Use of current altimeter data to characterize SWH variabilities within KaRIn swath

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Introduction

- **Context:**
  - We don’t know very well the global SWH small scales variability (global models are smooth)
  - SWH SWOT baseline based on KaRIn measurements (one single value in the 10-60 km swath), backup could be based on nadir values which is analyzed here.
- **Objective of this talk:**
  - Use Jason-1 Geodetic phase / Jason-2 matchups as proxy to give a global description of how the SWH will vary in the SWOT swath.

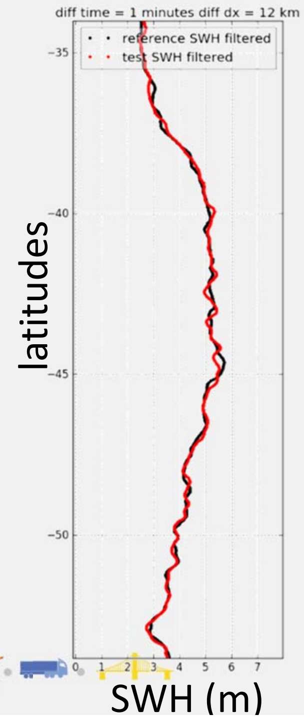
  ➔ Method developed by G. Dibarboure to estimate the SSH spatial variability in Karin/Swot_nadir comparisons.
- **Main conclusions:**
  - In the worst cases (far range swath, worst geographical areas), wave height will vary significantly (~1 m) in the SWOT swath.
  - Traduced in topography error, through SSB computation, we found that the SSB allocation error is under estimated for wavelength between 300 and 50 km.
  - Where the SWH variability is the higher, the error signal remains low with respect to topography signal amplitude.

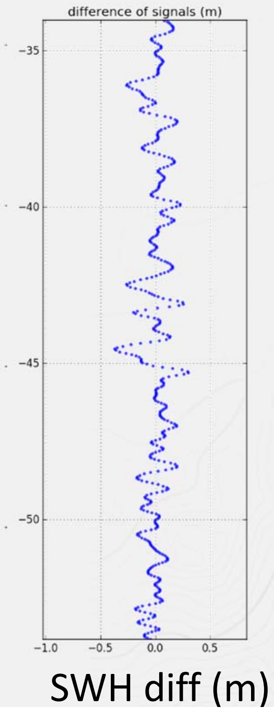
Method

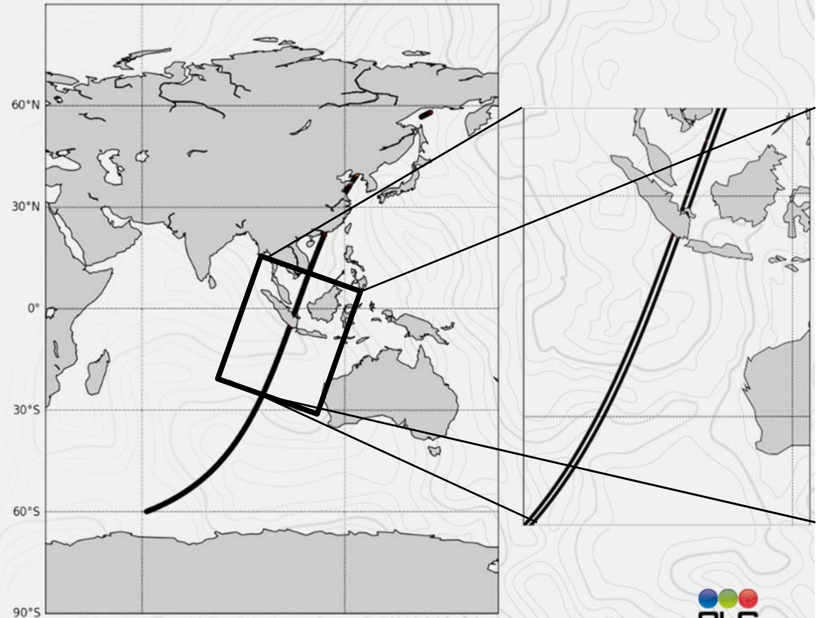
- Use the conventional altimetry constellation J1G/J2 (or J2G/J3) and specific colinear configurations to compute an approximation of the SWH variability for different swath distances (➔ G. Dibarboure method used to describe SSH mesoscale variability.)

