



# Improved L3 KaRIn calibration with version 3: better calibration of systematic errors and reduction of geophysical error absorption (SSB, tides)



## Introduction & Objectives

The images provided by KaRIn can be biased or skewed by a few centimeters to tens of centimeters. The main sources of these errors are an uncorrected satellite roll angle, interferometric phase biases and thermo-elastical distortions in the instrument baseline and antennas. To mitigate these topography distortions, a calibration mechanism based on the interferometric phase or topography data itself is applied. Level-3 product is part of SWOT Science Team DESMOS project led by P-Y Le Traon.

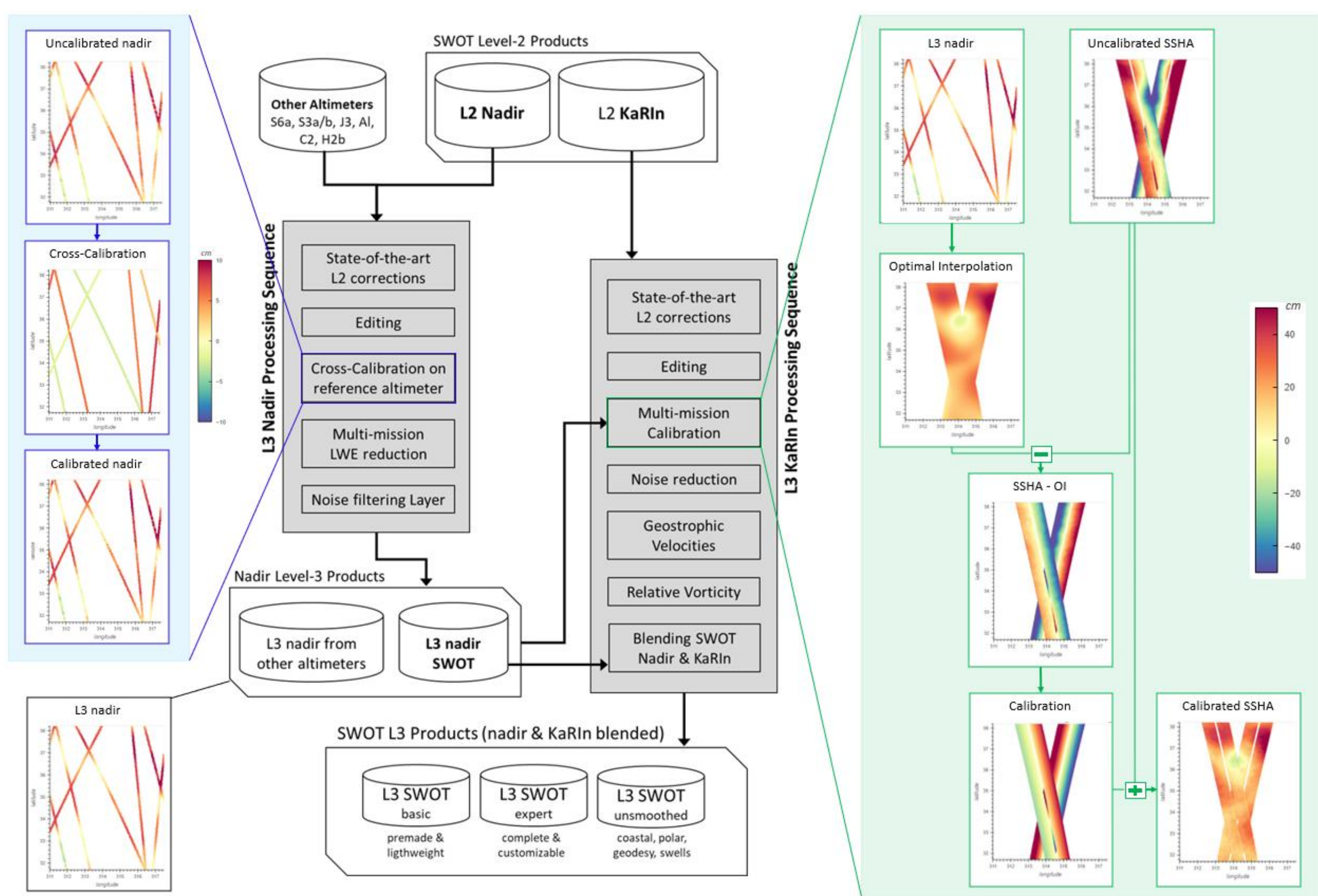


Figure: Overview of the Level-3 algorithm and datasets



## Methodology Overview & Data

Improvements to the calibration algorithm have been made for version 3 of the KaRIn L3 product. The major changes are the addition of harmonics at the daily frequency and the addition of optimal interpolation for the roll term.

