Towards a comprehensive analysis of radar altimetry backscattering over the cryosphere

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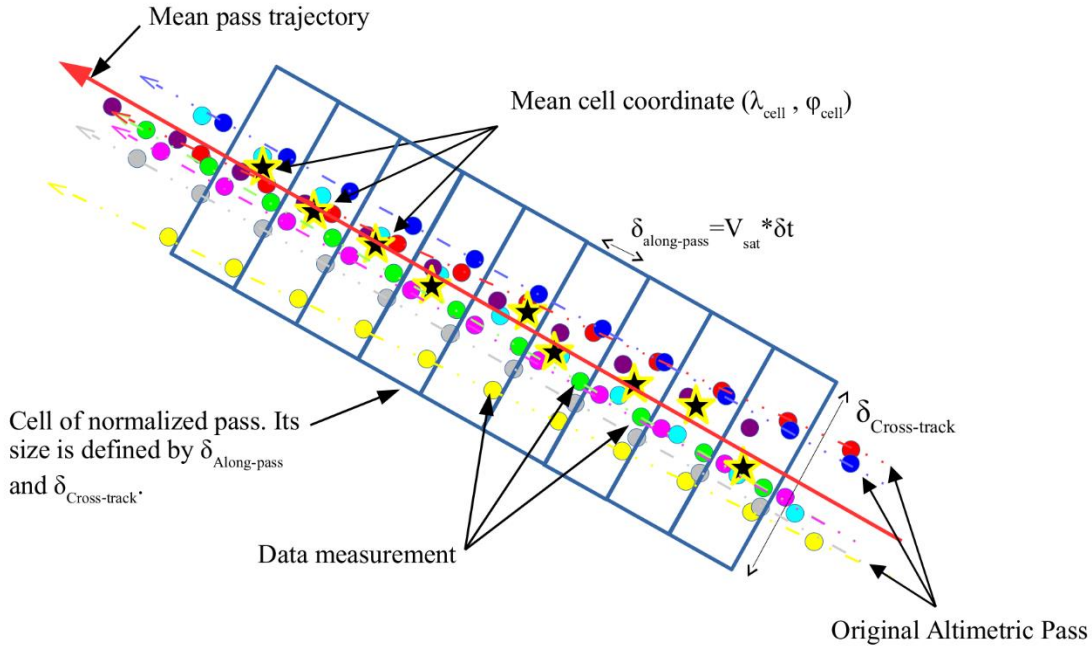
CTOH tools for analyzing radar altimetry data

- **Normalized tracks**

To perform statististical analysis
on an along-track grid

(Frappart et al., Adv. Space Res., in press)



