SWOT KaRIn performances in line with spectral error requirements for wavelengths of 80 km and above

Assessment of SWOT KaRIn spectral performance and error requirements during the 1-day repeat orbit

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Context

We analyzed KaRIn LR observations from SWOT "fast-sampling" phase (1-day repeating orbit) to assess KaRIn spectral performance.

KaRIn errors were estimated by subtracting the SSHA observed over the same track over two consecutive days. The resulting 1-day SSHA difference spectra include ocean variability and decorrelated 1-day KaRIn errors and were, thus, compared with the mission error requirements.

The analysis focused on cycles 508 to 520 (from 1 to 14 May 2023) and on near-, central and far-range pixels. Only results from the central pixel (34 km from the swath edge) are shown here.

Methods

- We first identified continuous segments of 2000 km (gaps smaller than 10 points where linearly interpolated).

- The spectra were computed for each segment by applying a linear detrending and a Tukey window tapering (alpha parameter =0.05).

- All individual spectra were averaged together to reduce spectral noise.

- Nadir SSHA observations were interpolated via nearest neighbor over the KaRIn track

Results: Spectral characteristics of KaRIn signal and error

○ Good agreement between KaRIn and Nadir spectra for wavelengths > 100 km

○ KaRIn spectra roughly k^{-2} for wavelengths < 100 km

○ Bump between 50 and 10 km due to MSS (corrected with 2023 hybrid MSS)