The calibration provided in the Expert product is the sum of the low-frequency and high-frequency corrections. In the technical product, a calibration containing only the low-frequency correction is provided. This calibration corrects systematic errors less effectively but avoids the absorption of geophysical correction residues and may be useful for certain applications.

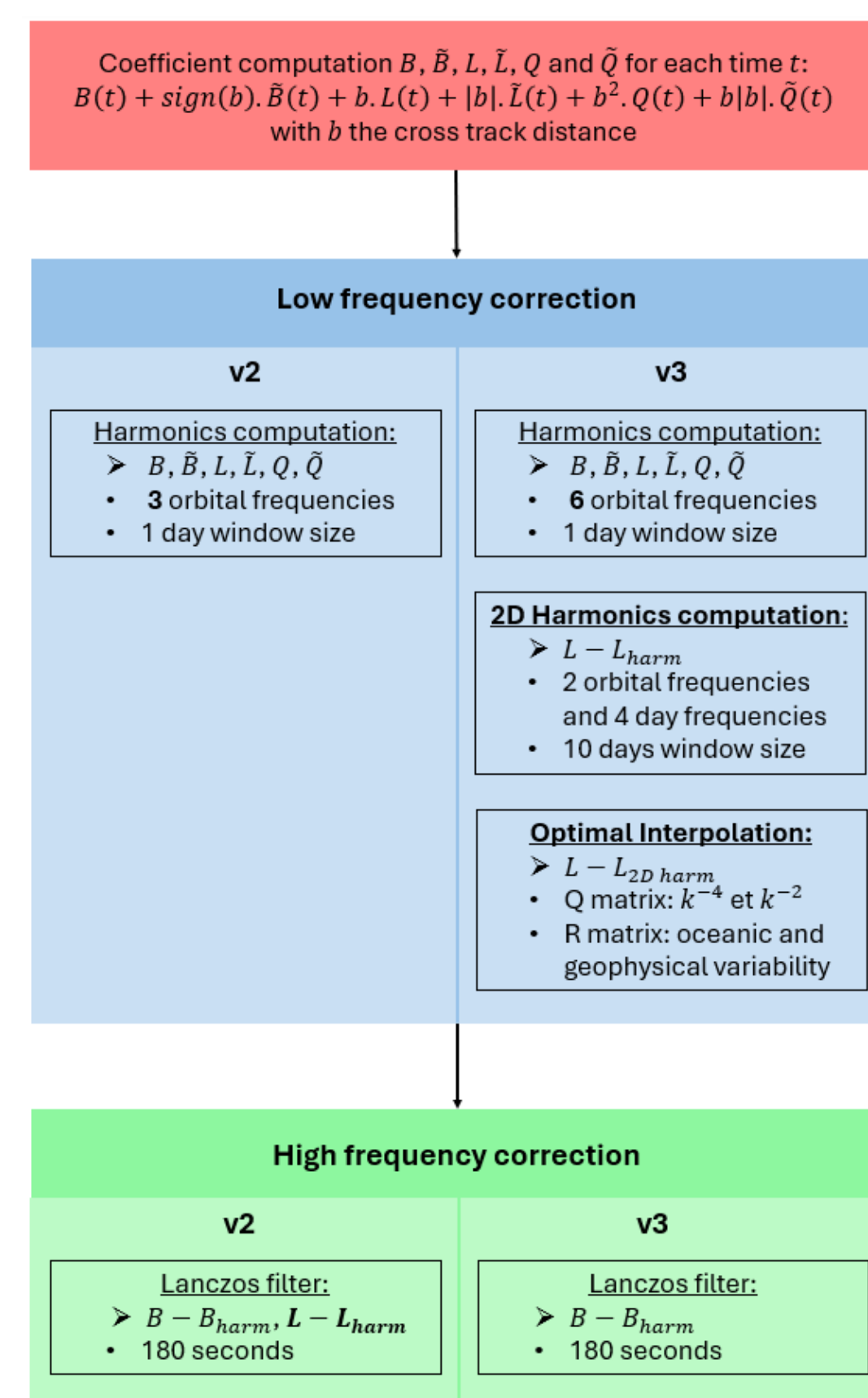


Figure: Overview of v2 and v3 calibration algorithm



## Improvement in the calibration of systematic errors

One altimeter (Sentinel-3a) is excluded from the calibration computation in order to preserve independent data for comparing v2 and v3 algorithms. On average, L3 KaRIn v3 calibrated SSHA is more consistent with L3 Sentinel-3a filtered SSHA at the crossovers than SSHA calibrated with v2 algorithm. Better consistency between KaRIn SSHA and Sentinel-3a SSHA indicates that the v3 algorithm is better at correcting systematic errors than v2.