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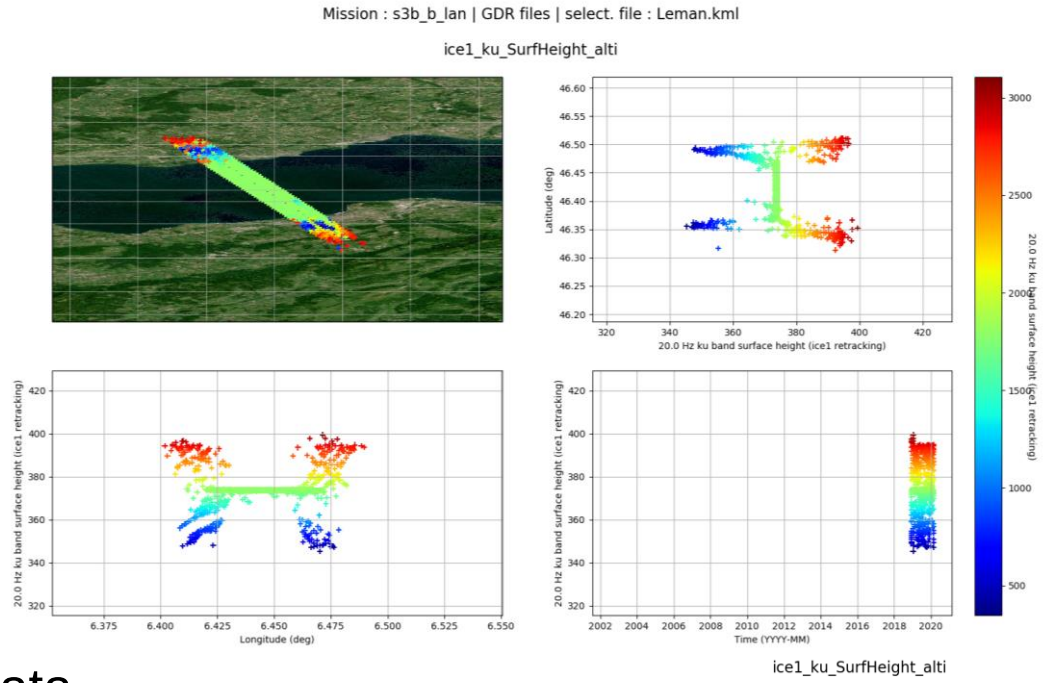
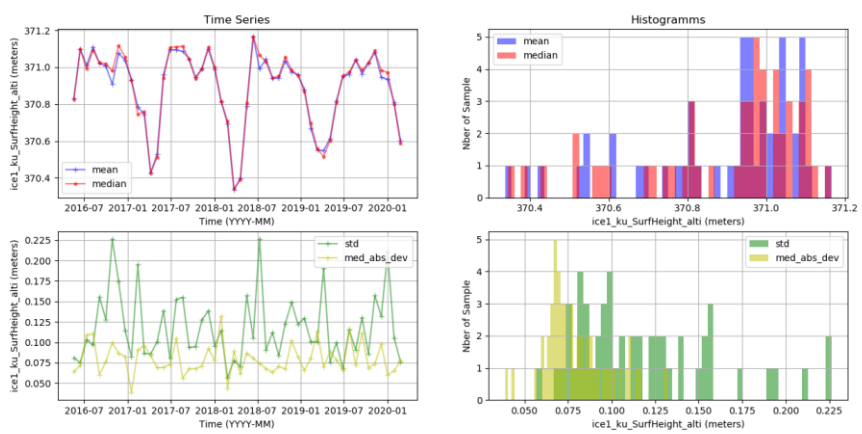


- **Altimetry Time Series (AlTiS) software**

  A GUI to visualize and process radar altimetry data
  from ERS-2, ENVISAT, Jason-1/2/3, SARAL, Sentinel-3
  and soon from Cryosat-2 (baseline D), Sentinel-6,
  and probably Topex/Poseidon



DUAL-CRYO | Workshop on Dual-Band Altimetry of the Cryosphere
Online (Webex) | 13-14 January 2021 | 14:00 - 17:30 GMT
esa

CTOH radar altimetry datasets

- **ERS-2 CTOH reprocessed dataset for land and ice caps**

  To ensure continuity with ENVISAT data (Frappart et al., Remote Sens. Env., 2016)

- **Normalized tracks parameters merged with the GDR data**
  ERS-2 (Ku), ENVISAT (Ku/S), Jason-1/2/3 (Ku/C), SARAL (Ka), and soon Sentinel-3 (Ku/C) and Sentinel-6 (Ku/C)

- **GDR subsets for AlTiS**

  ERS-2, ENVISAT, Jason-1/2/3, SARAL, Sentinel-3 and soon Cryosat-2 and Sentinel-6

More information at: https://ctoh.legos.obs-mip.fr

Improving water levels of peri-Arctic lakes

- **Temporal variations of σ^0, pulse peakiness and TB**

  reveal the changes in surface state of the lake:
  open water, ice, mix
  (Kouraev et al., Remote Sens. Env., 2003)

