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

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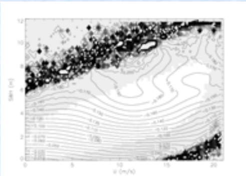
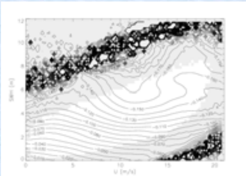
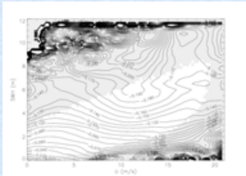
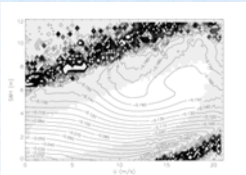
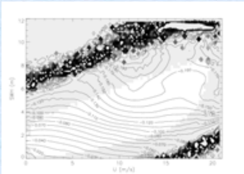
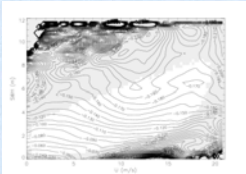
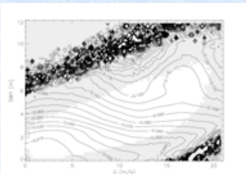
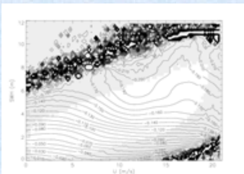
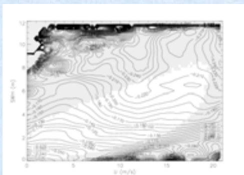
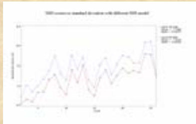
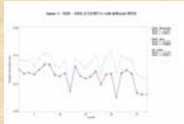
The following figures provide an overview of the evolution of the sea state bias on TOPEX altimeter side A and B. Three different periods have been processed with three different data sets for the SSB estimation. The non parametric technique is used for each data set with identical smoothing parameters. 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.

	Crossover estimation	Collinear estimation	SSH-MSS estimation
TOPEX A 21-131			
TOPEX A 132-235			
TOPEX B 240-350			

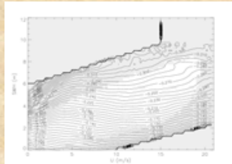
The following figures present different results on JASON 1 sea state bias. The aim is to provide a methodology to better asses Ku and C band sea state bias and consequently calibrate the dual frequency ionospheric correction. All the results are preliminary ones and need to be confirmed with GDR products,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

Ku band SSB for JASON 1





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.



Ku band SSB, Cycles 3-11

The figure on the left shows the impact of this new sea state bias on the crossover standard deviation compared to the SSB provided in the products. The sea state bias computed from Jason data decreases significantly crossover standard deviation.
The figure on the right presents the SLA standard deviation without correcting for the sea state bias and when applying the non parametric SSB and a parametric BM4 fitted on JASON 1 data. The SLA standard deviation is slightly lower with the non parametric SSB than with the BM4 model.

Ku band and composite SSB for JASON 1

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 independent ionospheric correction is thus needed to correctly assess the SSB difference between Ku and C band. The figure below presents Ku band SSB estimated using Doris ionospheric correction. The SSB difference between an estimate with Doris ionospheric correction and one with the dual frequency correction on the same dataset varies between 2 mm and 8 mm.

Another 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 :

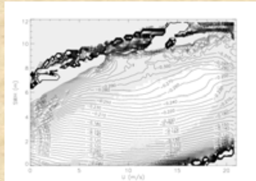
$$SSB(Co)=1.18 *SSB(Ku) - 0.18 *SSB(C)$$

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

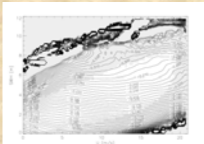
$$SSH = H - R(Ku) -SSB(Ku) - I(Ku)$$
$$I(Ku) = 0.18 *[R(Ku) + SSB(Ku) - R(C) - SSB(C)]$$

$$\Rightarrow SSH = H - (1.18*R(Ku)-0.18*R(C))-(1.18*SSB(Ku) -0.18*SSB(C))$$
$$SSH = H - R(Co) - SSB(Co)$$

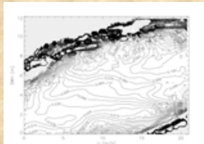
Using SSB(Co) for the SLA determination provides an interesting approach since the ionospheric correction is no longer needed. For the sea state bias aspect, it gives an estimate independent of the ionospheric correction. Combined with a Ku band estimate, it allows to obtain a C band sea state bias estimation.



Composite SSB, Cycles 2-11



Ku band SSB using Doris Ionospheric correction, Cycles 2-11



(Composite SSB - Ku band SSB)/0.18 = SSB(Ku) - SSB(C)

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.

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