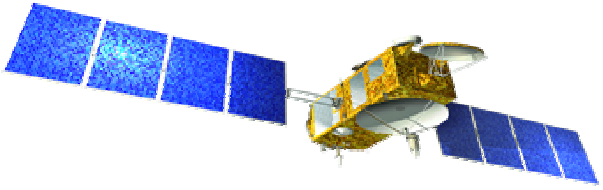


Results in TOPEX and JASON 1 sea state bias with the non parametric technique

S. Labroue, J. Dorandeu, M. Ablain, J. Savaresse and P. Gaspar

Status on Jason-1 SSB

- The SSB is estimated from 3 different data sets, using GDR for 2003 (1-37) :
  - crossover SSH differences
  - collinear SSH differences
  - direct measurements : along track residuals (SSH-MSS)

  => we observe significant differences between the 3 models derived from these data sets, which is not the case with other missions (TOPEX, ENVISAT, GFO).

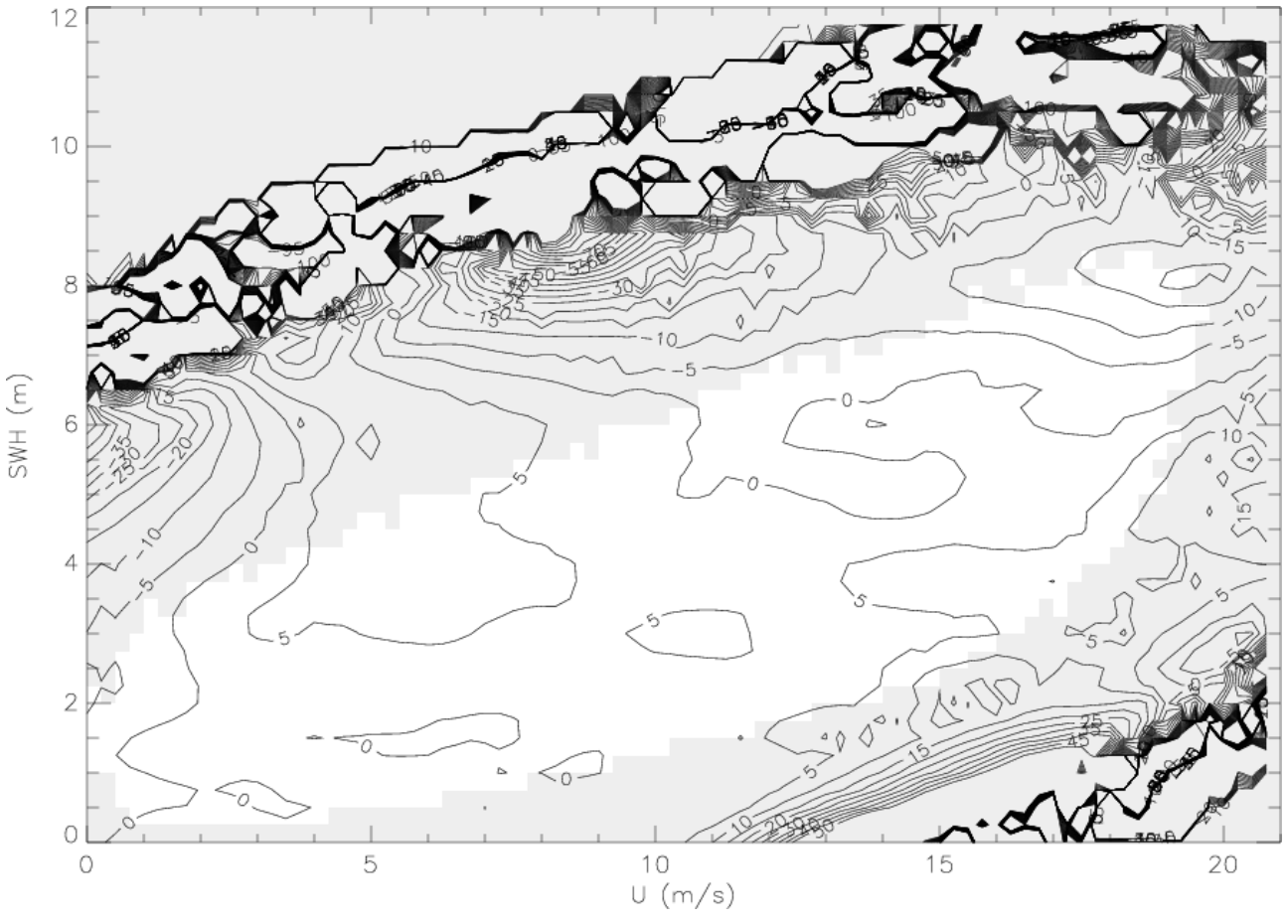
  => several types of errors have been tested without any success.

