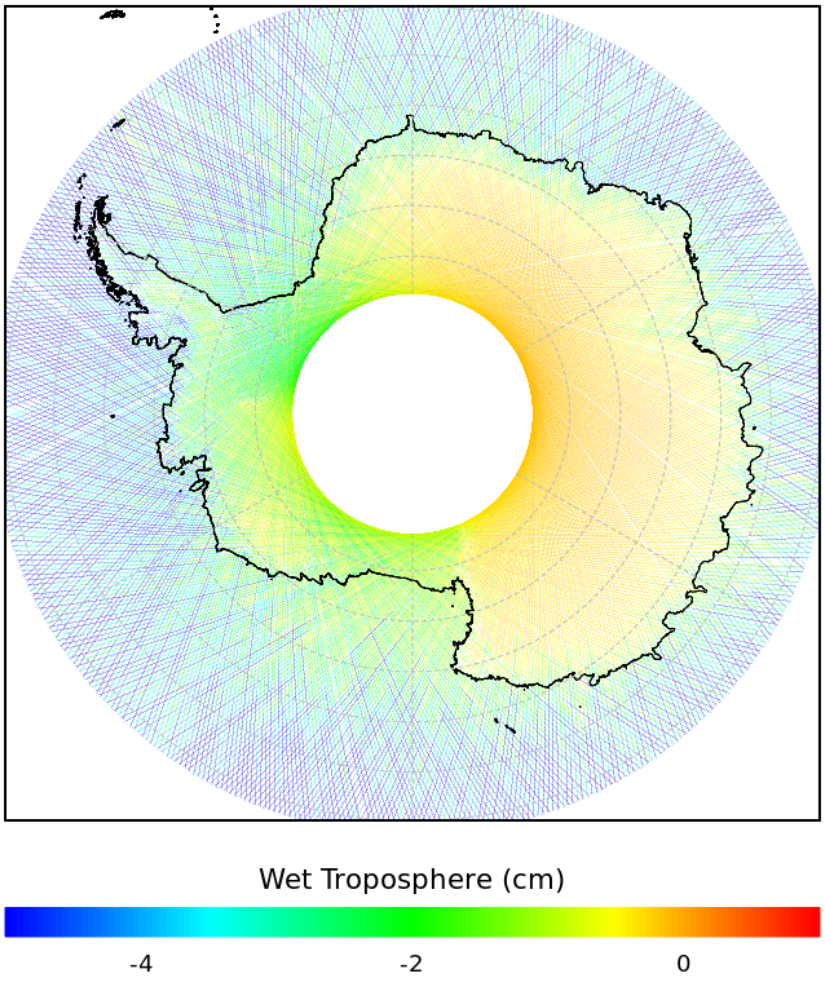
- CLIP_GLACIO = Height :thousands of km
- SLA = Sea Level Anomaly : a couple of centimeters
- Not the same geophysical meaning nor processing nor analysis

II/ Presentation of the chain/diagnosis

- Efficient calibration/validation/analysis tool with a physical coherence, on waveform parameters & applicated corrections
  - Performance assessment of a mission over ice sheets
  - Reference for evolutions (due to innovative Ka-band characteristics)
  - Editing, maps, histograms, statistical monitoring, continuous observations by pass, day, cycle
  - Analysis on the interaction between snowpack and radar wave thanks to the results

II/ Tuning of Editing

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



- At first, based on a test : if latitude < -6o° and corrected retrieved height > geoide + 10m

II/ Tuning of Editing

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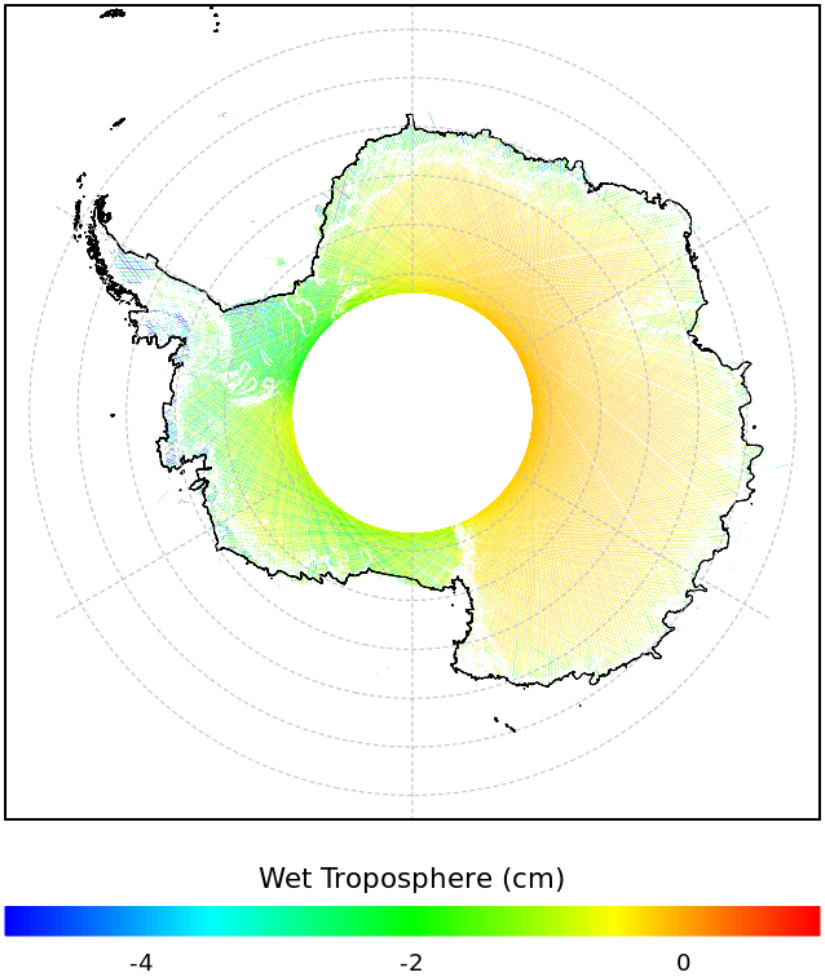