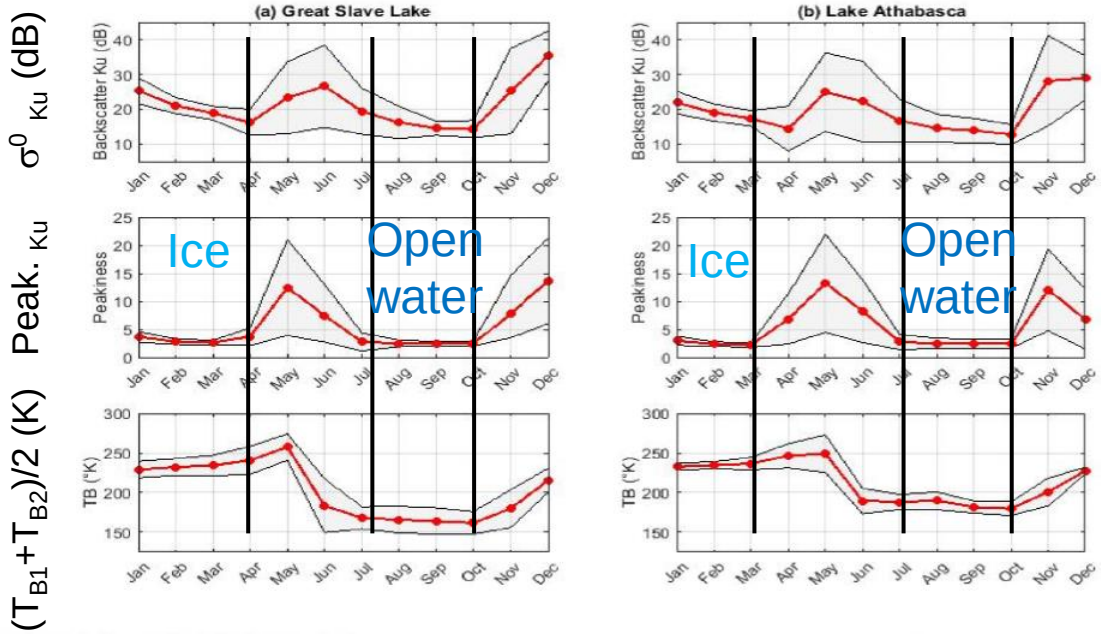
- **Unsupervised classification on these parameters**

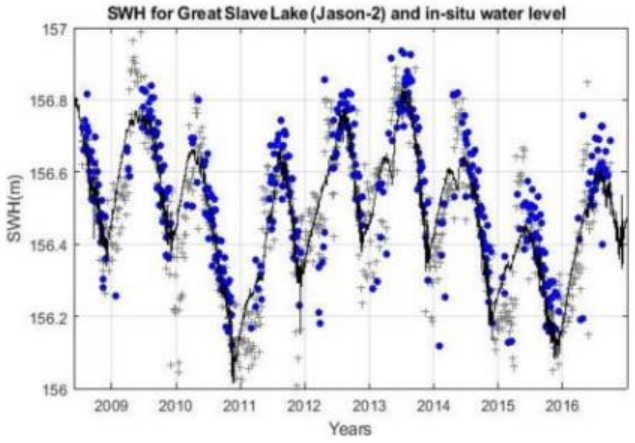
  allow to define thresholds to identify open water along the tracks all along the hydrological cycle

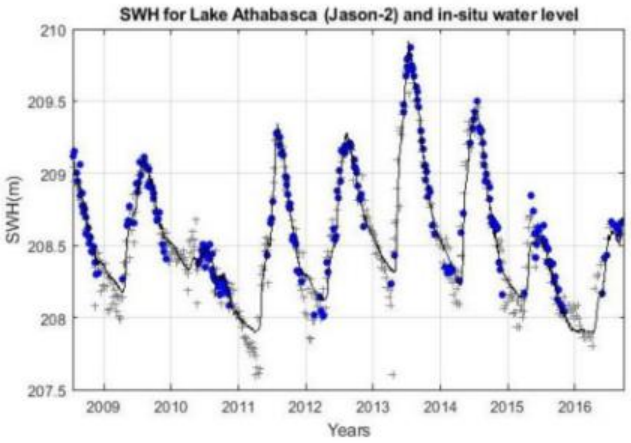
=> more accurate water level estimates

(Ziyad et al., Remote Sens., 2020)

