

CFOSAT Level-2 SWIM product evolution: Wave Slope Spectrum Range Extension

The current configuration in version 7.1 is based on the production of the modulation spectrum exploited up to 1112 m, while the slope spectrum is limited to 500 m, with values above this limit being forced to zero (see [CFOSAT AWWAIS 7.1 Release Note](#)). As a result, the partitions and the integrated parameters derived from them are also calculated over the interval [22.5;500] m.

A new improvement is proposed, consisting of extending the slope spectrum up to 1112 m. However, the presence of parasitic peaks at long wavelengths directly impacts the detection performance of the partitions. Indeed, a significant increase of parasitic components is observed beyond 800 m, causing the detection algorithm to be perturbed by a non-geophysical signal. For this reason, the detection limit of the partitions is set to 800 m (Fig. 1). This extension reduces the artificial rebound observed around 400–450 m (Fig. 1, blue curve), previously induced by the truncation at 500 m, leading now to a more representative distribution.

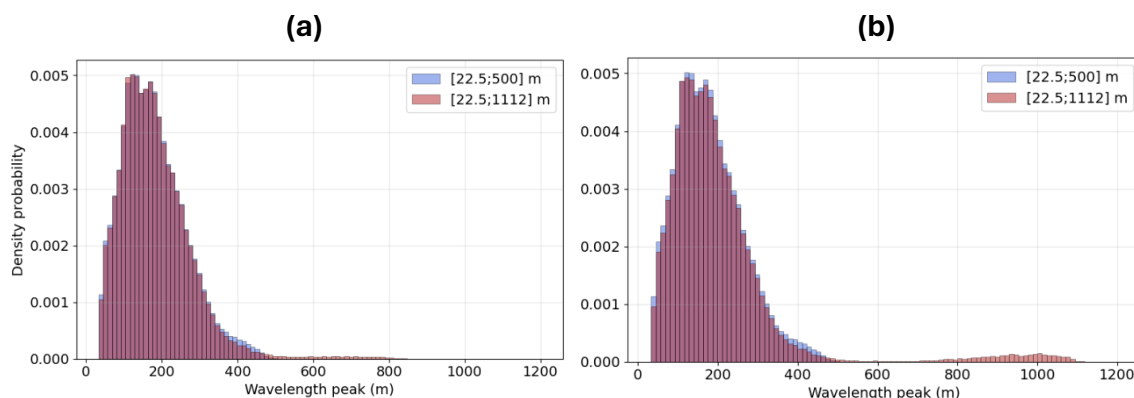


Figure 1: Distribution of peak wavelength for partitions 1 with the slope spectrum extended to 1112 m in red with (a) limit at 800 m and (b) limit at 1112 m compared to a slope spectrum limited to 500 m in blue.

The extension of the slope spectrum to 1112 m, combined with a limitation of partitions to 800 m, is a compromise to maintain consistency between the partitions calculated to date (i.e. slope spectrum and partitions limited to 500 m) and the partitions now detected on the extended spectrum. Figure 2 shows the partition matching between two datasets (actual [22.5;500] m and new [22.5;1112] m). The matching is based on the following criteria: overlap > 60%, wave direction difference < 15°, and wavelengths of both partitions within one spectral wavenumber step.

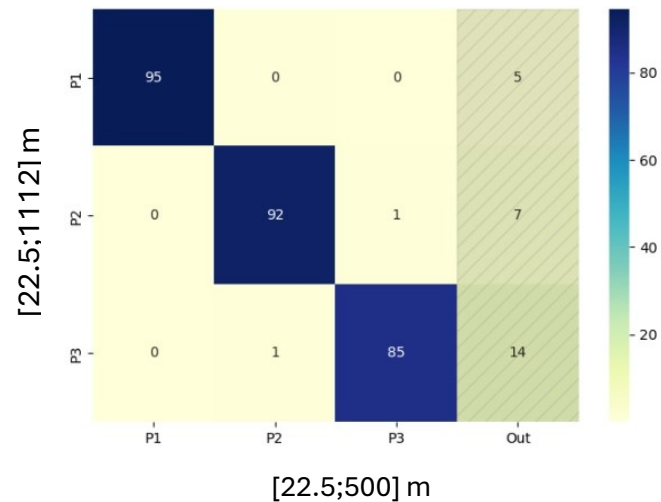


Figure 2: Partitions matching between a dataset [22.5;500] m and [22.5;1112] m.

The differences between the two versions remain limited, with partitions 1 and 2 exhibiting a correspondence greater than 90%.

The filtering currently implemented to attenuate parasitic peaks is optimized for the wavelength range [22.5; 500] m and is coherent until 800 m. Therefore, this does not yet effectively suppress those observed at longer wavelengths. A study is ongoing to define a new filtering method aimed at improving performance over the extended range [22.5; 1200] m to ultimately extend the detection range of partitions from 800 m to 1112 m.