- Case dx =10 km ~ comparison Swot Nadir/Karin near range

➔ Very low differences







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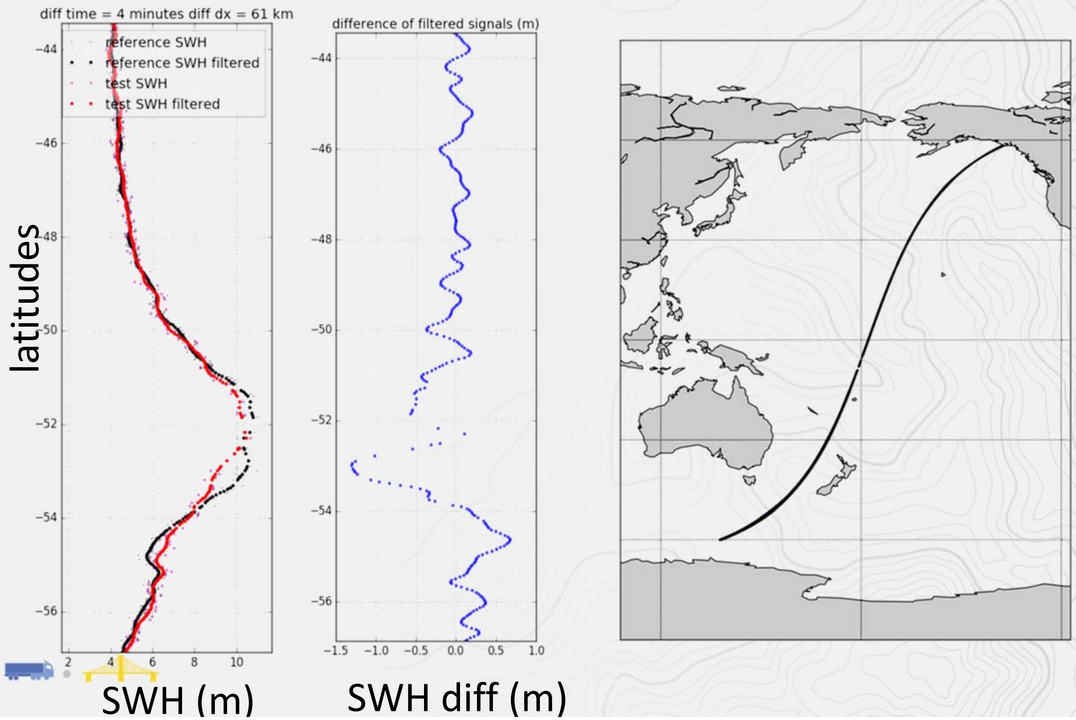
- Case dx =60 km ~ comparison Swot Nadir/Karin far range

➔ Stronger differences depending on geographical area.