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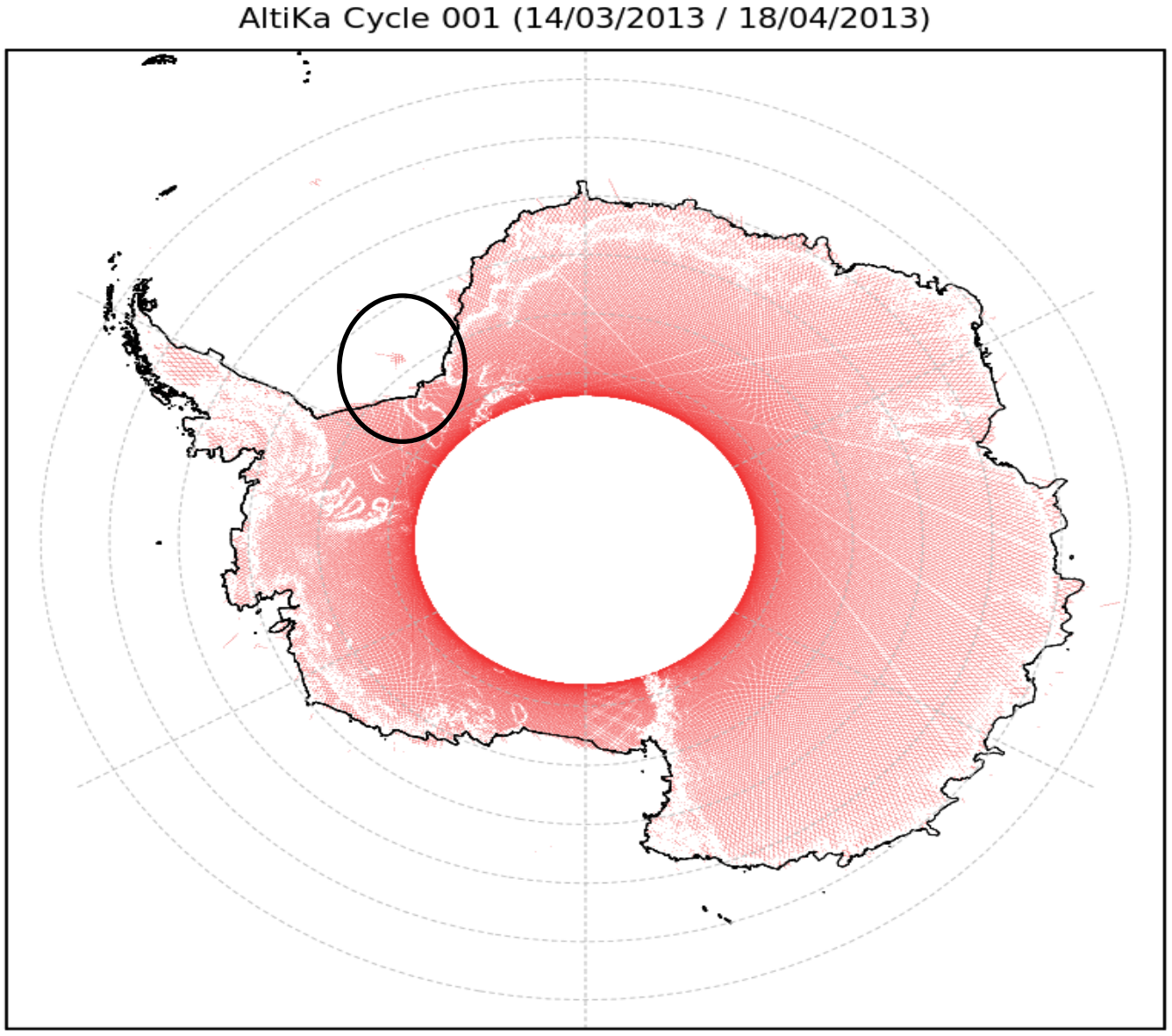
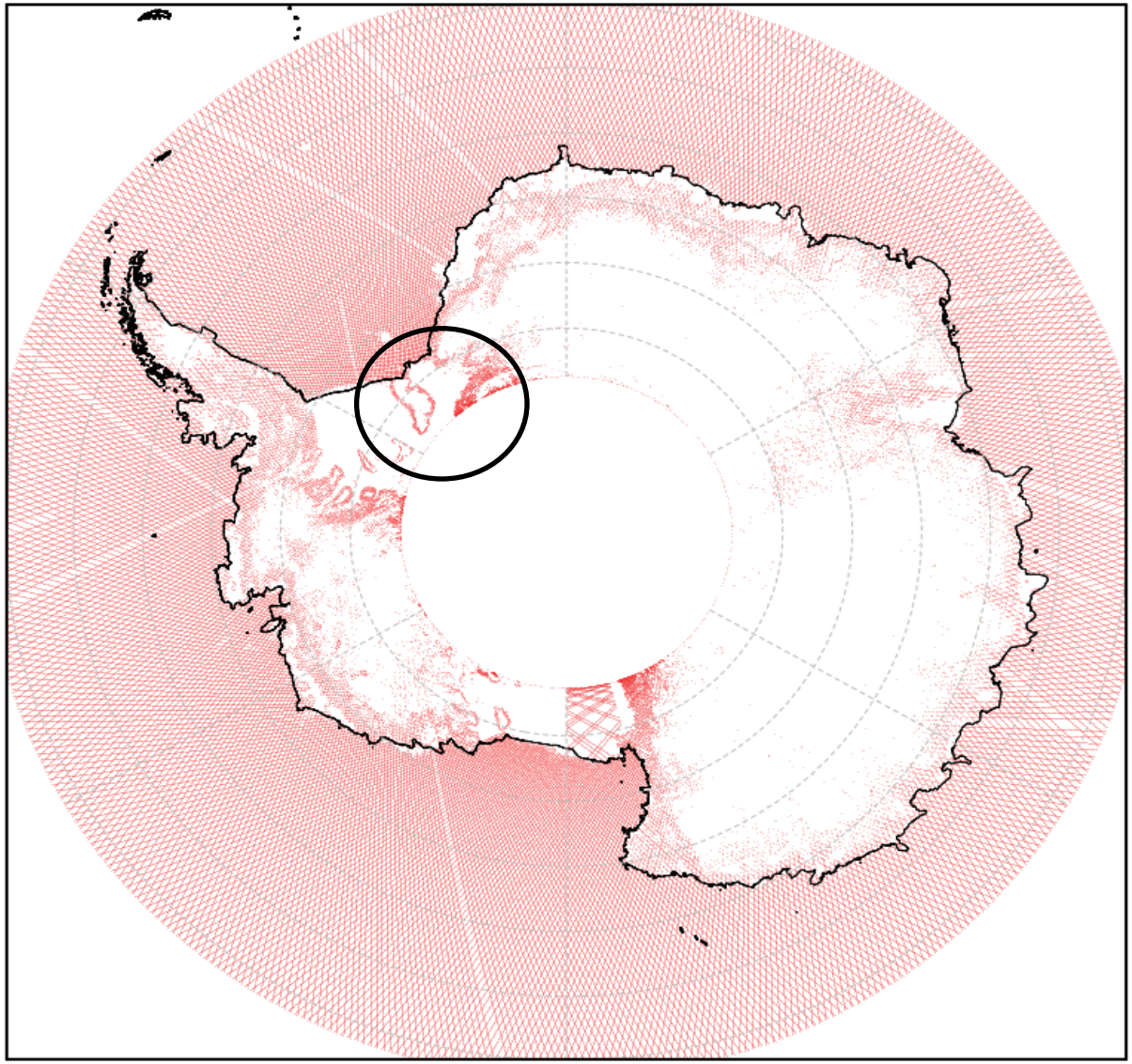
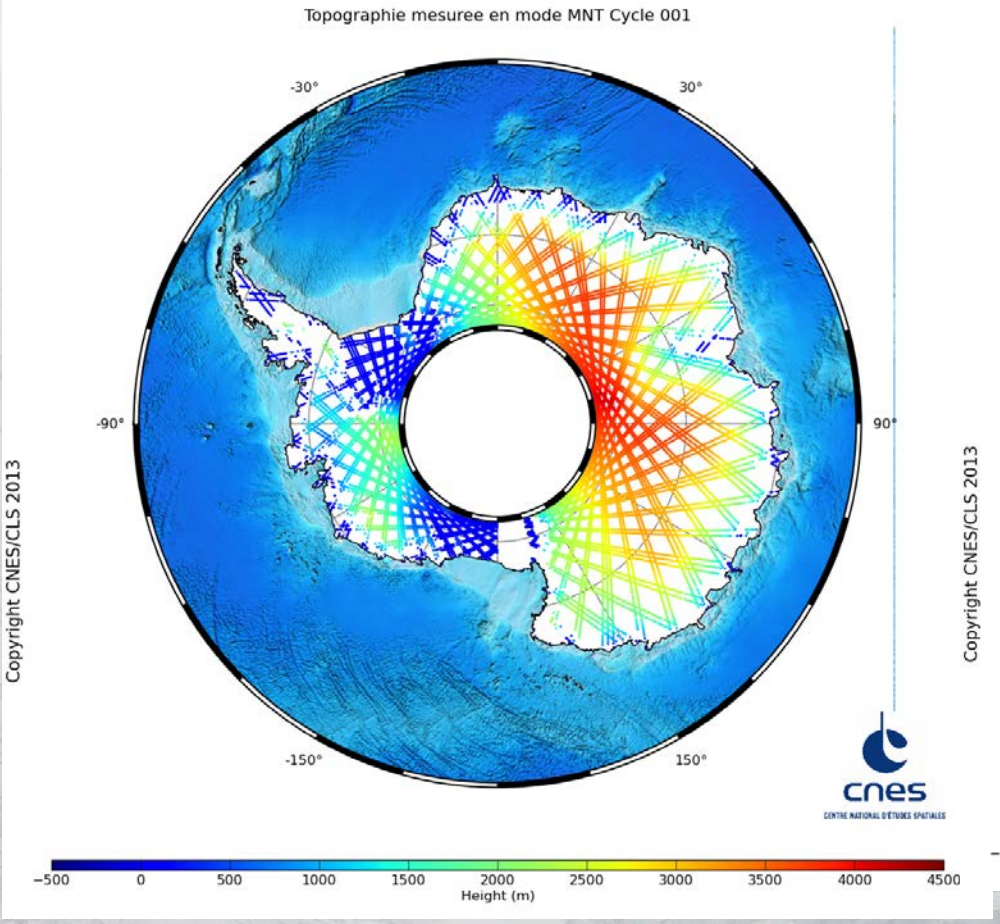
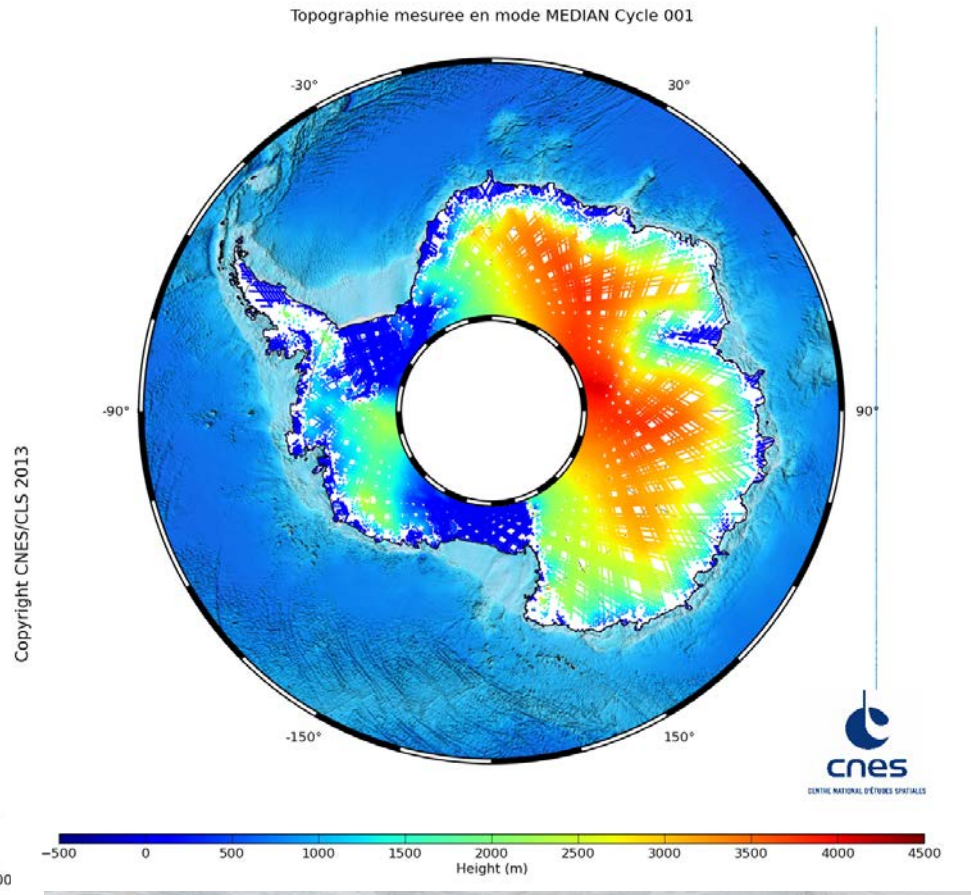