  => it is difficult to recommend strongly one model among others.

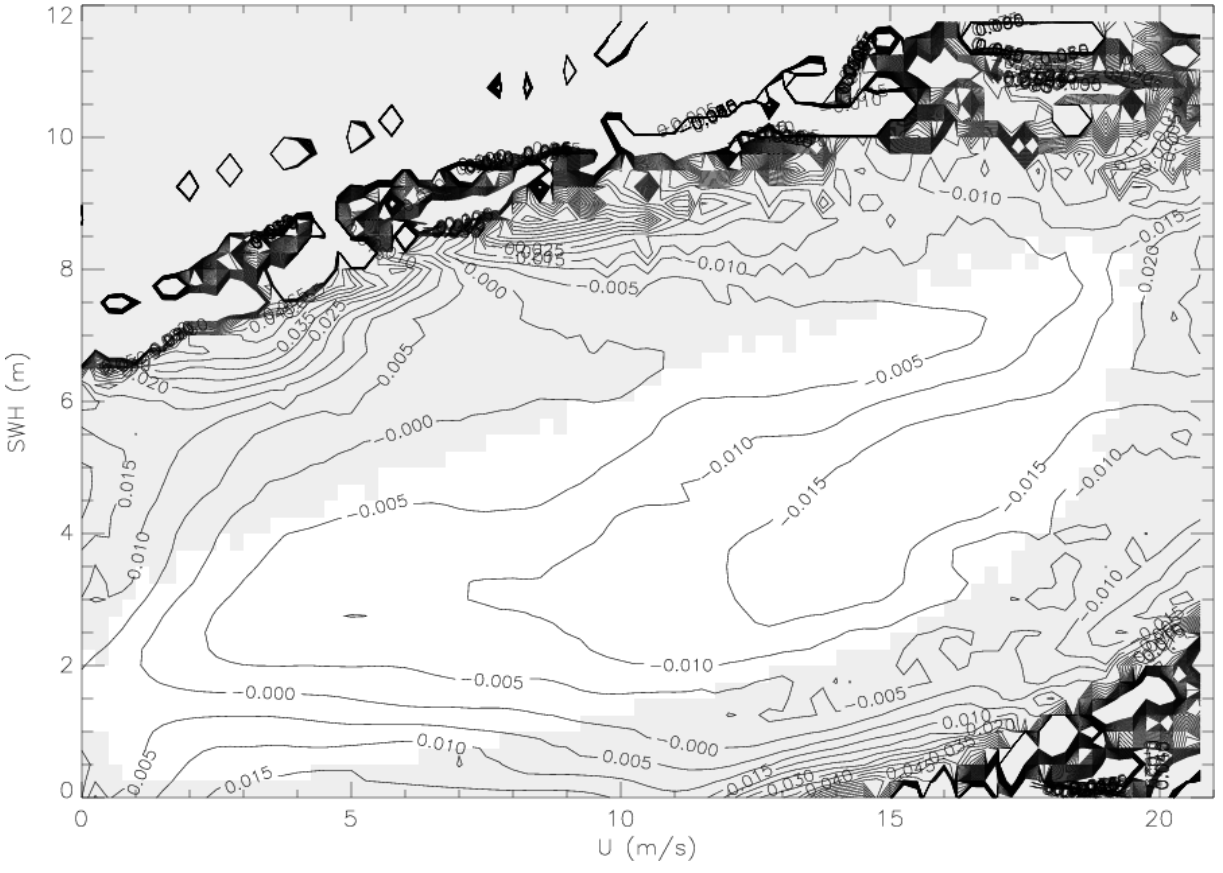
- The second aspect is the difference of magnitude between TOPEX and Jason-1 SSB

=> Results on Jason-1 SSB
=> Comparison between Jason-1 and TOPEX SSB
=> Proposition of a new SSB model for Jason-1 consistent with the next GDR version