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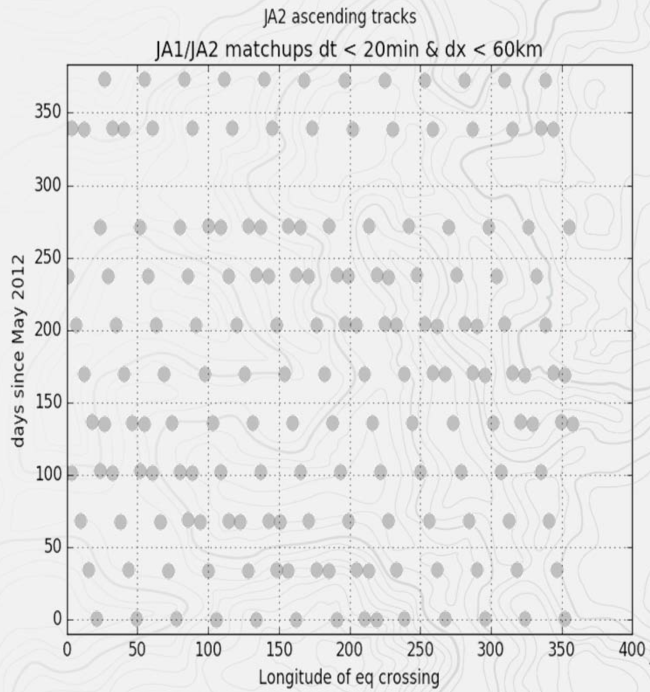
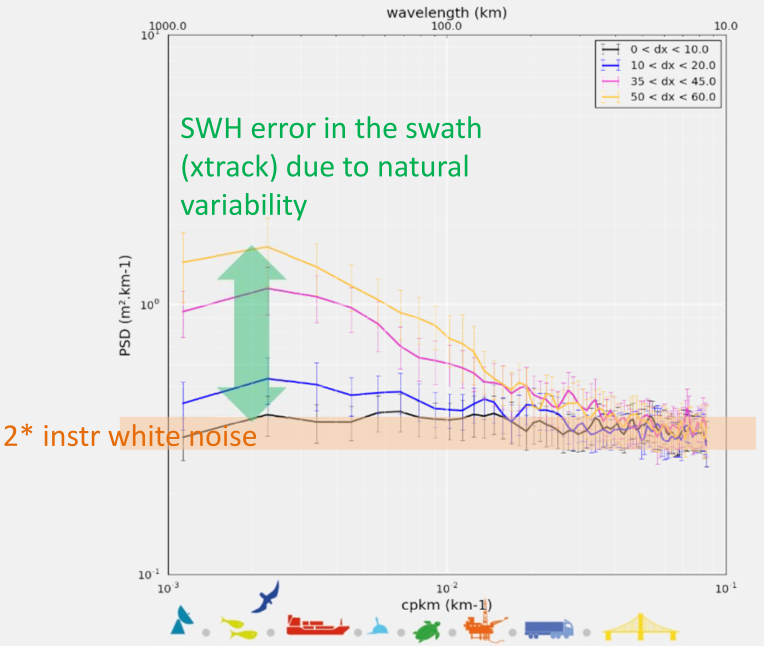
- Use of all matchups to compute global statistics:
  - Select only dt < 20 minutes
  - Subsample 4 cases:
    - Nadir/Nadir = 0 < dx < 10 km (55 occ)
    - Nadir / near range= 10 < dx < 20 km (60 occ)
    - Nadir / middle range = 35 < dx < 45 km (60 occ)
    - Nadir / far range = 50 < dx < 60 km (56 occ)



SWH variability

- Global assessment shows that SWH variability increases when cross track distance with respect to nadir increase.
- Geographical assessment shows that areas of strong SSH variability are mainly concerned ➔ consistent with notion of SWH modulation by SSH and tides currents