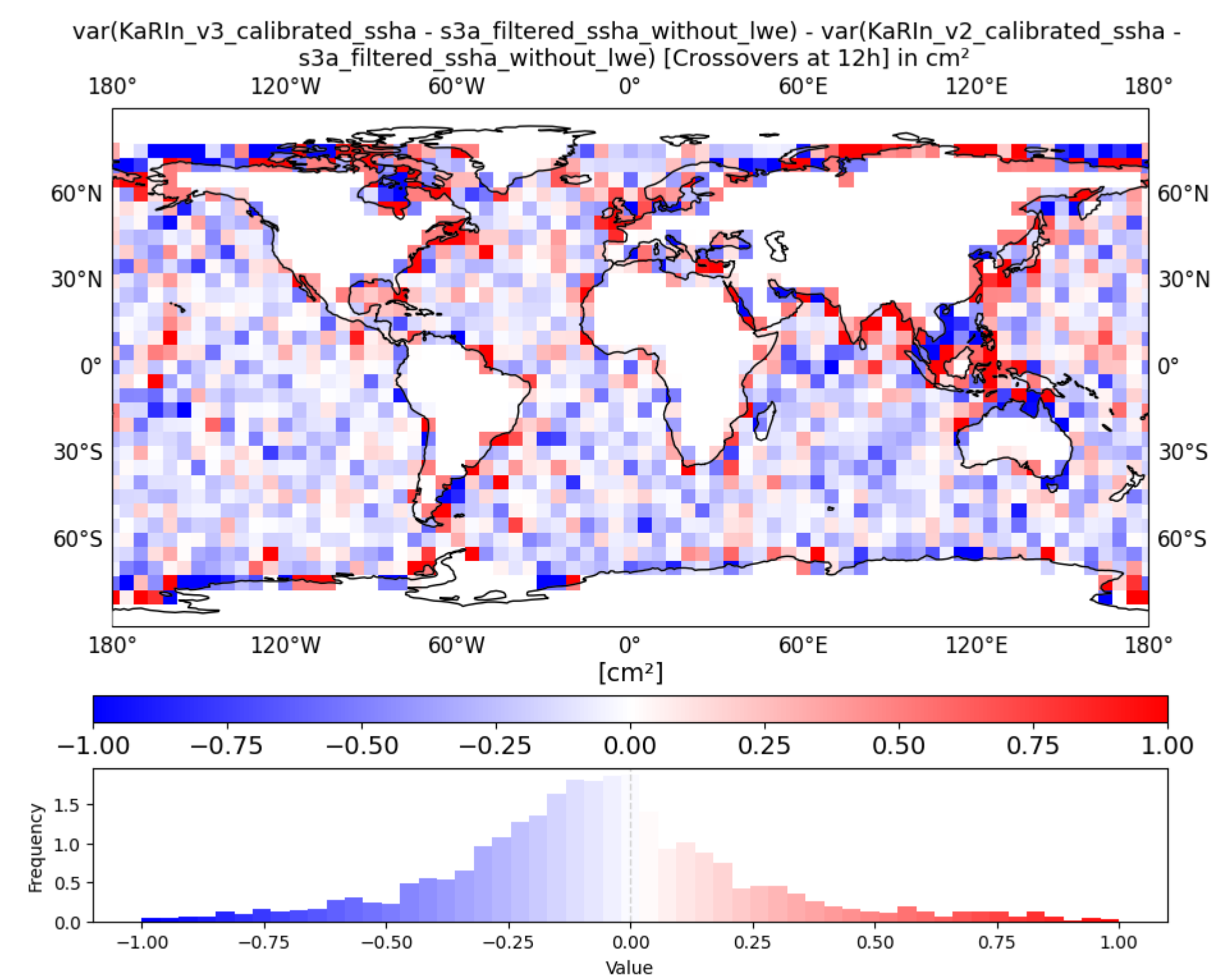


Figure: Comparison from L3 v2 and v3 KaRIn calibrated SSHA to L3 Sentinel-3a (s3a) filtered SSHA not used in the calibrations