Jason-2

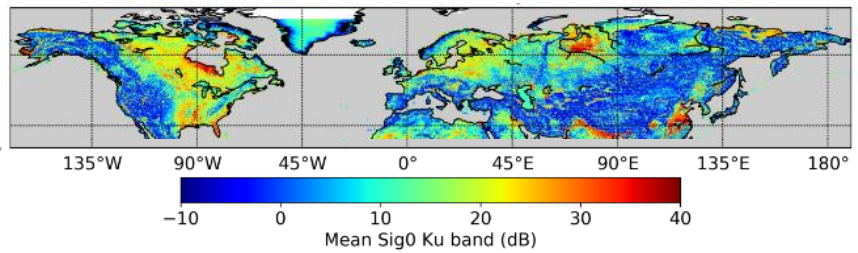


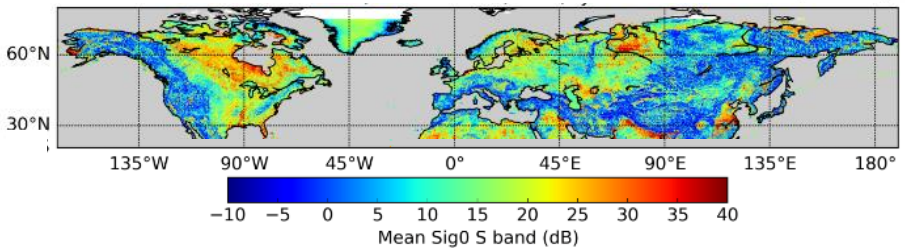


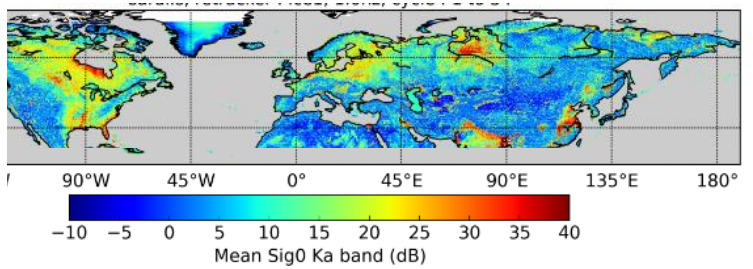


Backscattering signatures at high latitudes

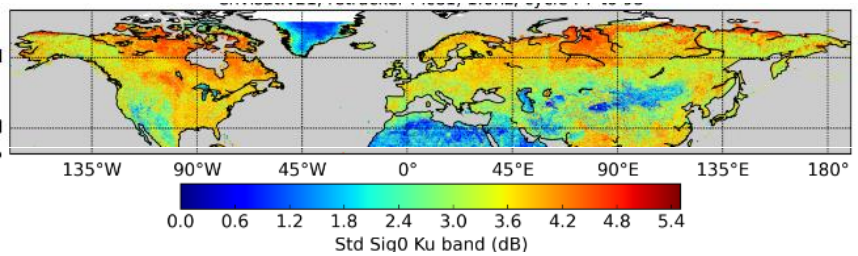
- **Average σ^0** **Ku (ENVISAT)** **S (ENVISAT)** **Ka (SARAL)**