AltiKa Cycle 001 (14/03/2013 / 18/04/2013)
Valid Measurements

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



Non-valid measurements: edited or missing





To ameliorate our analysis :

- need to find a more accurate flag of validation : mask
- locate missing measurements ?
- Separate effects from the different tracking modes (for instance problem with the MNT mode Cycle 1)

III/ Results

- Dense results processing and monitoring : about 50 parameters

  * For the waveform parameters (Height, Leading Edge, Backscatter, Trailing Edge)

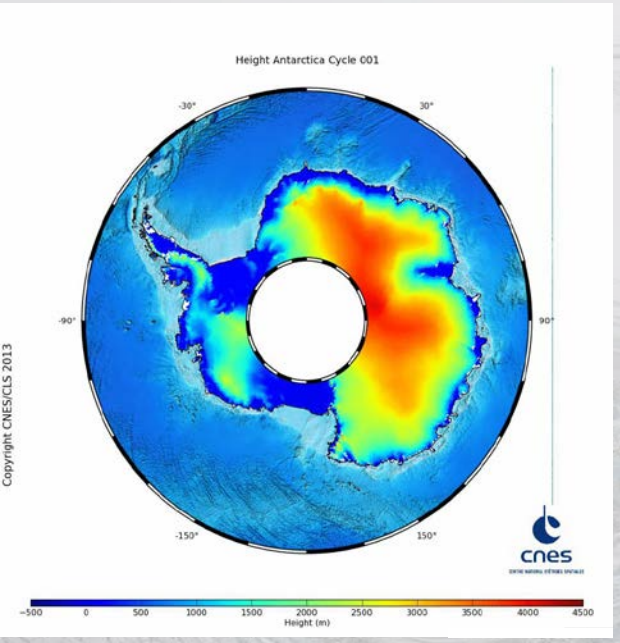
  * Editing parameters (flags, thresholds…)

  * Corrections (Dry troposphere, Wet troposphere, Earth Tide, AGC …)

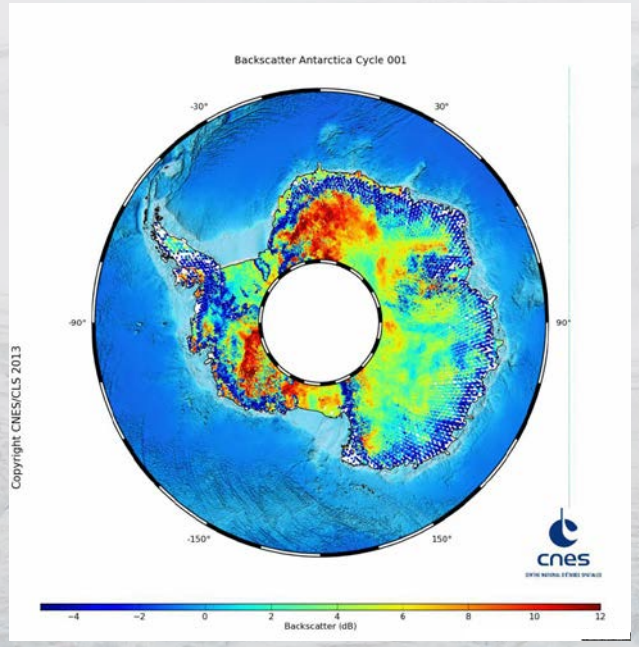
  * Others (Tracking Mode, Ascending, Descending Passes…)

  * Maps, Histograms, Statistics : mean, variance, minimum, kurtosis …

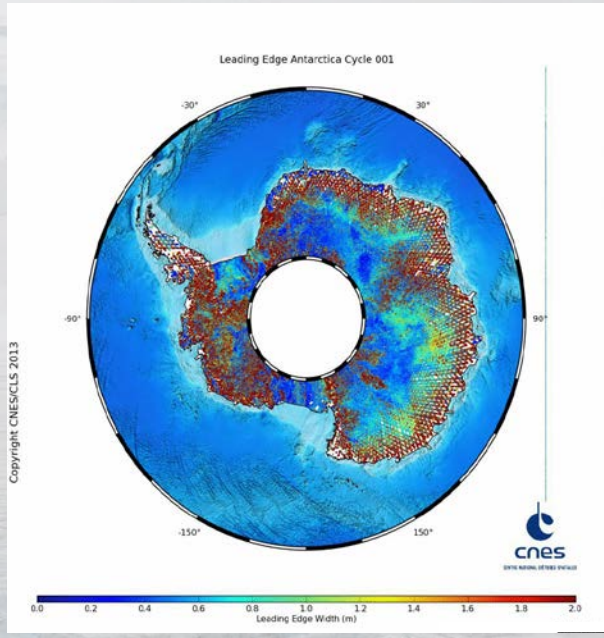
III/1/ Results over Antarctica



Height



Backscatter

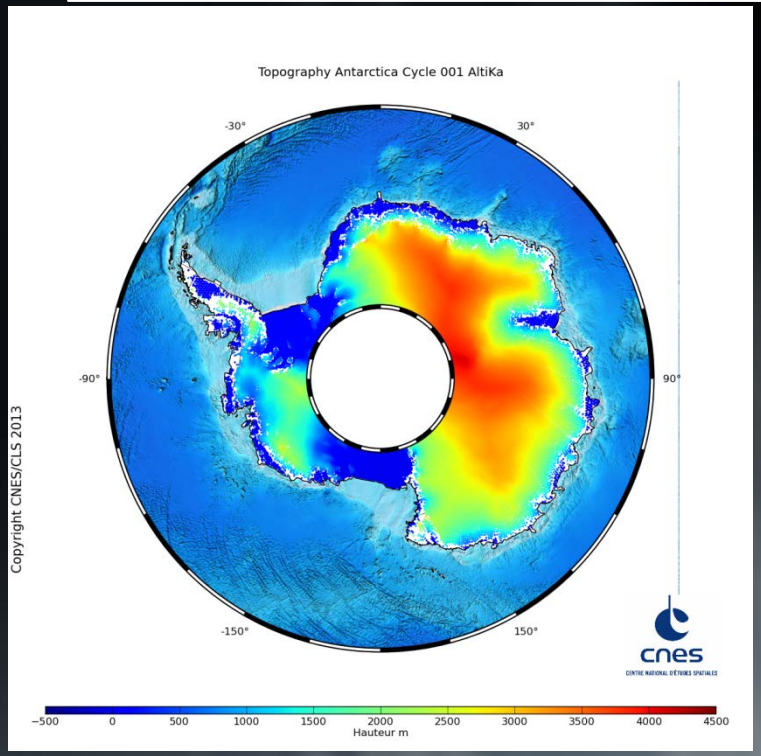


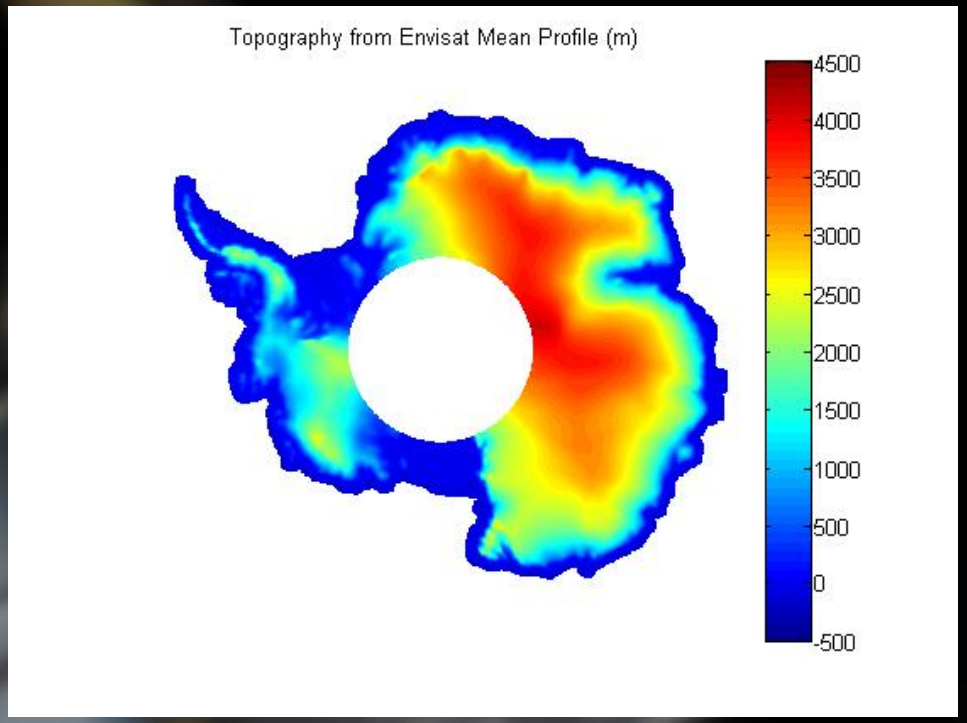
Leading Edge

First 3 SARAL cycles

Temporal survey has finally begun !