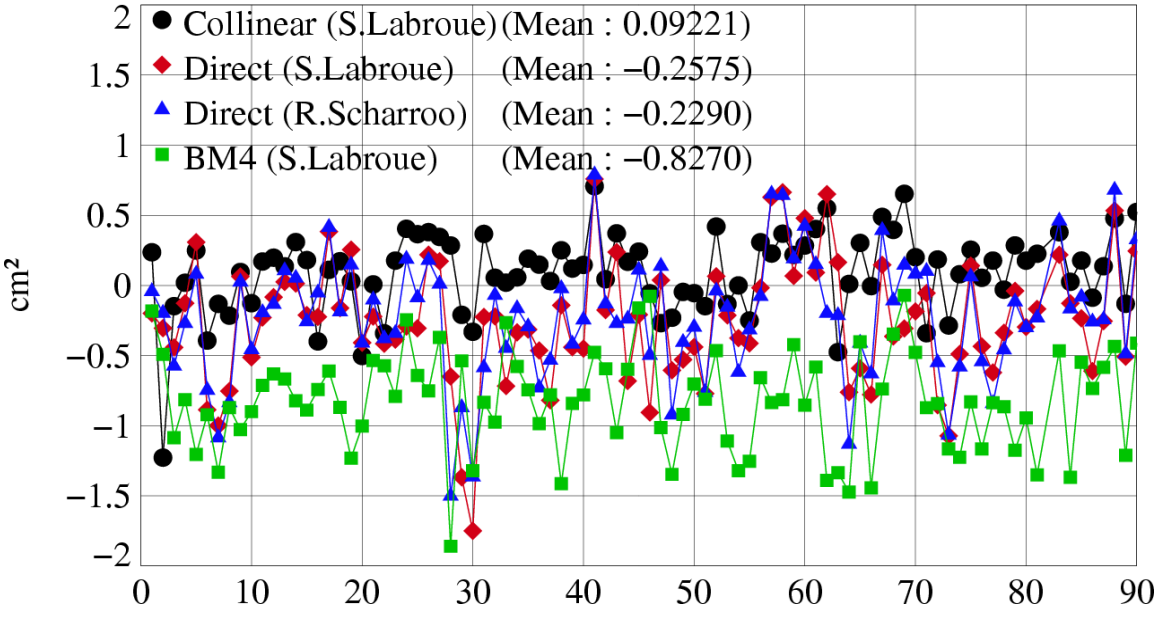
Collinear SSB – Crossover SSB



Collinear SSB – Direct SSB



Variance gain of SSB models at crossovers

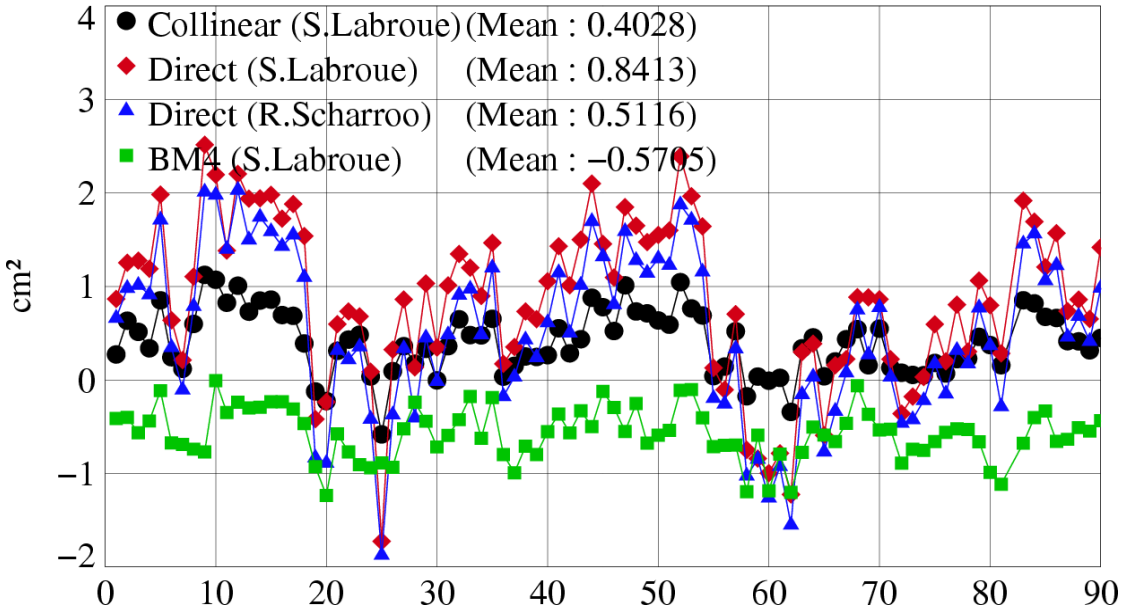


Several SSB models are compared to the GDR SSB in terms of variance gain on crossover SSH.