○ **1-day SSHA difference spectra (divided by 2 for direct comparison) above error requirements**
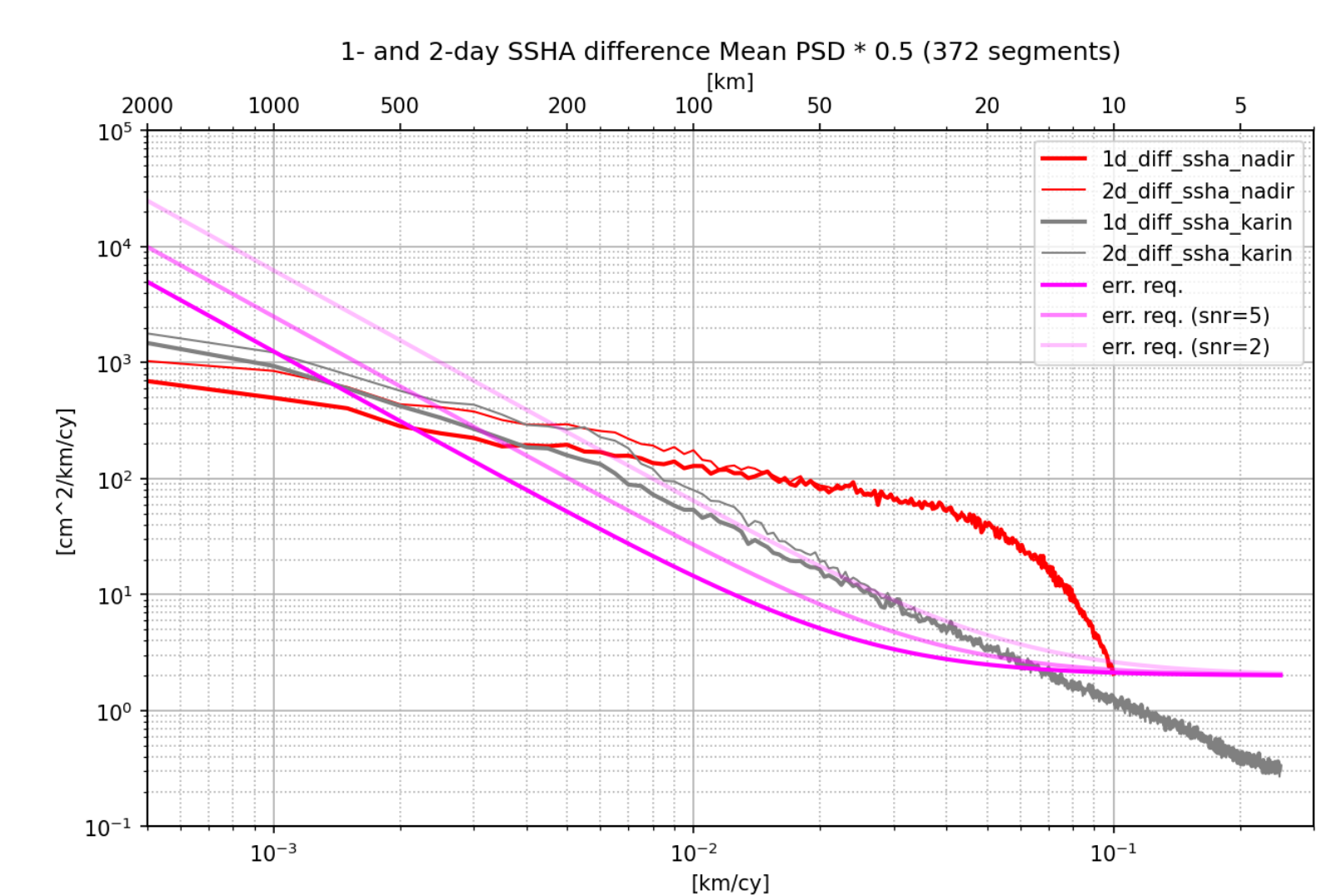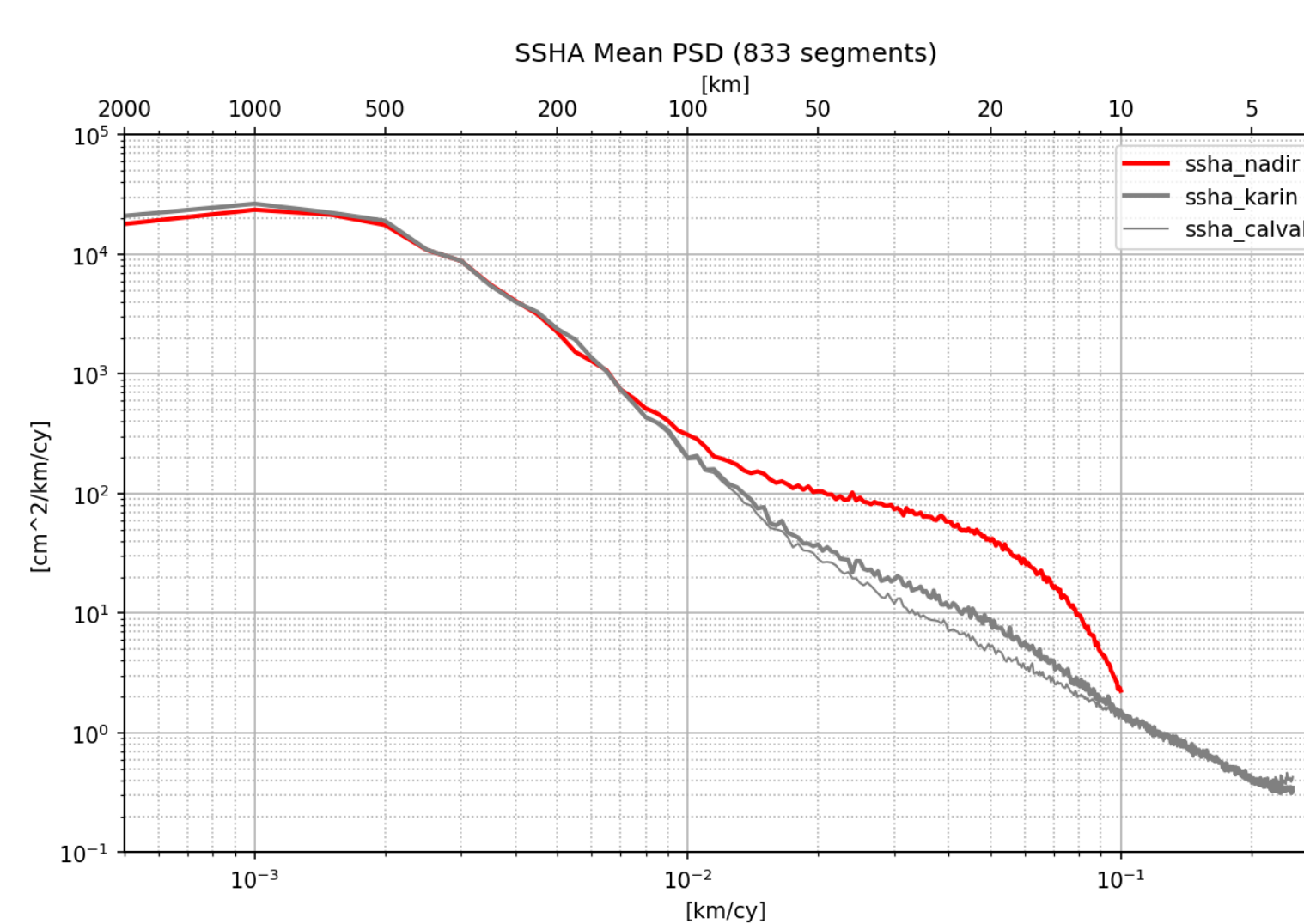
Results: Estimates of ocean variability contribution to 1-day difference spectra
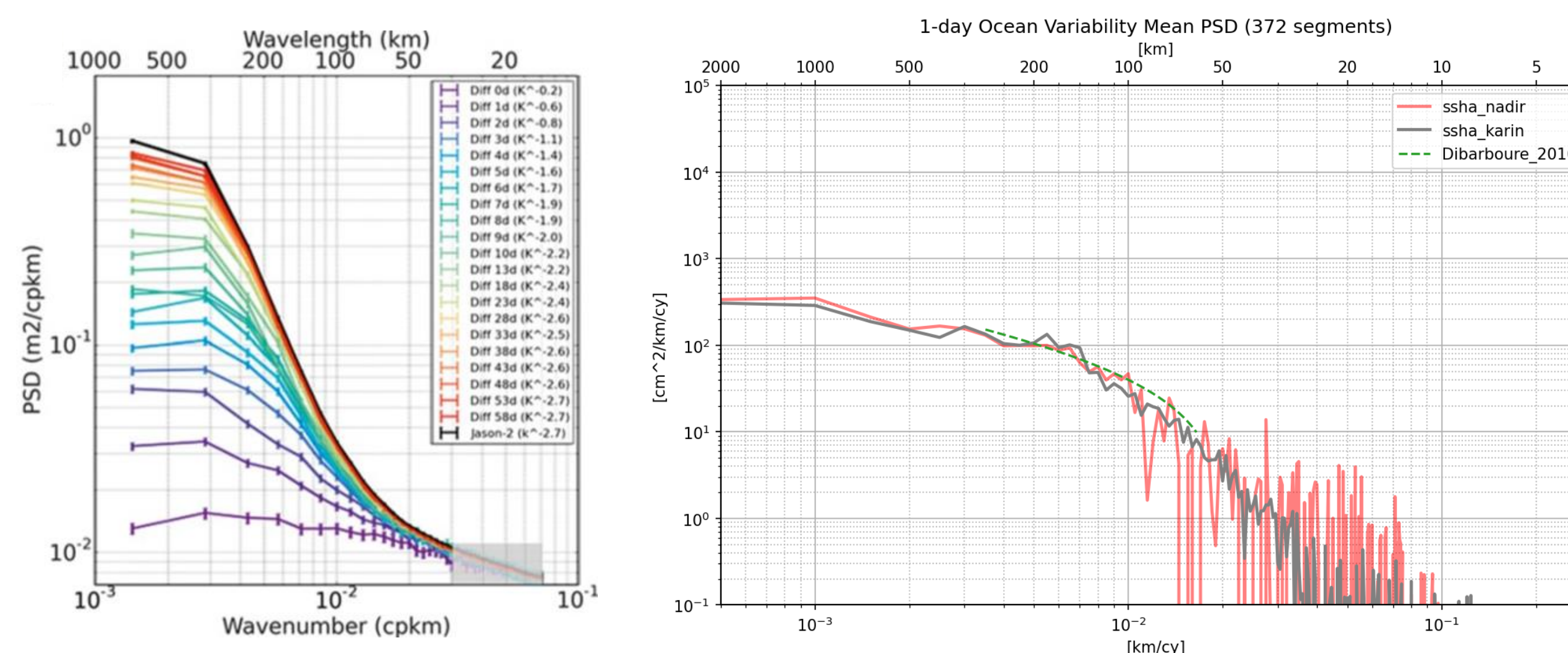
From Dibarboure et al. 2016
https://doi.org/10.1175/JTECH-D-16-0015.1.

○ Ocean variability estimated as difference between 1-d and 0-d difference spectra from Dibarboure and Morrow, 2016 (based on Nadir observations, thus limited to wavelengths > 70 km)

○ Ocean variability also estimated as difference between 2-d and 1-d KaRIn difference spectra

○ The two estimates are consistent with each other

Conclusions

➤ **When accounted for ocean variability, KaRIn spectral error estimates are within the requirements for wavelengths > 80 km**

○ No big differences when across-track filtering is applied (not-shown)
○ Results consistent for near- and far-range pixels (not-shown)
○ Analysis to be extended below 80 km using reprocessed data from the full 1-day orbit period (smoother 1-day and 2-day difference spectra)