## Reduction in absorption of Sea State Bias in the low frequency calibration

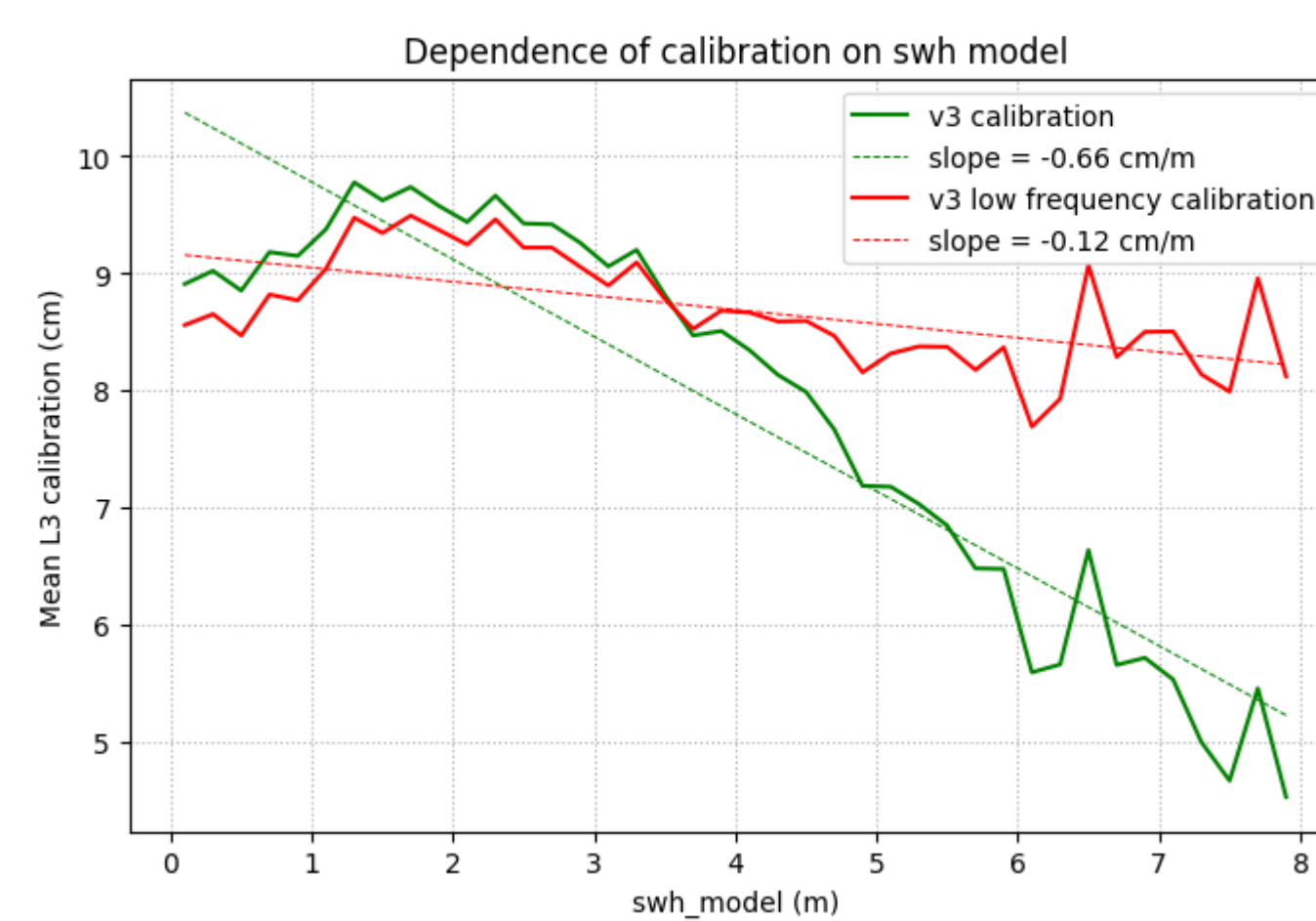


Figure: Dependence of averaged calibration on sw\_h model for L3 v3 and v3 low frequency calibrations

Calibration aims to remove systematic errors that are not related to ocean conditions. In principle, calibration should be independent of Sea Weight Height (SWH). In practice, calibration absorbs errors from geophysical corrections such as Sea State Bias (SSB). This absorption is visible with an averaged v3 calibration that has a slope of -0.66 cm per meter of SWH. On the other hand, the low frequency v3 calibration available in the technical product is a calibration that absorbs less SSB with a greatly reduced slope.