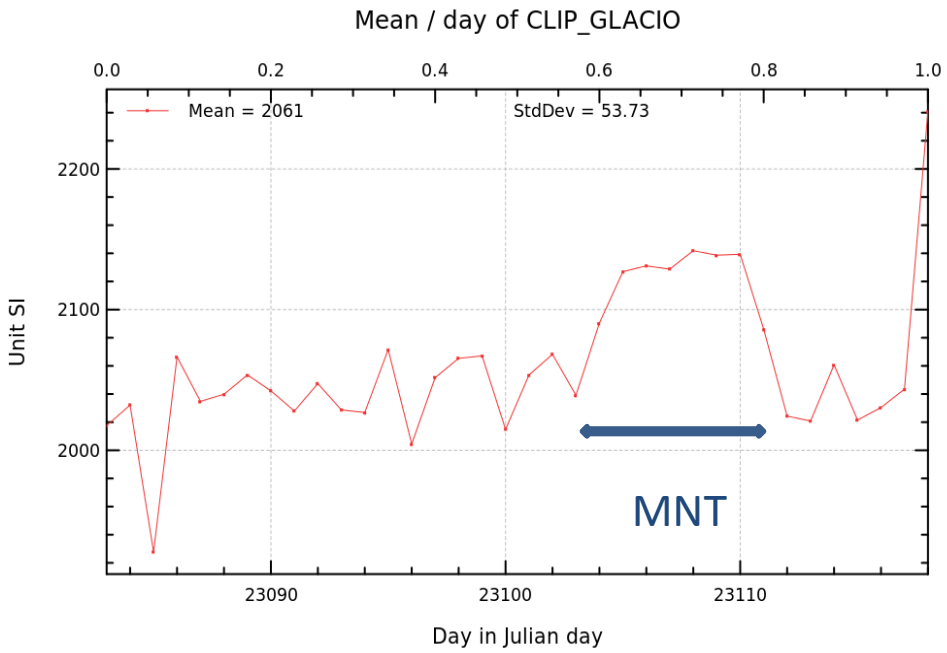
III/1/a/ Height

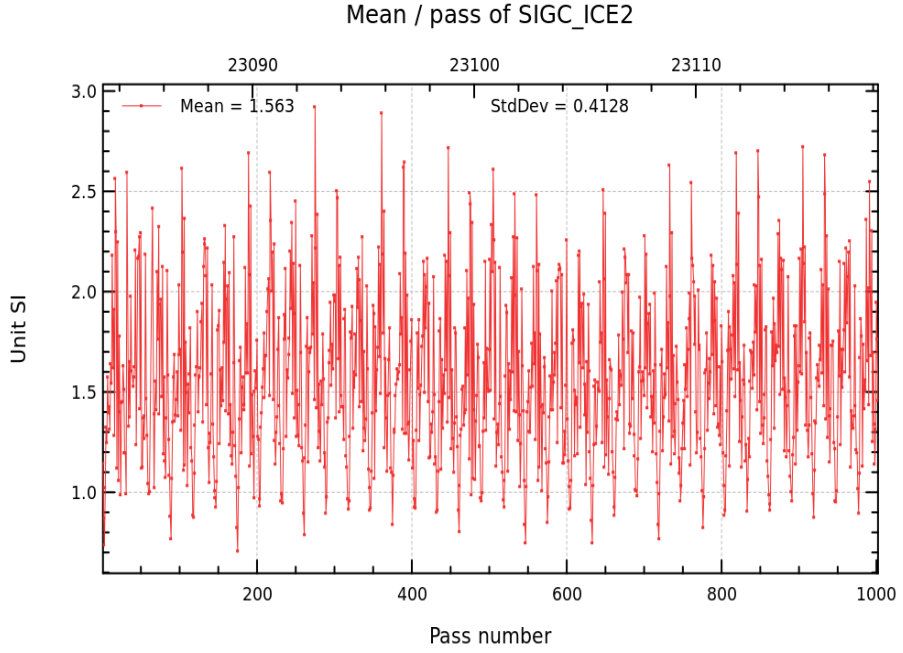




- Coherence with Envisat at large scale : finer analysis possible with the residuals from the mean track

III/ 1/b/Temporal surveys

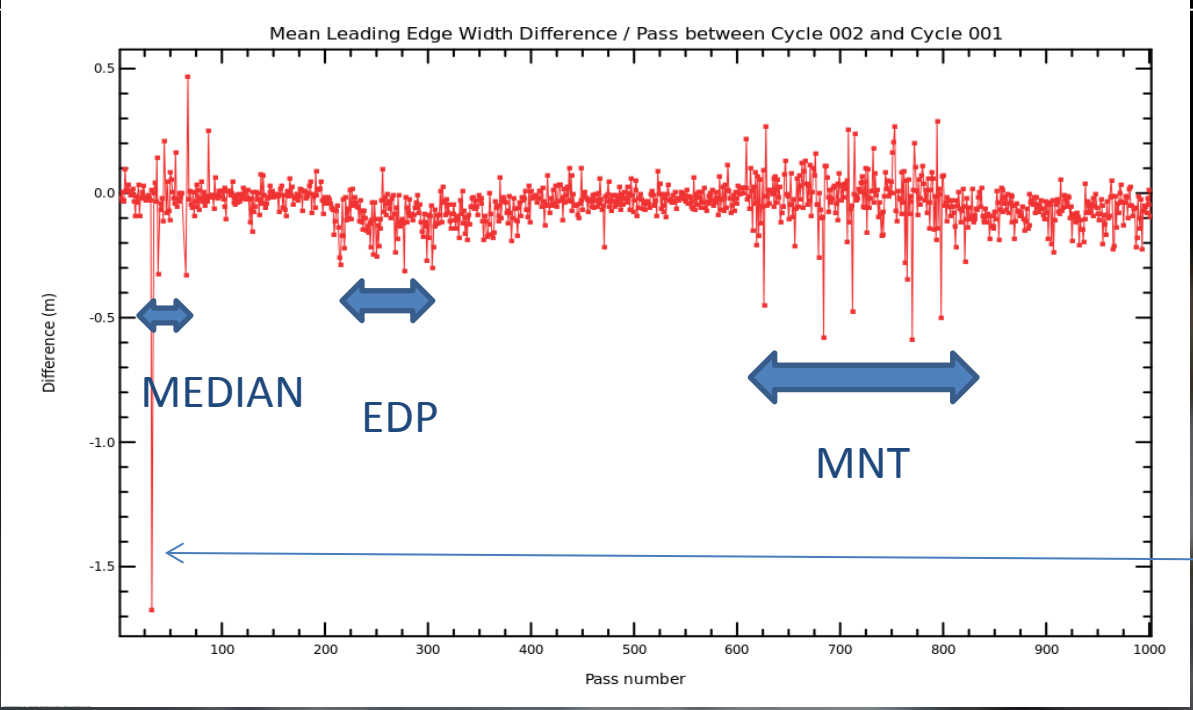




Seasonal variability observable eventually or instrumental events noticeable (illustrated)

Temporal survey at different scales and with different statistics : differences between cycles?