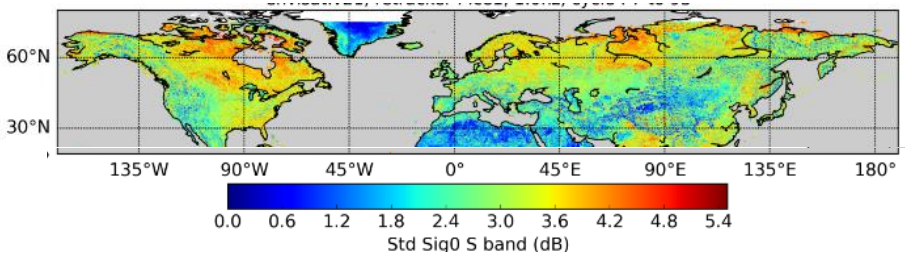


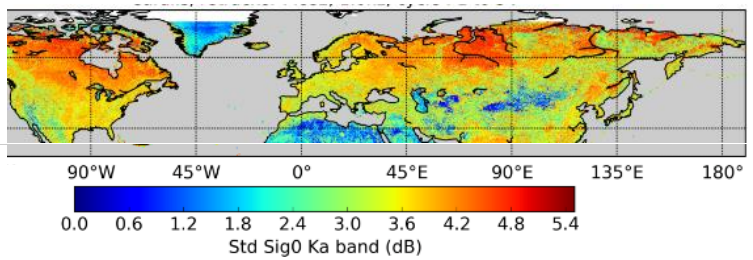




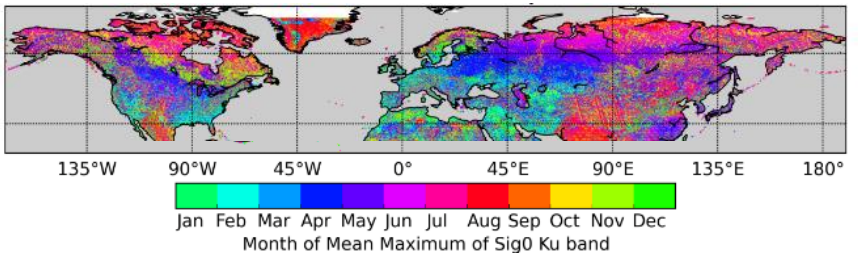
- **Std σ^0** **Ku (ENVISAT)** **S (ENVISAT)** **Ka (SARAL)**

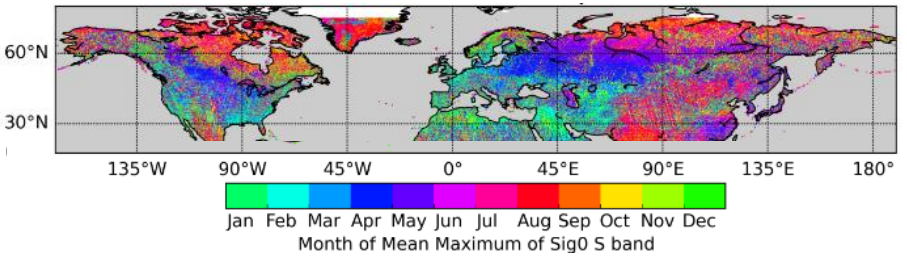


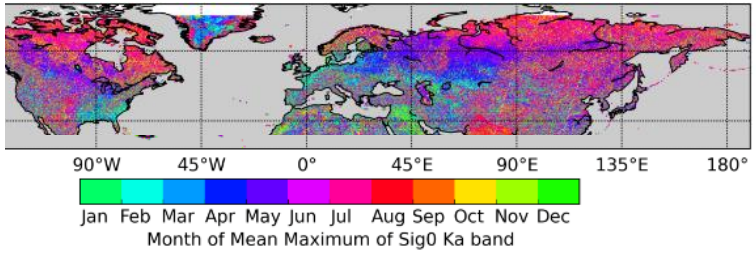




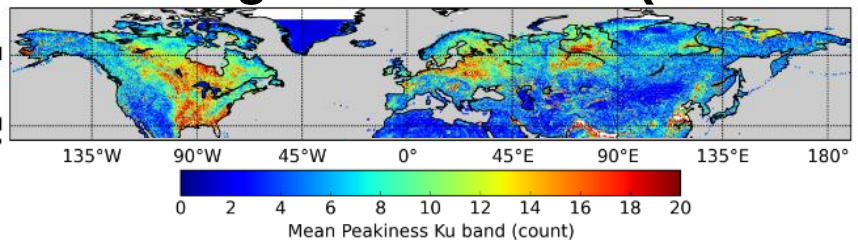
- **Month of σ^0 max** **Ku (ENVISAT)** **S (ENVISAT)** **Ka (SARAL)**