## Reduction in absorption of Tides in v3 calibration and especially in v3 low frequency calibration

V2 calibration absorbs tidal residue signals: it contains a signal with an amplitude of 1.8 cm at the M2 frequency in the English Channel. V3 calibration and, above all, v3 low-frequency calibration absorb less tidal signal, with an M2 amplitude of 1.1 cm in the English Channel for v3 and 0.4 cm for v3 low-frequency one.

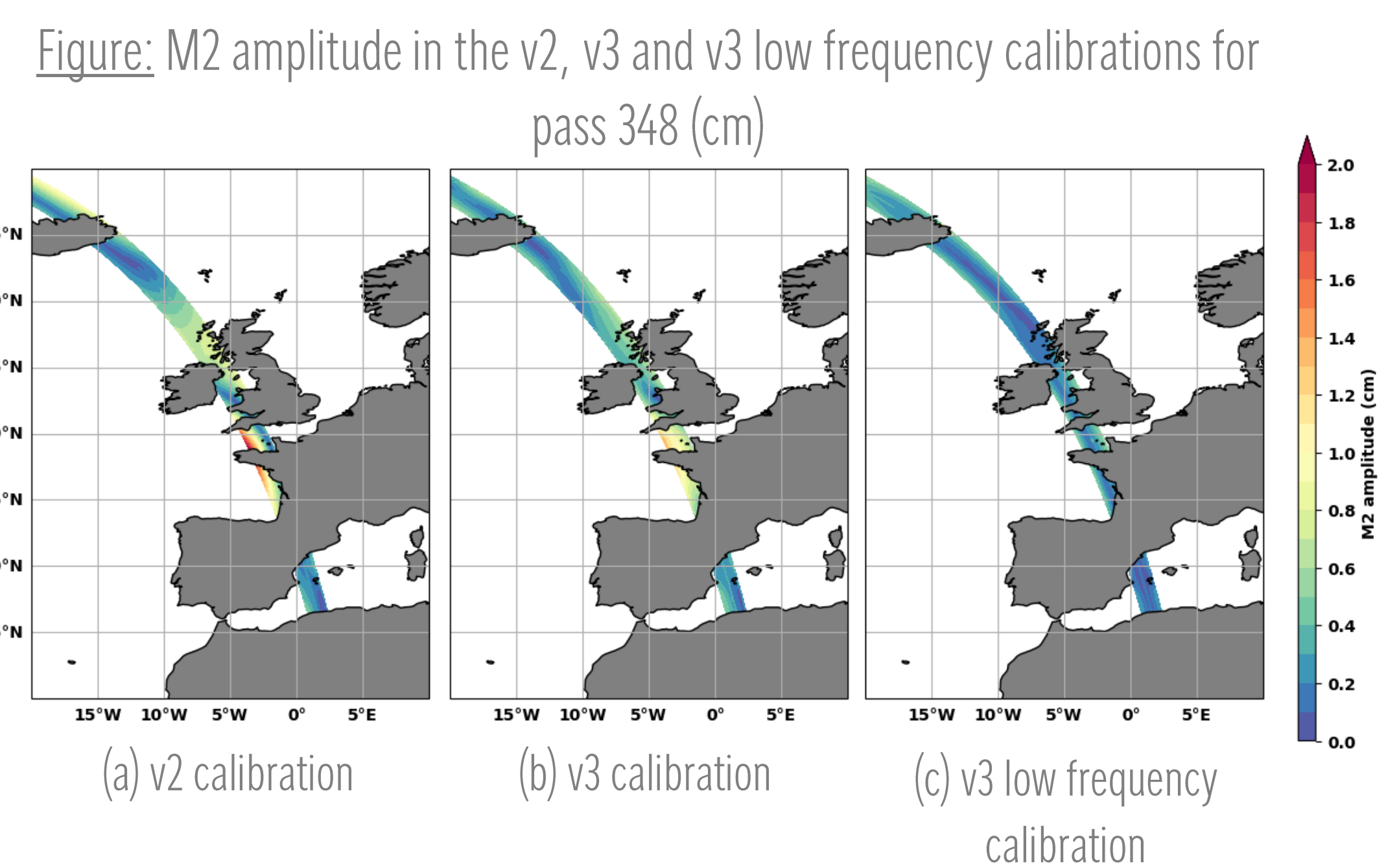


Figure: M2 amplitude in the v2, v3 and v3 low frequency calibrations for pass 348 (cm)

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SWOT KaRIn Calibration Algorithm: principle, updates and analysis of the absorption of geophysical corrections residues such as tide and sea state bias

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