III/1/b/Differences between cycles

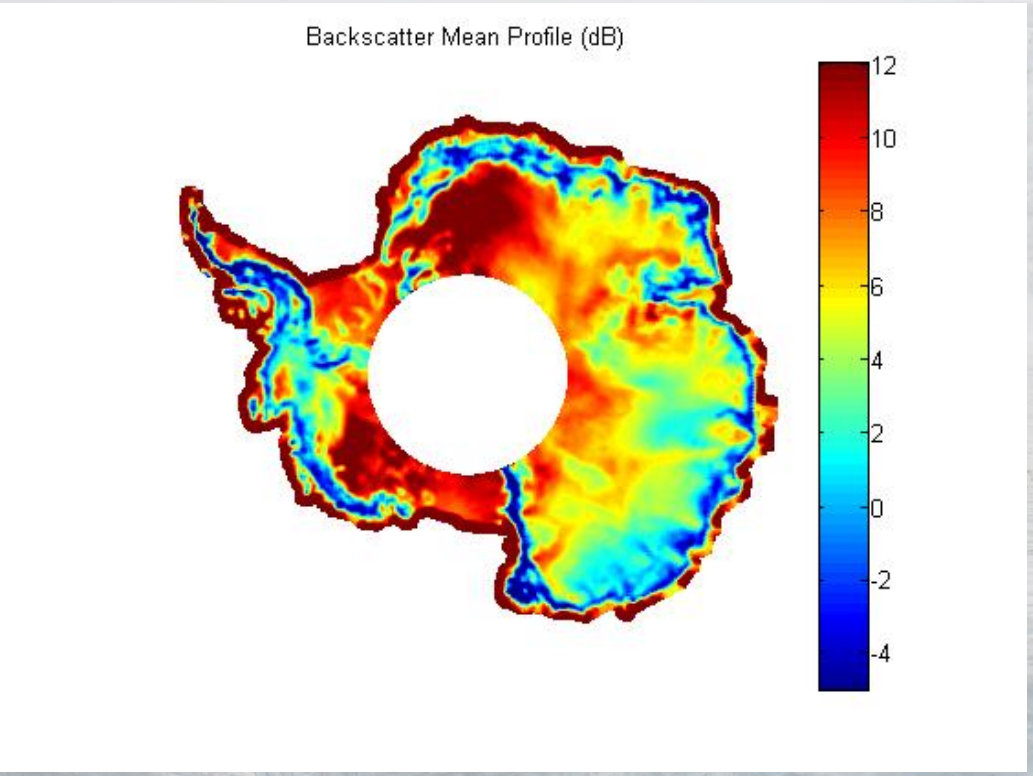


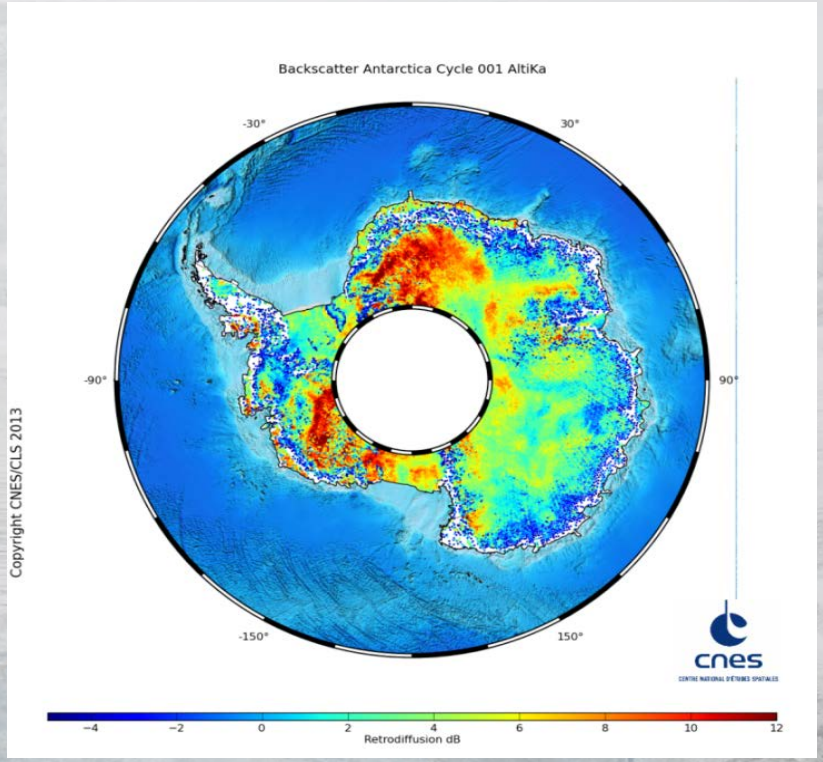
Whole Cycle 2 in Median Tracking mode

Thanks to the ICE Calval tool, we may detect instrumental events or bugs

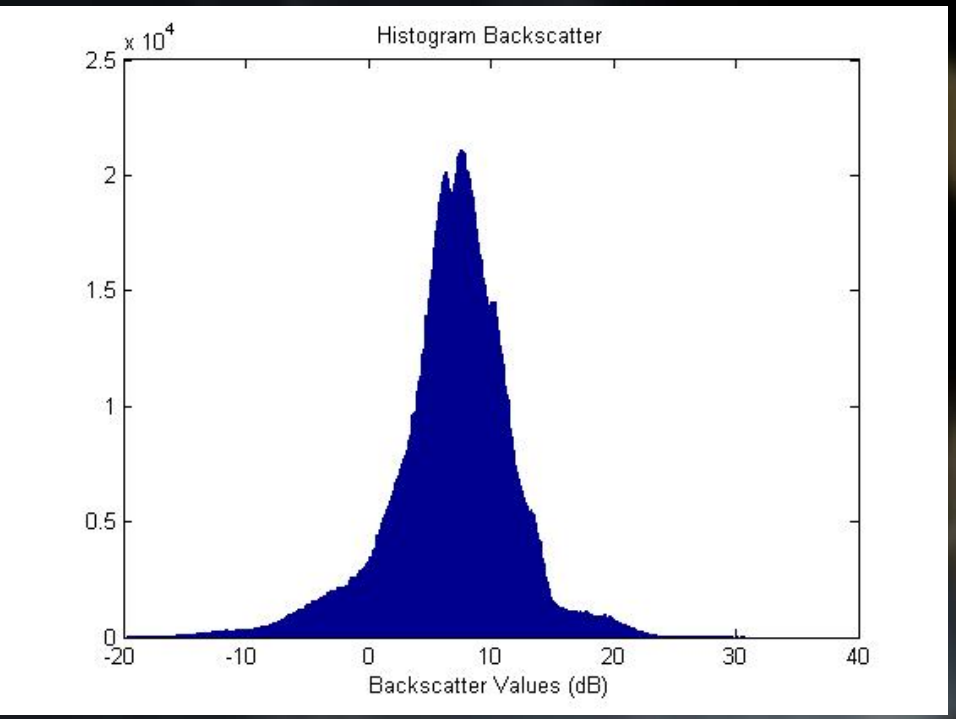
Essential step before any physical interpretation

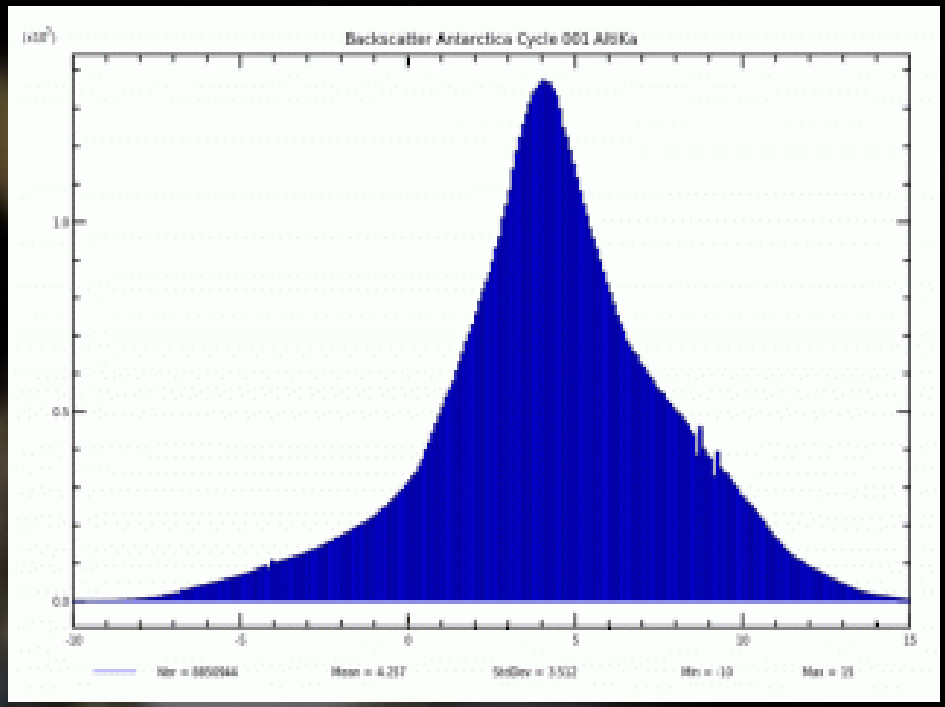
III/1/c/Comparison with Envisat : Backscatter





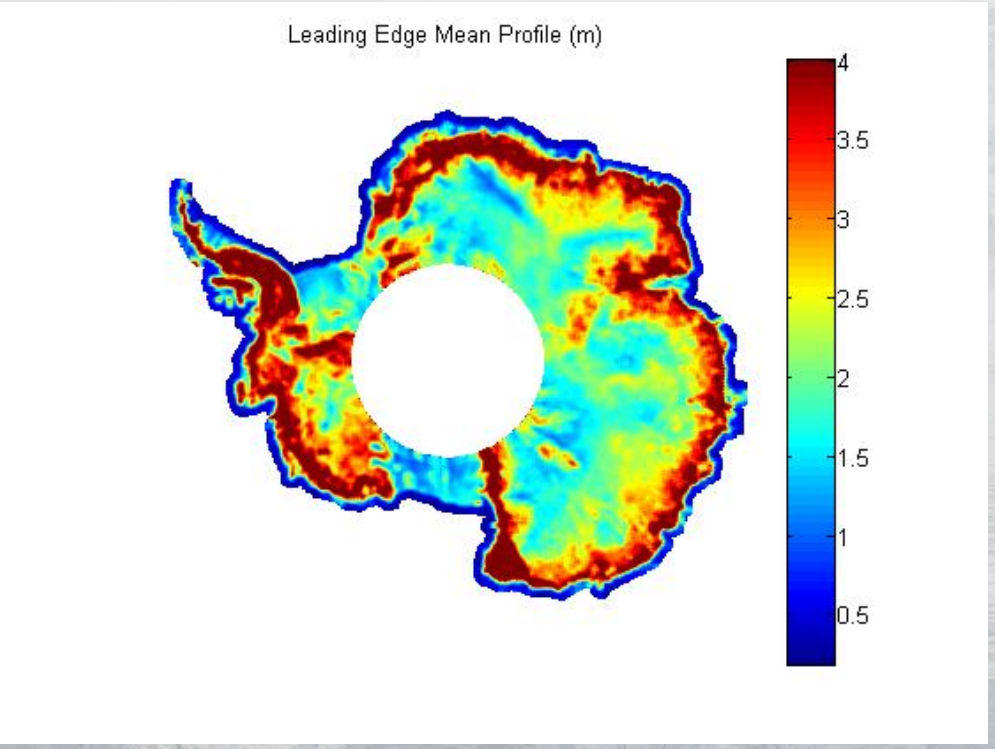
- Comparison done with Cycles 1,2,3 from SARAL and 37, 77, 78 from ENV (same seasonal periods) and the mean profile