For the collinear and direct SSB, it is an independent data set.

- The BM4 model does not improve the variance although it has been fitted on crossovers. It is due to the limitations of a parametric model.
- The collinear SSB exhibits the largest variance reduction compared to the other direct models.
- Both direct models give the same performances, despite the U/sigma0 formulation.

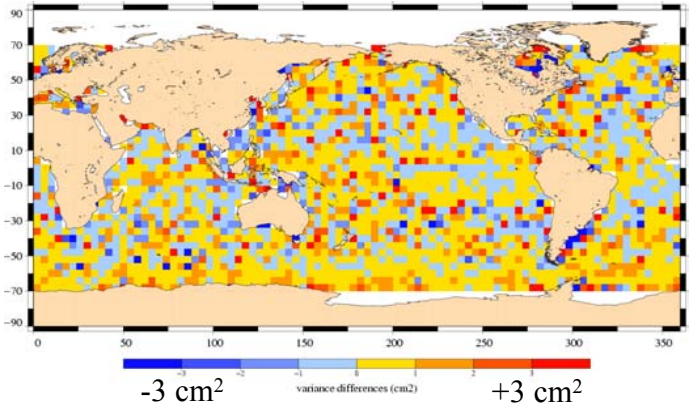
Variance gain of SSB models along-track

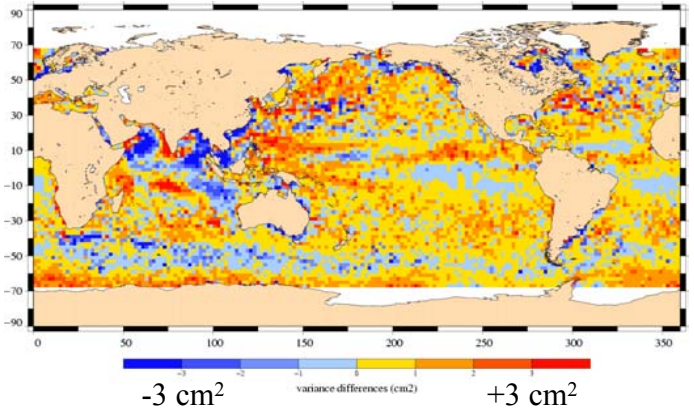


Several SSB models are compared to the GDR SSB in terms of variance gain on SLA.

- The BM4 model does not reduce the variance.
- Both direct models give better variance reduction. It is expected since they have been fitted on this data set.
- The direct SSB models seem more correlated with oceanic signals than the collinear SSB.

Variance gain, Cycles 1-90
Variance(SSB_Direct) - Variance(SSB_Collinear)