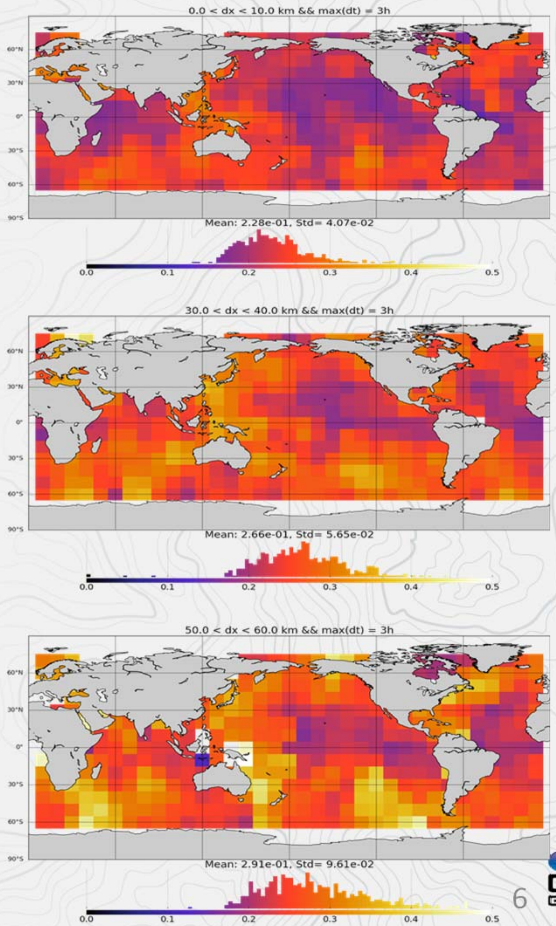


Rms Raw

DX 0/10km

DX 35/45 km

DX 50/60 km



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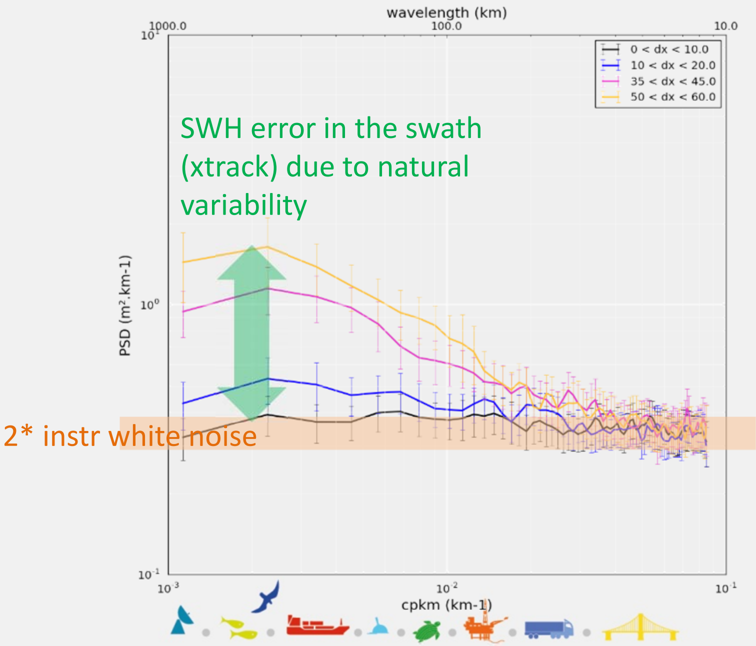
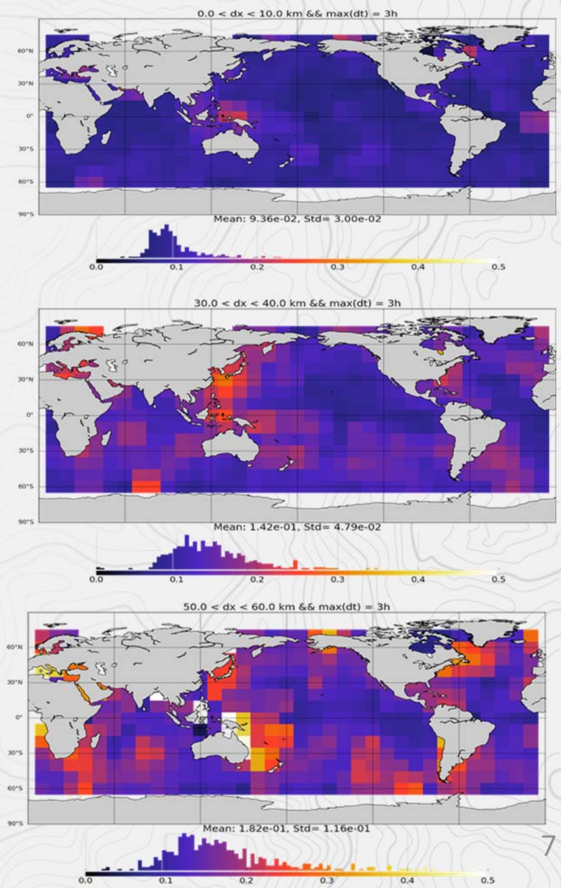