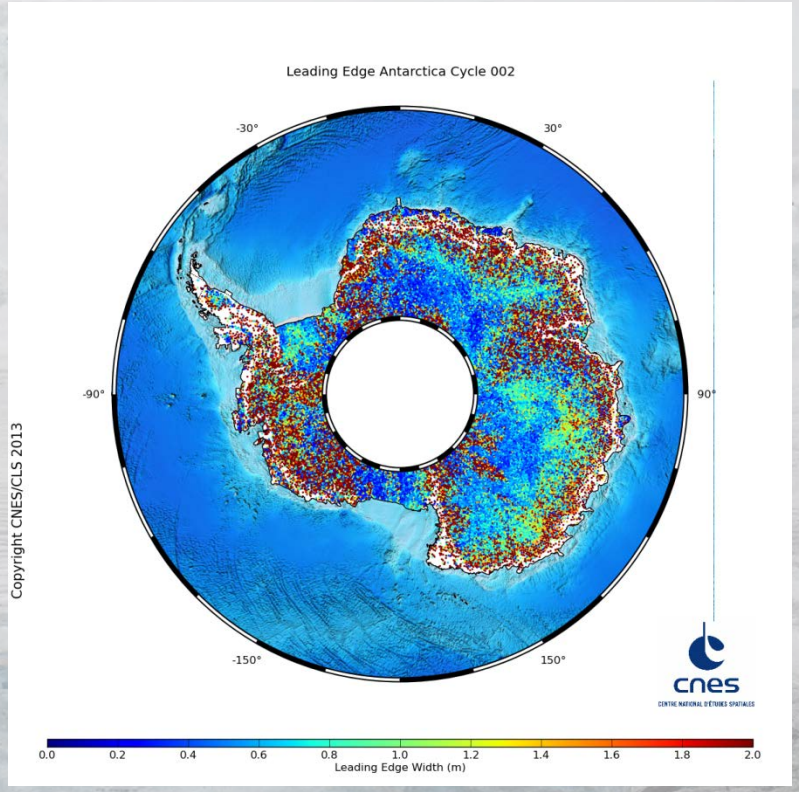




- Mean BS ENV : 6.85 ± 4.9 dB + 2 modes
- Mean BS ALKa : 4.25 ± 3.30 dB + 1 (3) modes
- ➔ Difference : about 3 dB less for SARAL

III/1/d/Comparison with Envisat : Leading Edge Width





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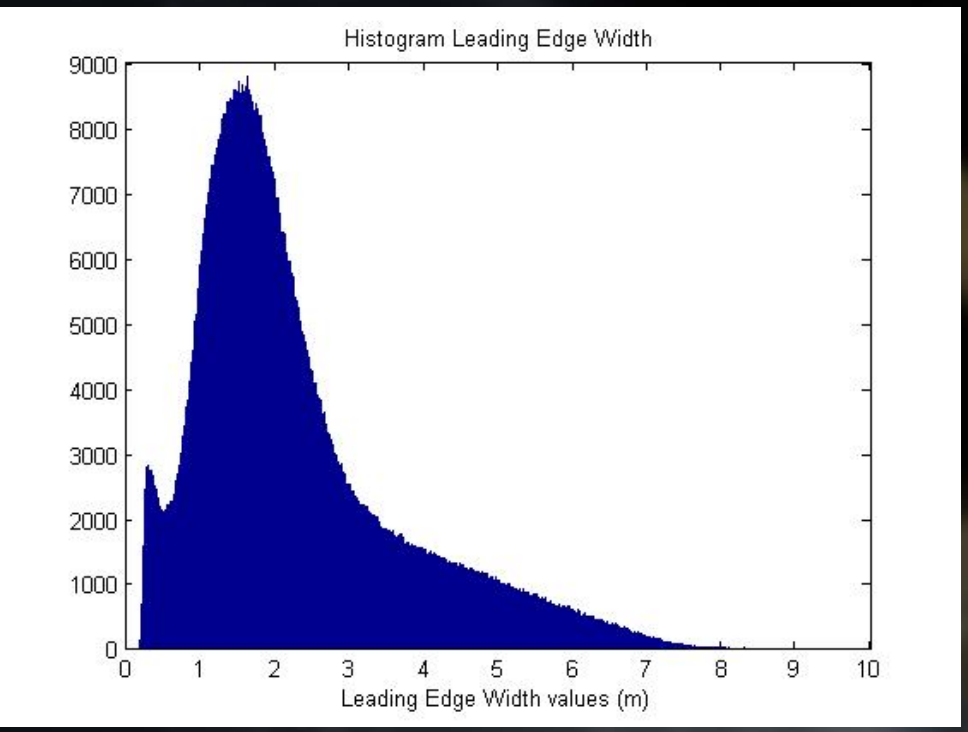
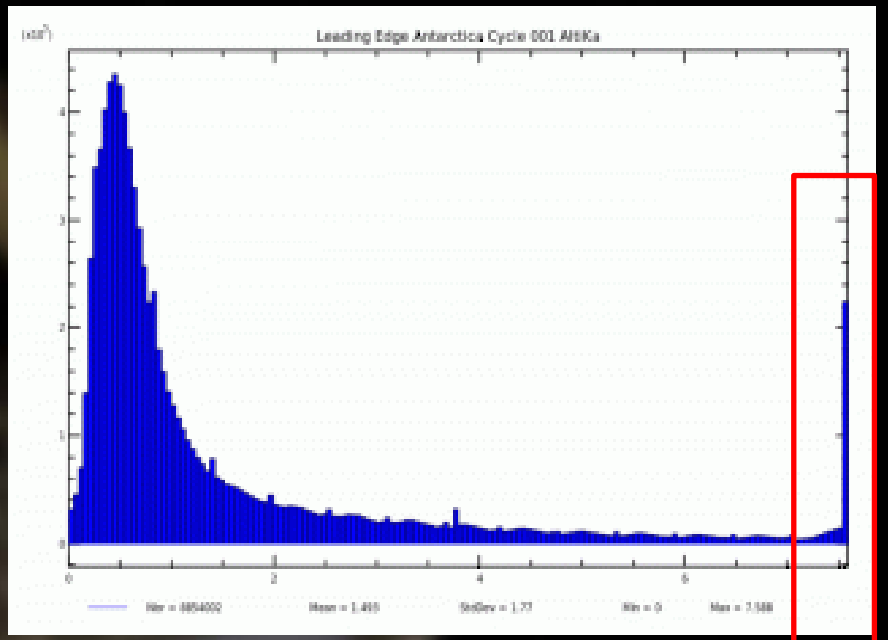