SLA

Crossover = independent data set

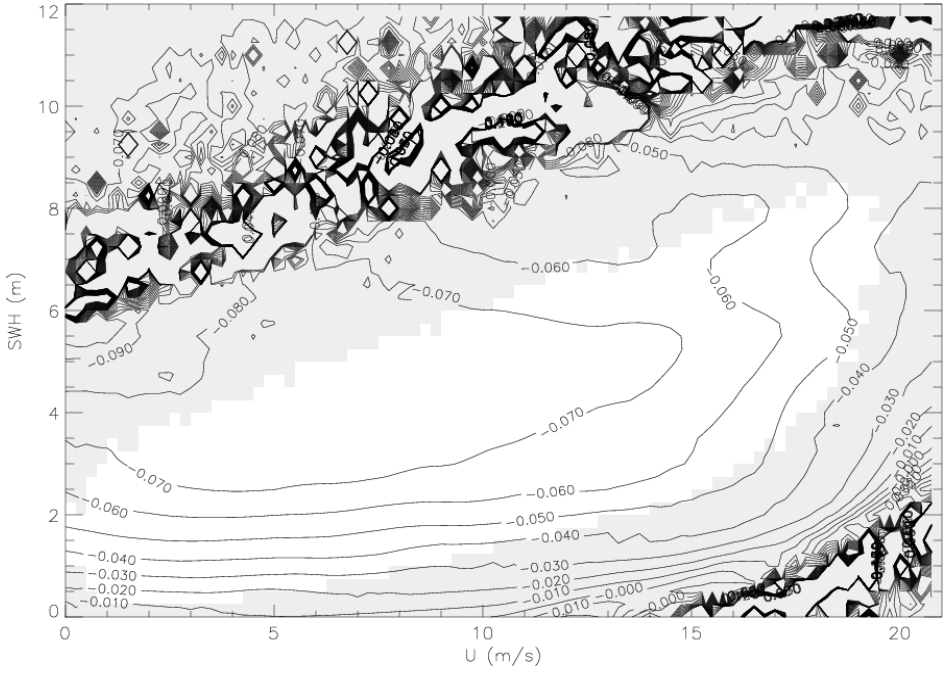
The map of the variance difference is quite homogeneous at crossovers and shows that the collinear SSB decreases the variance in most of the regions.

The difference of variance is more correlated with oceanic variability.

The variance reduction is mainly due to the collinear SSB, except for some regions (circumpolar current, coastal regions, Indian ocean). All these regions disappear on the crossover map.

=> The direct SSB seems more correlated to oceanic variability than the collinear SSB.

Results for TOPEX SSB



Crossover side A - Crossover side B

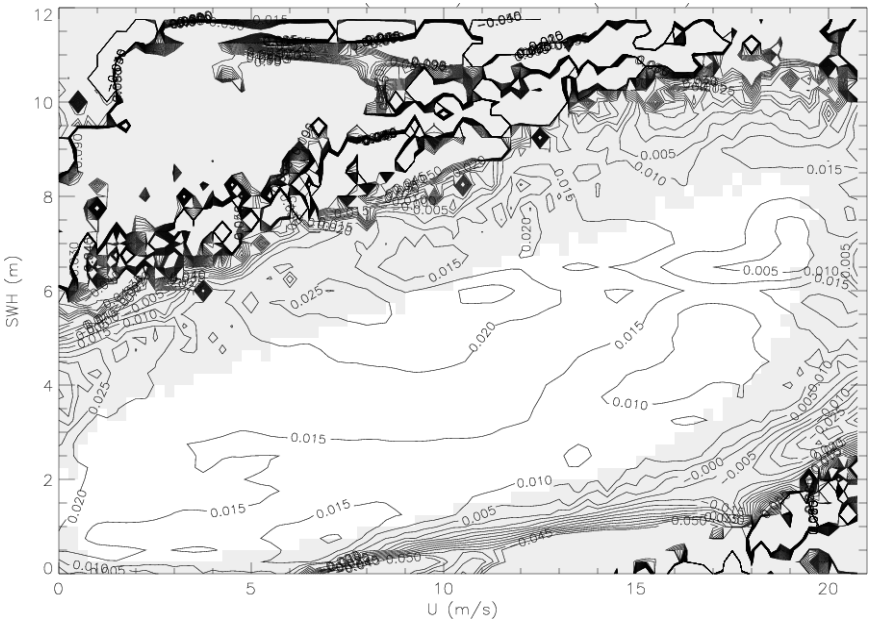
Crossover SSB for TOPEX B exhibits large errors compared to the side A estimate. This behaviour comes from the change of sign between ascending/descending/north/south SSH (detected by the change of sign of the pseudo time tag bias between side A and side B)