Rms
Signal Filtered <50 km

DX 0/10km

DX 35/45 km

DX 50/60 km

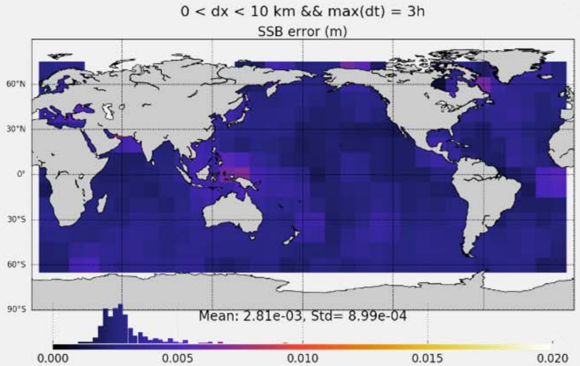


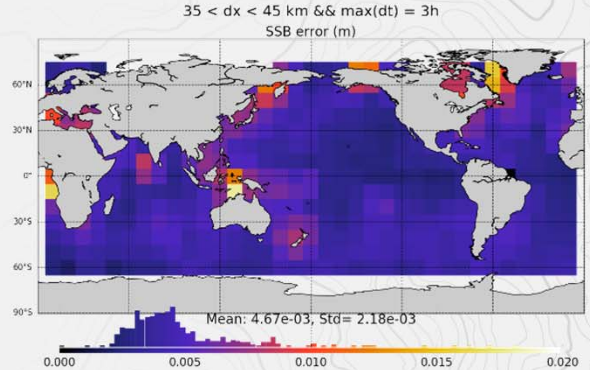
Impact on SWOT SSH through SSB

- Use of SSB first order 3% of SWH as first approximation to compute the impact of SWH variability on SWOT topography retrieval.

➔ Errors are below 5 mm (in average) in most of the cases. Around 1 or 2 cm in worst cases

