Comparison of non parametric estimates of TOPEX A, TOPEX B and JASON 1 Sea State Bias

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The following figures present different results on JASON 1 sea state bias. The aim is to provide a methodology to better assess Ku and C band sea state bias and consequently calibrate the dual frequency ionospheric correction. All the results are preliminary ones and need to be confirmed with GDR products, new JMR calibration and software evolutions. All the estimations presented here are performed with crossover data computed from the IGDR products.

The dual-frequency ionospheric correction is obtained assuming a given difference between the Ku and C band sea state biases. Therefore, unsurprisingly, the difference between the Ku and C-band SSB estimates is almost exactly the SSB difference imposed for computing the dual frequency ionospheric correction.

An alternative method is proposed to evaluate the SSB difference between Ku and C band. We use the composite sea state bias which is the following combination of Ku band SSB and C band SSB:

$$SSB_{(Co)} = 1.18 \times SSB_{(Ku)} - 0.18 \times SSB_{(C)}$$

It is derived from the SSH equation in Ku band and from the dual frequency ionospheric equation:

$$SSH = H - R(Ku) - SSB_{(Ku)} - I(Ku)$$

$$I(Ku) = 0.18 \left[ R(Ku) + SSB_{(Ku)} - R(C) - SSB_{(C)} \right]$$

$$SSH = H - (1.18 \times R(Ku) - 0.18 \times R(C)) - (1.18 \times SSB_{(Ku)} - 0.18 \times SSB_{(C)})$$

Using SSB_{(Co)} for the SLA determination provides an interesting approach since the ionospheric correction is no longer needed. For the sea state bias aspect, it gives an estimate independent of the ionospheric correction. Combined with a Ku band estimate, it allows to obtain a C band sea state bias estimation.

The following figures provide an overview of the evolution of the sea state bias on TOPEX altimeter side A and B. Three different periods have been processed with three different data sets for the SSB estimation. The non parametric technique is used for each data set with identical smoothing parameters. TOPEX A (cycles 21-131 and 132-235) shows good agreement between the 3 estimates whereas TOPEX B presents strong differences, especially between crossovers and collinears. Furthermore, whatever the data set used, the sea state bias is different between side A and B.

The Ku band sea state bias for JASON 1 has been estimated from IGDR products with cycles 3 to 13. The figure below shows the SSB variation with wind speed and significant wave height. The sea state bias for JASON 1 will have to be estimated with GDR data and new JMR calibration.

The difference between composite SSB and Ku band SSB multiplied by a constant provides the difference between Ku and C band sea state bias. The difference is mainly a function of SWH with little wind speed dependence. The difference lies between 1 cm and 12 cm which is roughly the expected magnitude between Ku and C band for the SSB.