=> Selection of collinear SSB to avoid these effects

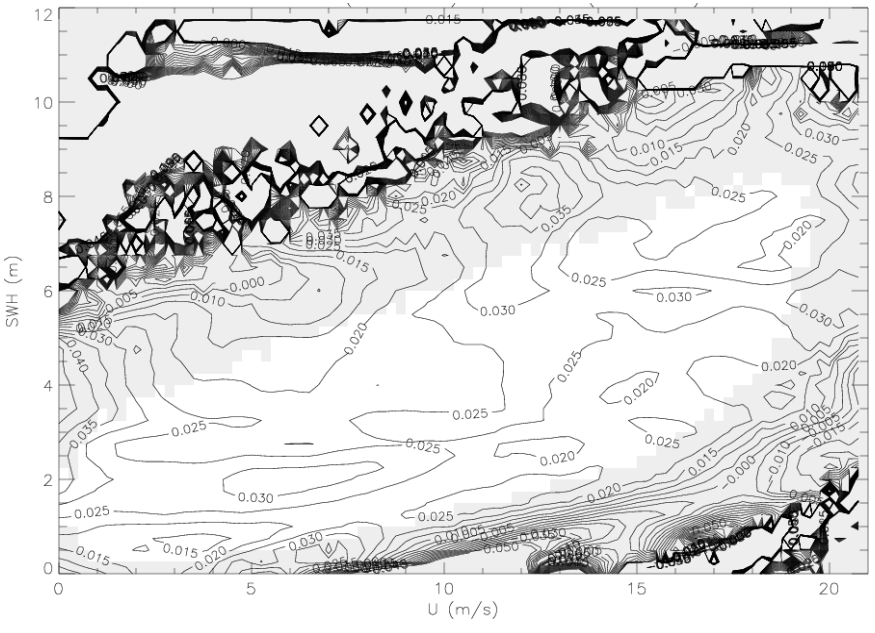
SSB differences : Collinear SSB – Direct SSB

The difference between collinear and direct SSB exhibits a very good agreement for TOPEX A.

The difference for TOPEX B behaves as ionospheric correction for low waves.

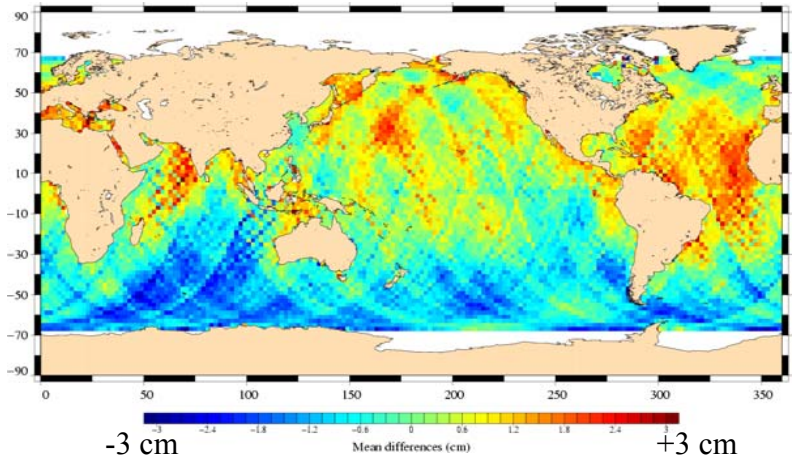


TOPEX A

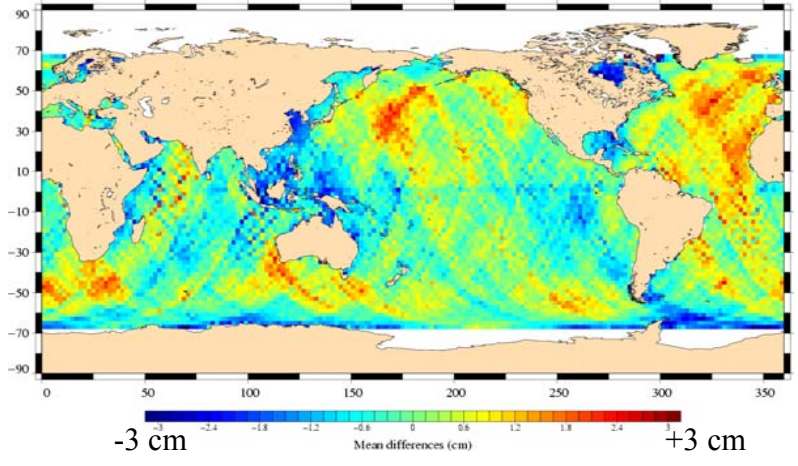


TOPEX B

Jason-TOPEX residuals, Cycles 1-21



Collinear SSB on both missions.



Direct SSB (R. Scharroo) on both missions

The North/South orbit error is still present on the left map, whereas it disappears when correcting TOPEX and Jason-1 with direct SSB models.