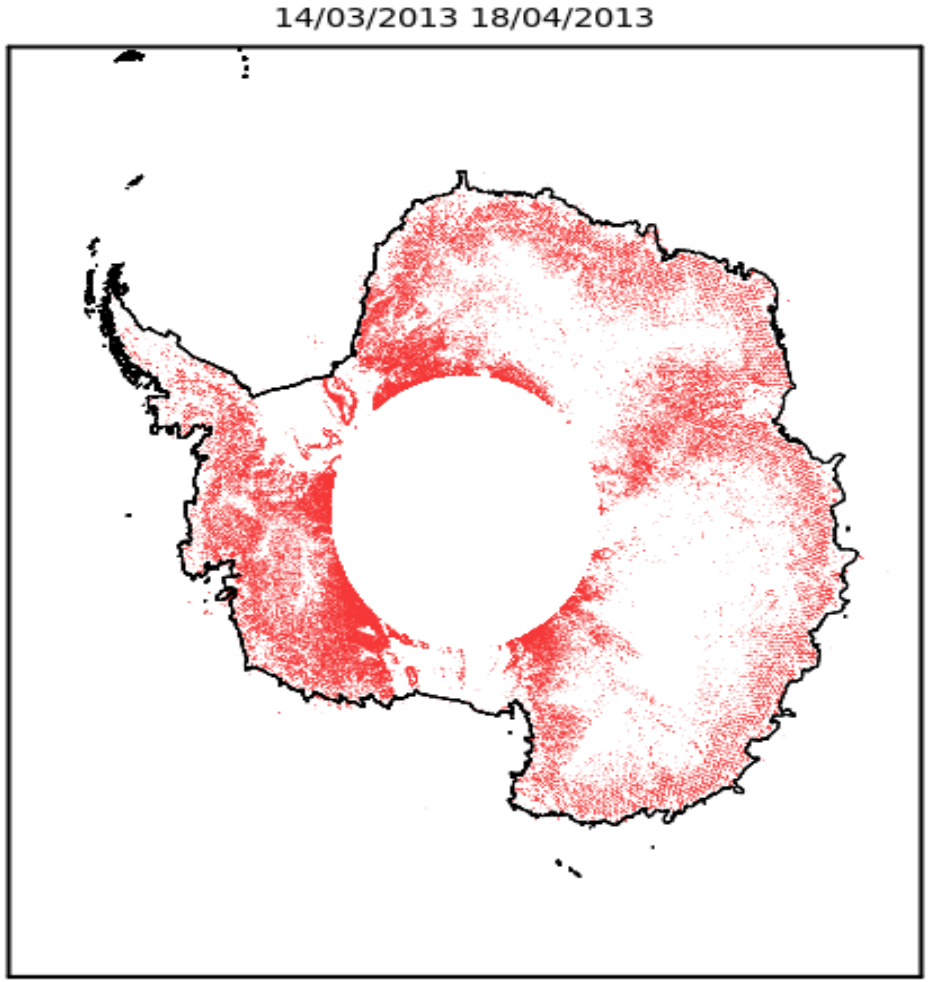


- Mean LeW ENV : 2.3 ± 1.41m + 2 modes
- Mean LeW ALKa : 1.47 ± 1.73m

➔Difference : about 0.8m less for SARAL

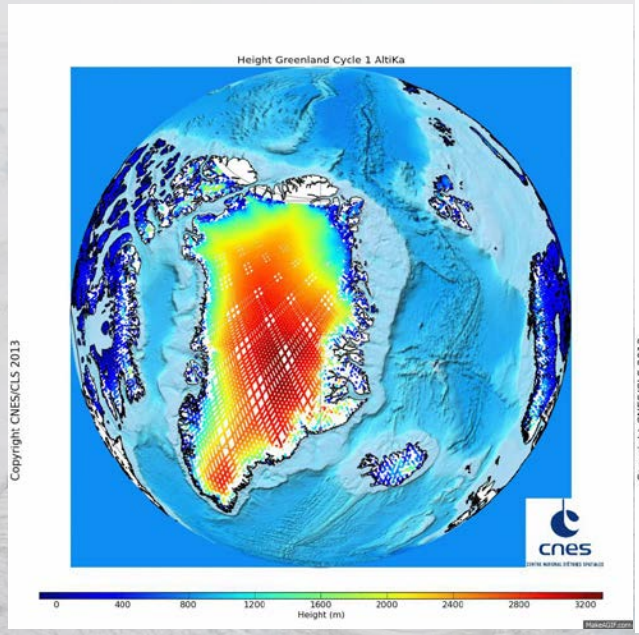
➔Threshold of 7.588m in Ice-2 retracking : due to the number of gates required to compute the Leading Edge
➔To relax/tune for AltiKa?

Measurements where Leading Edge Width is out the maxima bond (count)

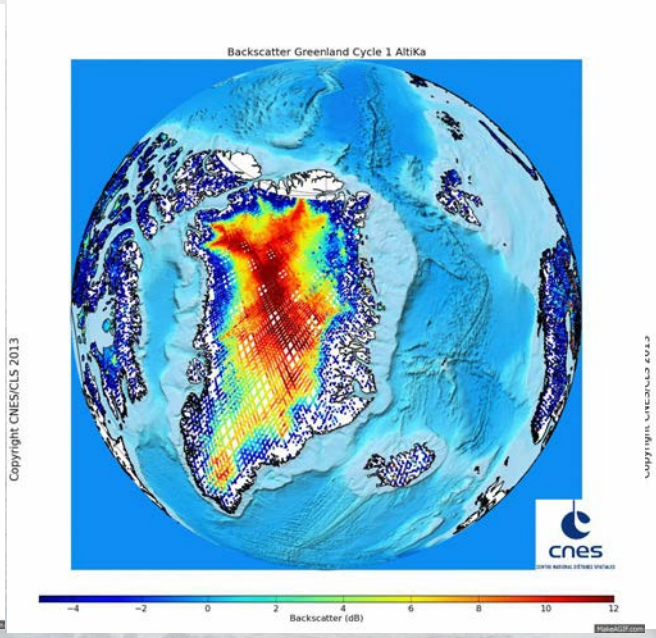


- On these areas, not confident about the Ice-2 retracking : need to look at the waveforms and tune the algorithms more precisely (scheduled within the Peachi project)