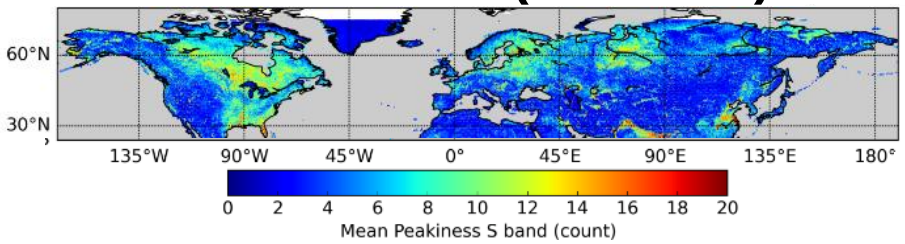


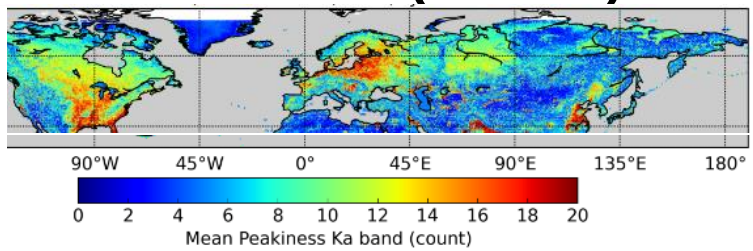




- **Average PP** **Ku (ENVISAT)** **S (ENVISAT)** **Ka (SARAL)**



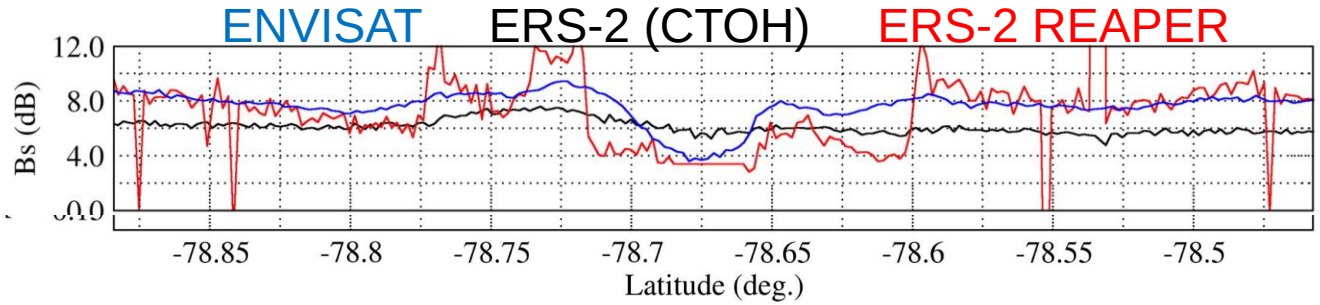




(Frappart et al., Adv. Space Res., in press)

ERS-2 CTOH reprocessed dataset for land and ice caps

- **Retracked ERS-2 waveforms**
  Ice-2 retracking algorithm
  (Legrésy et al., Remote Sens. Env., 2005)



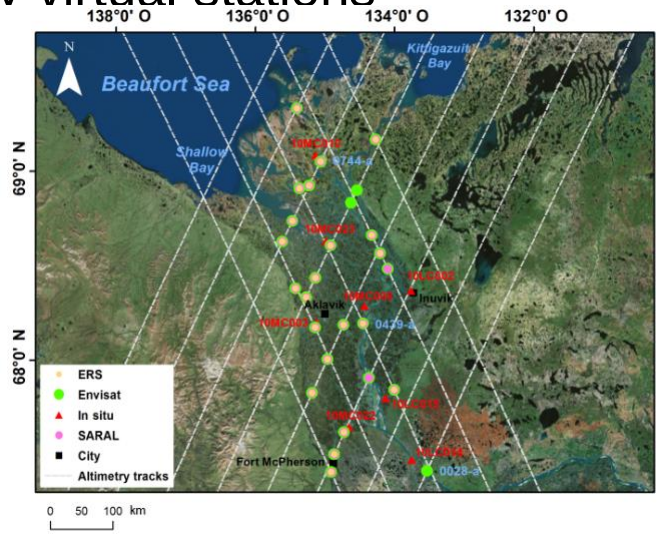
(Frappart et al., Remote Sens. Env., 2016)