SSB model for next GDR version

- The difference between MLE 3 and MLE 4 retracking shows no difference on the SWH dependence.
  => the SSB values are independent from the retracking algorithm
  => the SSB for a future version of retracking (MLE 3 or MLE 4) can be deduced from the distributed GDR products

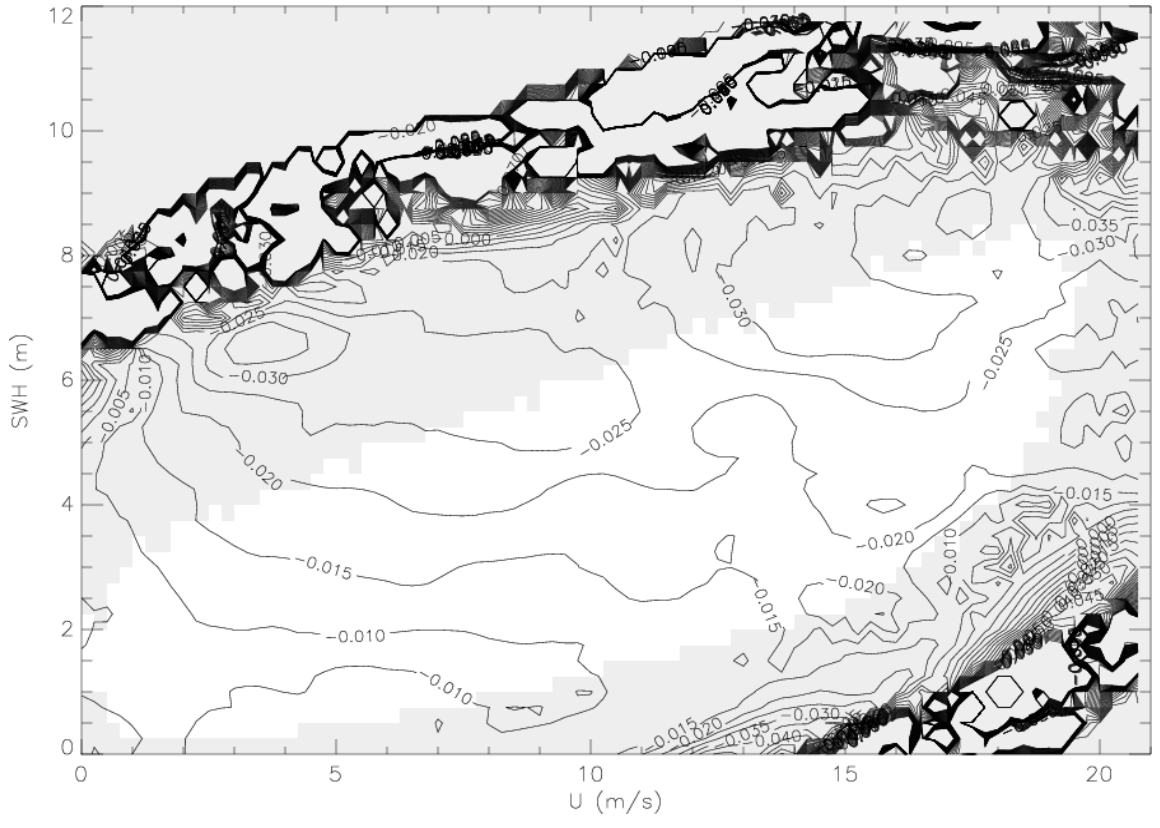
- SWH values are corrected for the suitable instrumental correction

- Range instrumental correction has been removed since it is constant along SWH

- These new SSB models still exhibit the same difference between collinear and direct SSB