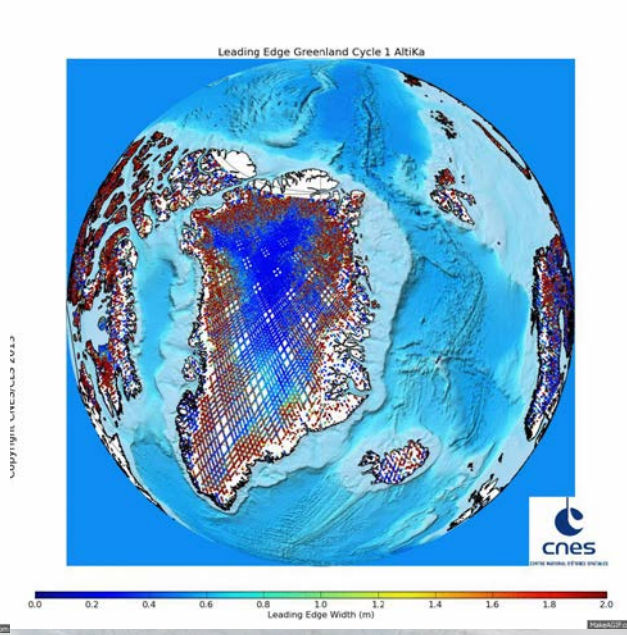
III/ 2/ Greenland



Height



Backscatter



Leading Edge

First 3 SARAL cycles

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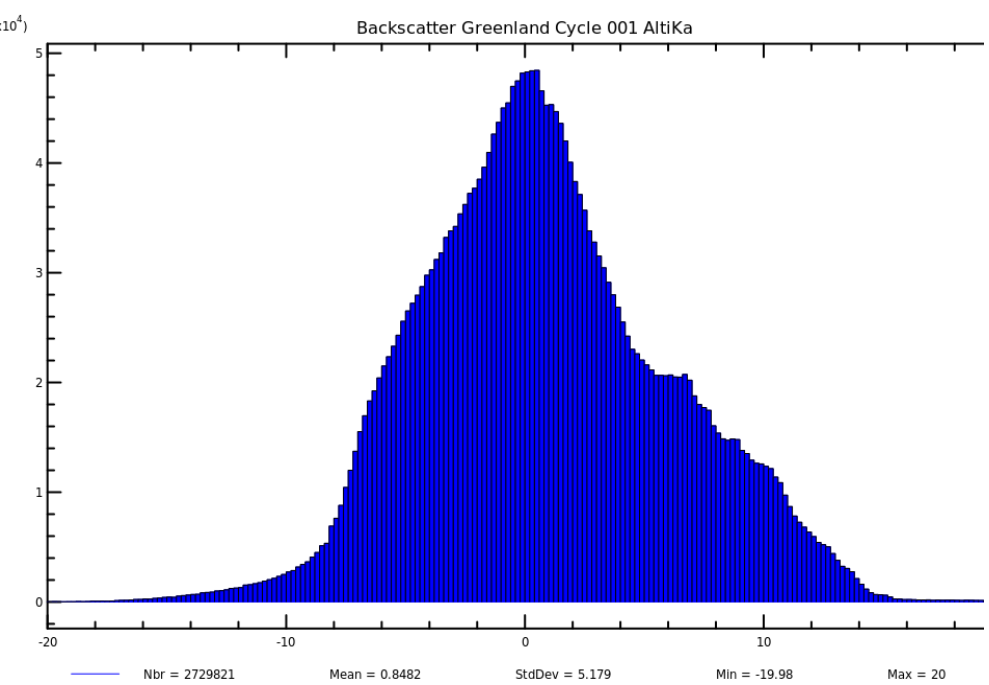
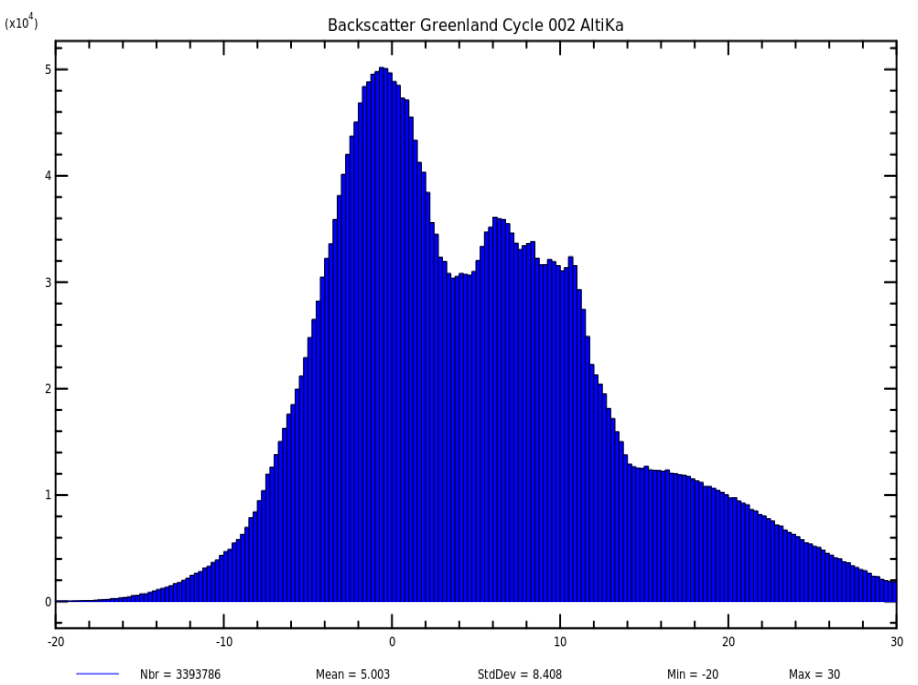
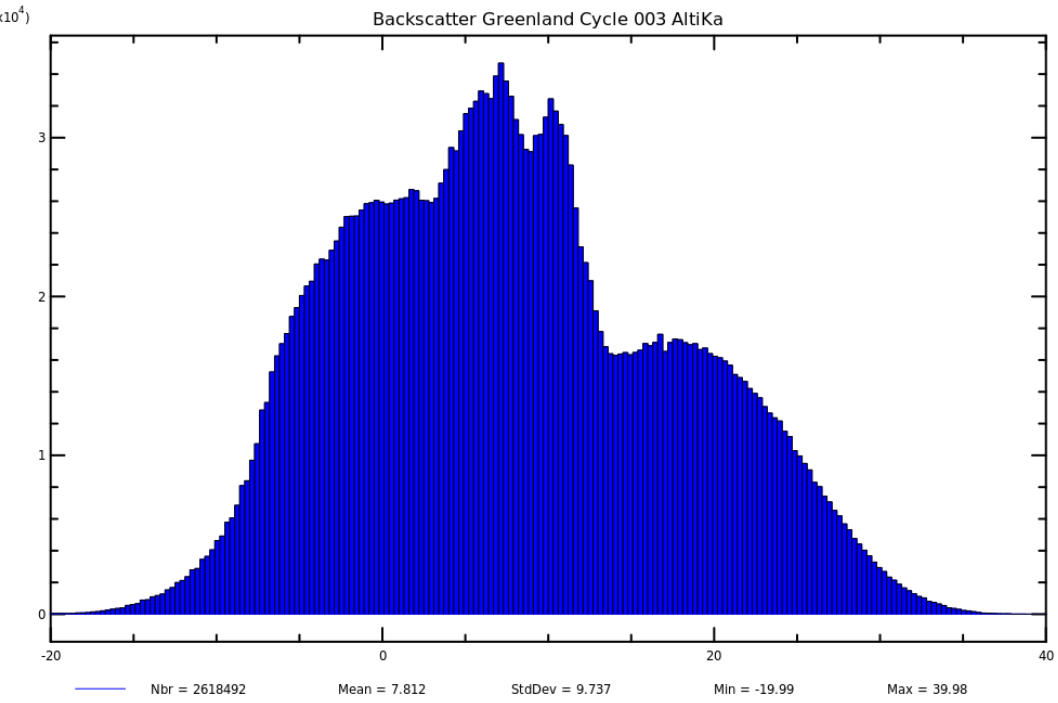
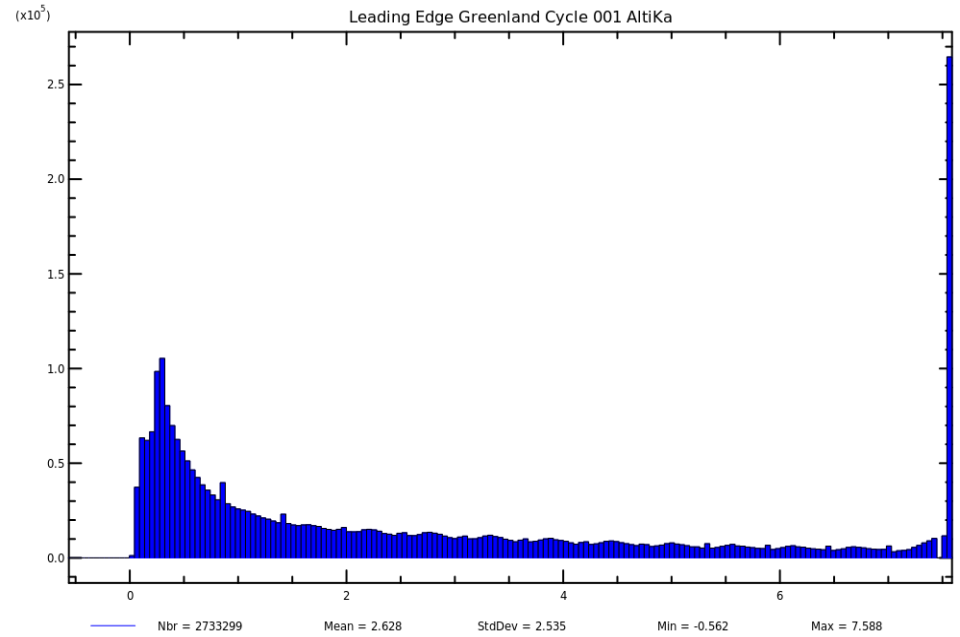
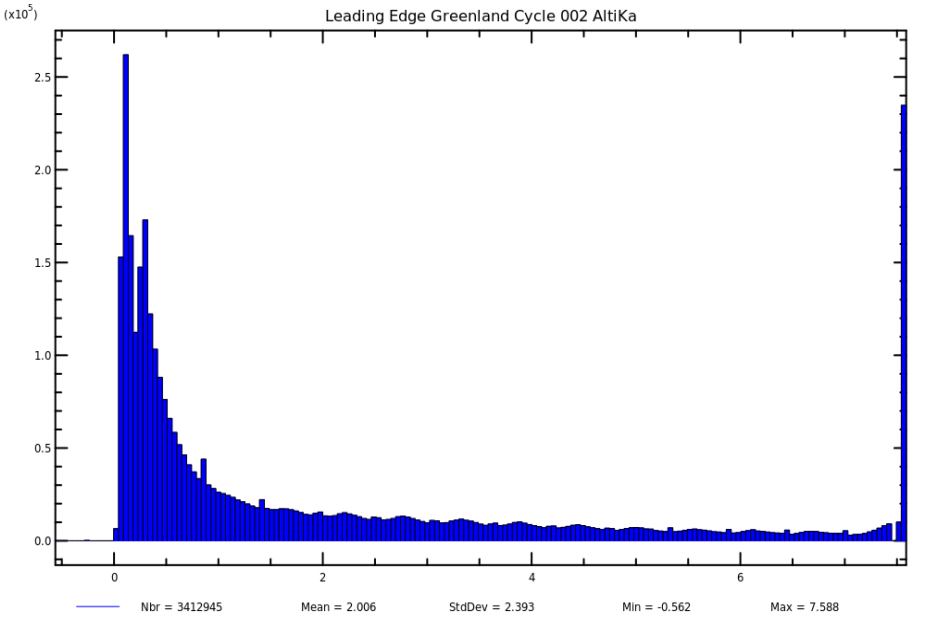


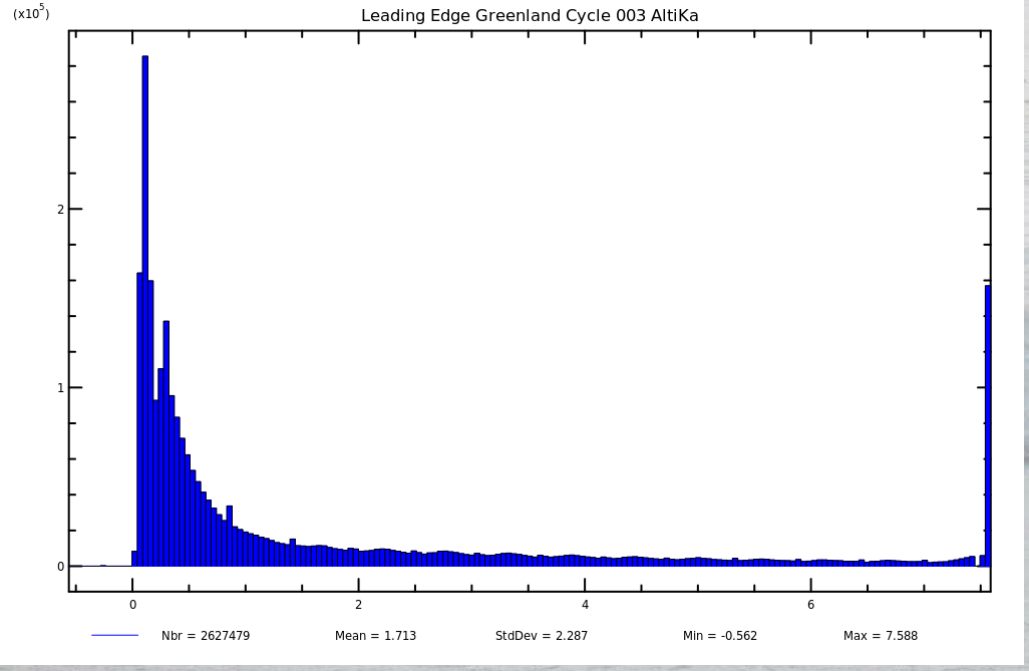




- Much more variable than in Antarctica : need to go further to understand


Leading Edge Greenland Cycle 001 AltiKa
(x10^5)
Nbr = 2733299
Mean = 2.628
StdDev = 2.535
Min = -0.562
Max = 7.588


Leading Edge Greenland Cycle 002 AltiKa
(x10^5)
Nbr = 3412945
Mean = 2.006
StdDev = 2.393
Min = -0.562
Max = 7.588


Leading Edge Greenland Cycle 003 AltiKa
(x10^5)
Nbr = 2627479
Mean = 1.713
StdDev = 2.287
Min = -0.562
Max = 7.588

To conclude

- Tool development = basis to provide efficient and extensive analysis of the data over ice sheets
- First step to analyse data and eventually detect any anomaly that could appear
- Essential to settle the basis to future studies, improvements of algo/data (Peachi project)…

- Scientific analyse with AltiKa results starting

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Perspectives

Absolute evolution of parameters: good but to remove large scale evolutions and analyse more finely the ice dynamics, 3 possible ways:

- Crossovers, Residuals, Comparison theoretical pass/Saral pass
- Comparison with Envisat
- Intercalibration : Cryosat
- Greenland : further development
- Further analysis with xovers

Temporal survey made as long as the data is provided : will help to understand Ka-band waveform parameters

Sea ice ?

Thanks to you all

Any questions?