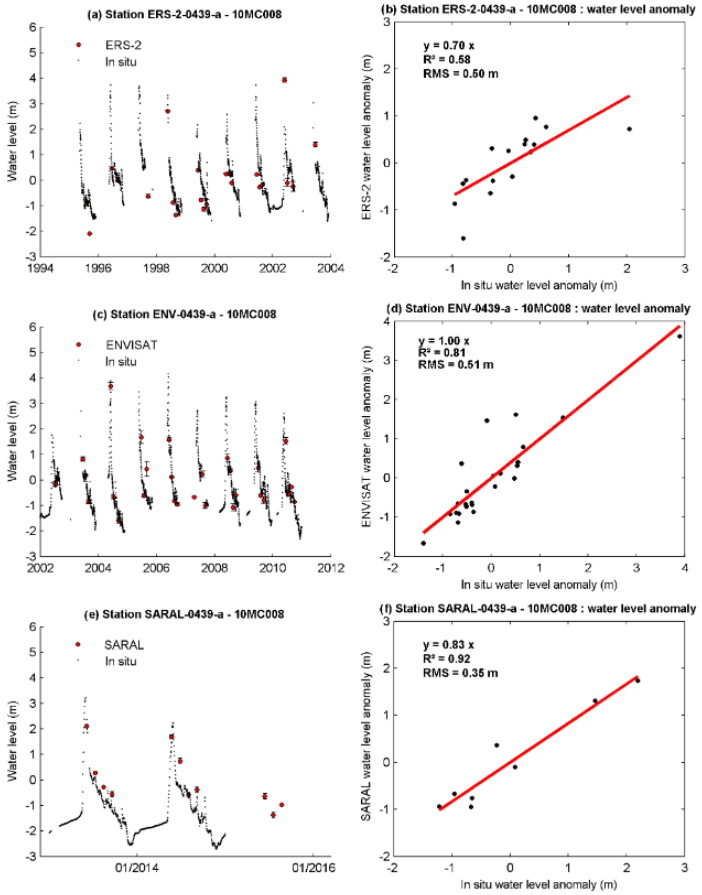
- **Correction of large-scale geographic bias**
  for each parameter (range, backscattering, …)
  for both Ice-1 (from REAPER, ESA) and Ice-2 retrackers