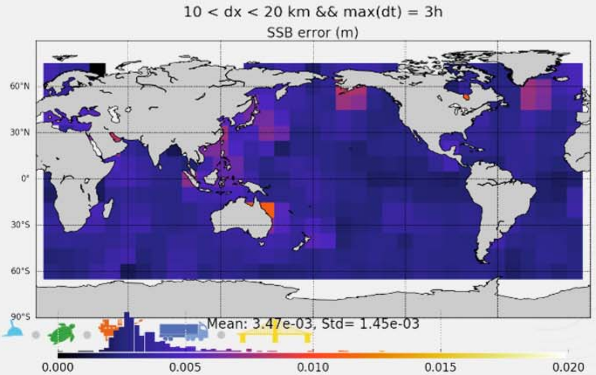
DX
0/10km

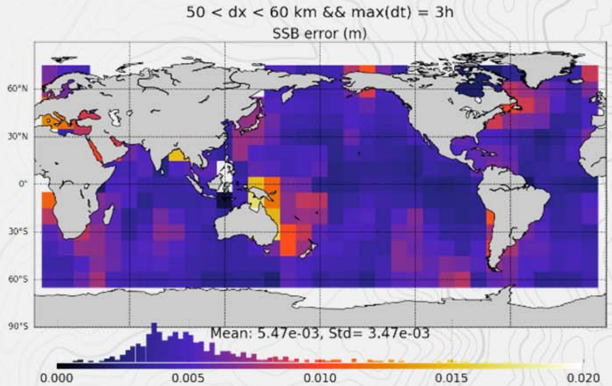




DX
10/20km

DX
35/45km





DX
50/60km

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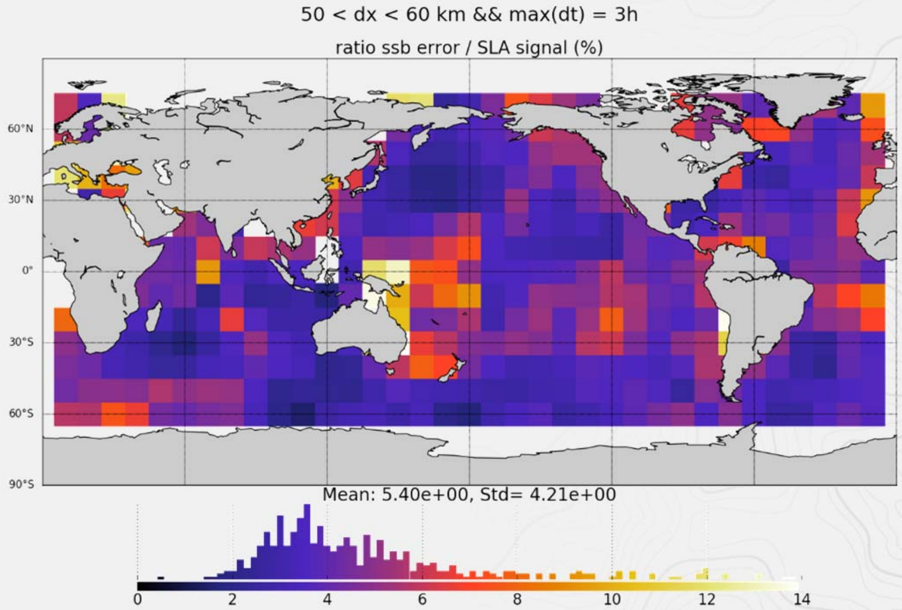
Impact on SWOT SSH through SSB

- The ratio between SSB err estimated and the SLA signal shows that this is not the areas of strong currents that are the most impacted (except the case of East Australian current which seems still present a high ratio)



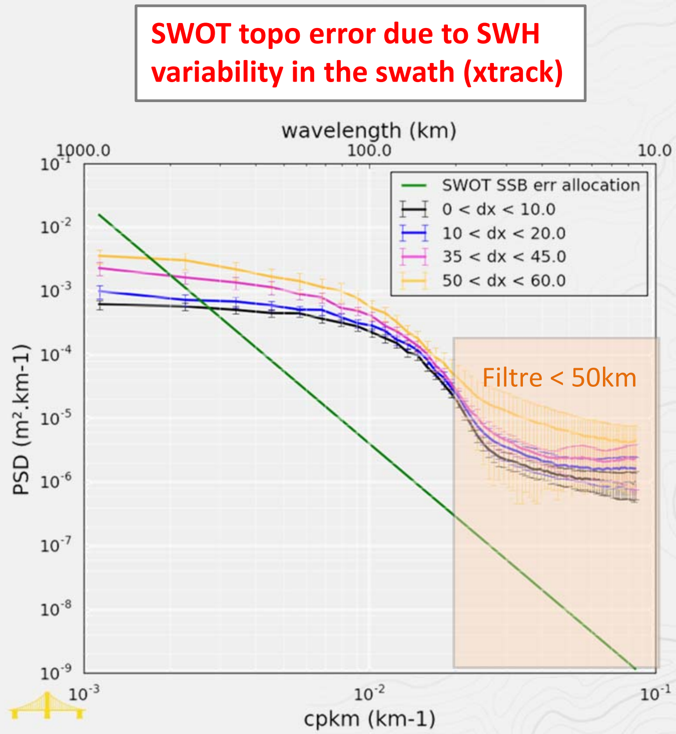
DX 50/60km

WORST CASE

Impact on SWOT SSH through SSB

- The global metric of SSB error computed using J1G/J2 matchups appears higher than the SSB error allocation.

The allocation was constructed using global SWH models, smoothing significantly the SWH small scales variability it thus underestimated



Conclusion

- Limit of the method:
  - ➔ Use LRM SWH datasets derived from better retracker ➔ lower level noise, less spectral bump error
  - ➔ Use better filtering methods such as EMD already tested by Y. Quilfen (Ifremer), other innovative algorithms recommended by CCI Wave projects ➔ significantly reduce the level of noise.
  - ➔ Perspective: use of Sentinel-1 sub images, CFOsat, airborn flights (MASS) to better characterize the zonal / cross track SWH variability. ➔ R. Husson has started to work on the subject.

- SWH will vary in the SWOT swath, notably in the strong current areas.
- The corresponding errors on the KaRiN topography is not null but negligible with respect to the topography signal.
- SWOT SSB error allocation is under estimated compared to these results.

Thank you for your attention

Pour justifier du cutoff Jason3 SWH à ~50 km. Si nécessaire