Jason (New GDR) – Jason (GDR), Collinear SSB

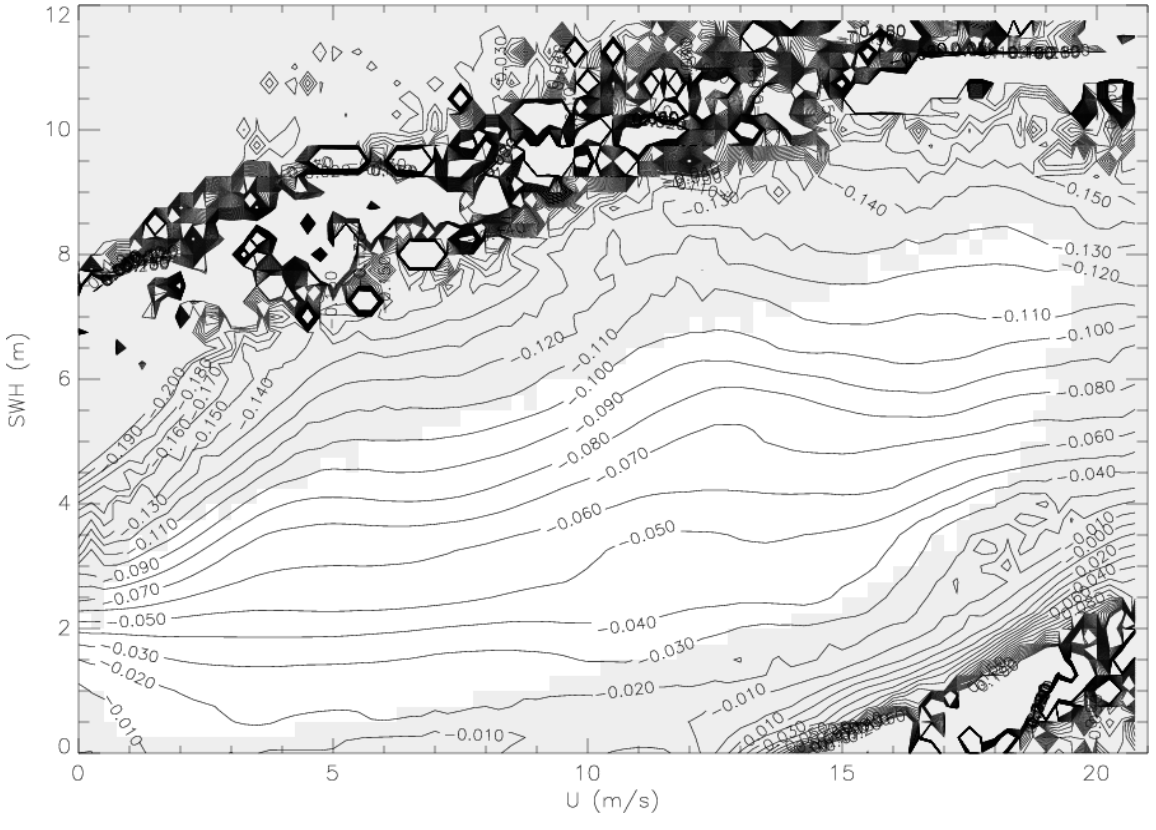
2cm



Jason (New GDR) – TOPEX, Collinear SSB

9 cm

=> 1.5% of SWH



SSB results for several missions

SWH (m)	U (m/s)	Jason-1 SSB (cm)	ENVISAT SSB (cm)	GFO SSB (cm)	TOPEX B SSB (cm)
2	7	-11.5	-12	-11	-8
4	2	-22	-20.5	-19	-11.5
4	12	-21	-23	-24	-16
6	15	-26	-29	-32	-18
8	18	-30	-35	-36	-19.5

Conclusions

- From the methodological point of view
  - The collinear method gives better results for the variance reduction globally and also spatially.
  - The direct method seems to be more correlated to oceanic variability.
  - The direct method is more sensitive to systematic geographically correlated signals whereas the SSH differences are more likely to reduce or cancel these signals.
  - The direct method seems to remove an error we know to be due to orbit error whereas the collinear SSB does not remove it.
  - Through the comparison with TOPEX SSB along SWH and U, the collinear SSB gives a difference with TOPEX more regular, especially for low waves.

    => we recommend the SSB model fitted from collinear differences

- New SSB model recommended for the next GDR version
  - Considering previous performance results, the new model is estimated from collinear SSH differences.
  - The new model increases the SSB magnitude of 0.3 % of SWH, for waves greater than 2 m.

- Differences between TOPEX and Jason-1 SSB
  - The difference is about 1.5 % of SWH for waves ranging from 2 m to 8 m, when correcting for the suitable instrumental corrections.
  - Zanife et al (2003) have shown that this difference is due to tracker bias difference between both altimeters and that this difference is close to 2 % of SWH.
  - The magnitude of Jason-1 SSB is in agreement with the one obtained on GFO, ENVISAT, Poseidon-1 and ERS-2.