- **DTC based on range**

⇒ Useful for building networks of altimetrv virtual stations at high latitudes

In the McKenzie Delta:
ERS-2 : 22 VS
ENVISAT: 27 VS
SARAL: 24 VS

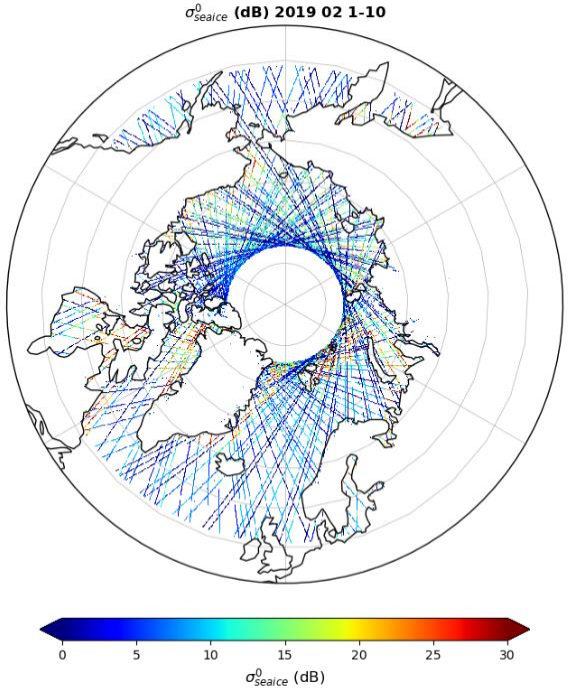


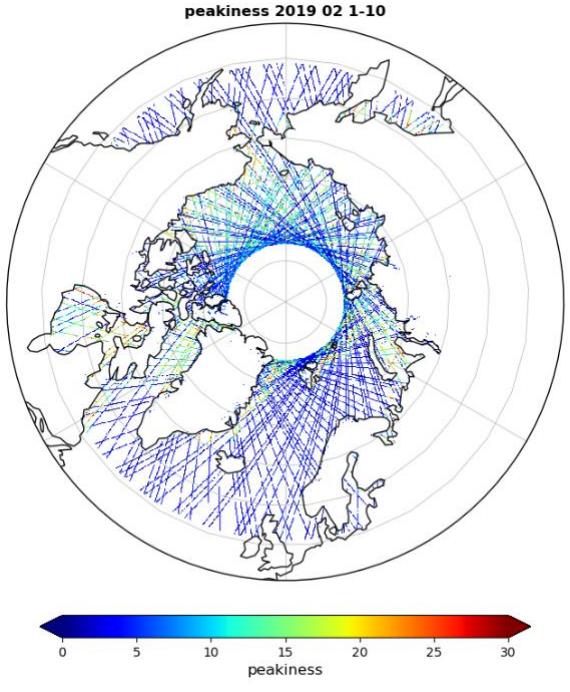


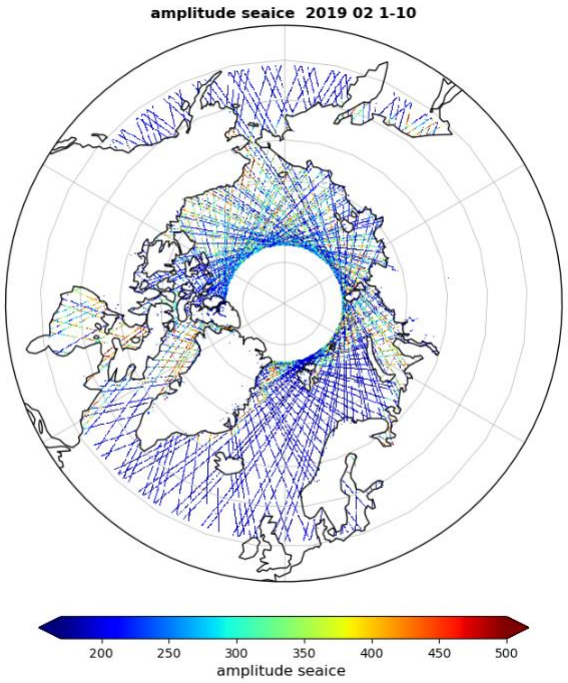
(Normandin et al., Hydrol. Earth Syst. Sci., 2018)

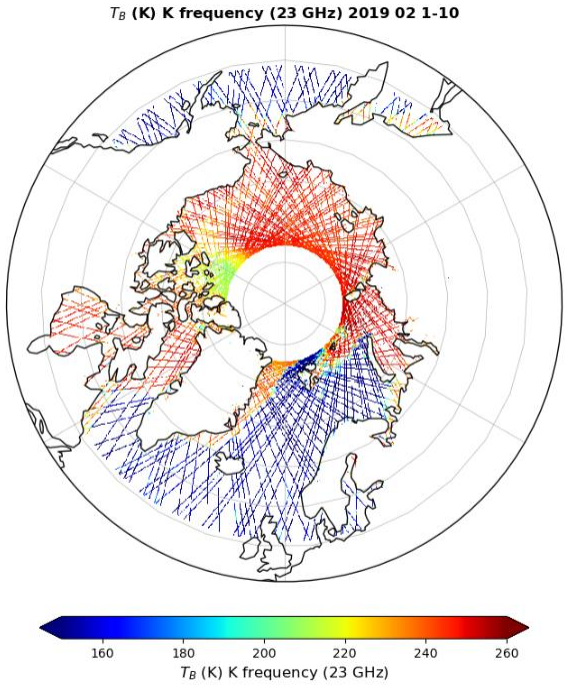
Backscattering analysis over sea ice

- **10 days of SARAL data (Ka): σ^0 OCOG, peakiness, WF amplitude, T_B at K-band**









- **Soon with Sentinel-3 (Ku/C)?**

Ocean product: to be tested
Land product: waiting for the future reprocessing (e.g., water/ice discrimination over Arctic lakes)