A second look at dual-frequency altimetry

Work in Progress
(A bit of a rush job I'm afraid, but an indication of the work I will be doing. Please stop me and ask for a better explanation!)

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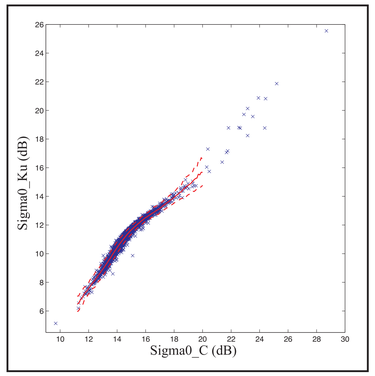
The title 'A second look ...' refers not only to the fact that TOPEX and Jason are viewing the same points nearly simultaneously, but also that I'm making a quick reprise on earlier programs and work. Most of the basic ideas are already published in the following papers:

Quartly G. D., M. A. Srokosz and T. H. Guymer, 1999: Global precipitation statistics from dual-frequnecy TOPEX altimetry, *J. Geophys. Res.*, **104**, 31489-31516. (see especially the Appendix)

Quartly G. D., 2000: Monitoring and cross-calibration of altimeter σ^0 through dual-frequency backscatter measurements, *J. Atmos. Oceanic Tech.*, **17**, 1252-1258.

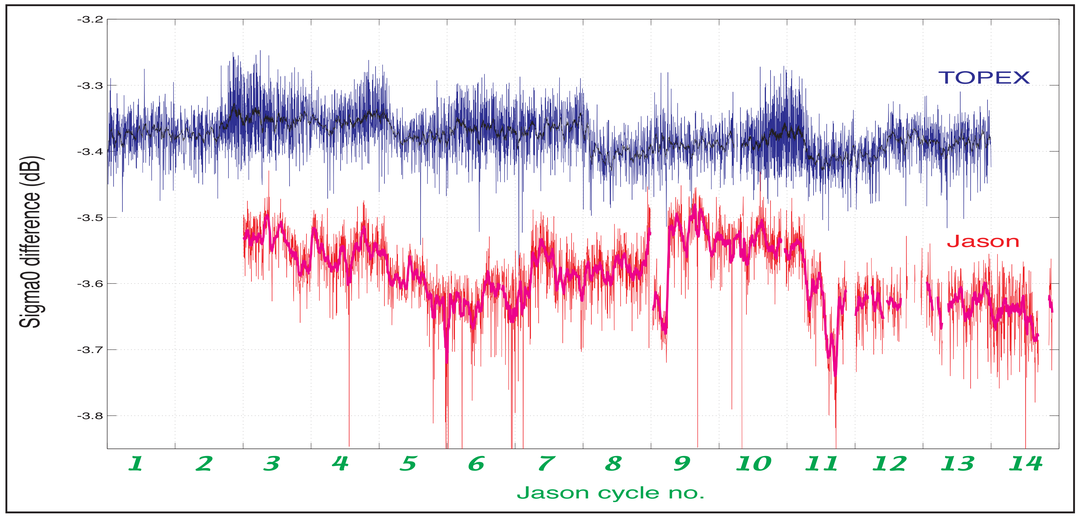


Yes, the usual starting point for my work — a scatter plot of σ^0_{Ku} versus σ^0_C (in this case, the illustration is from TOPEX cycle 344). The blue crosses mark a subset of the points, and the red lines give the mean relationship and ±1 std. dev. about that mean. Rain will be manifested by σ^0_{Ku} values significantly below the mean line.

Alternatively, the same information may be better represented by i) histograms of the number of observations, ii) the departure from $\sigma^0_{Ku} = \sigma^0_C$, and iii) the std. dev. of the scatter about the mean.

Monitoring performance σ^0

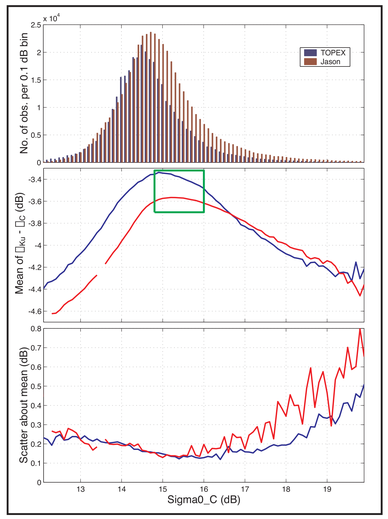
Close to the peak of the sigma0 discrepancy curve, there is a near-constant offset between σ^0_{Ku} and σ^0_C. As this is in the most populous region of the histogram, there are many observations with σ^0_C between 14.8 dB and 16.0 dB (highlighted by the green box). Thus for each pass, I can find the mean value of σ^0_{Ku} - σ^0_C for points with σ^0_C in that range.

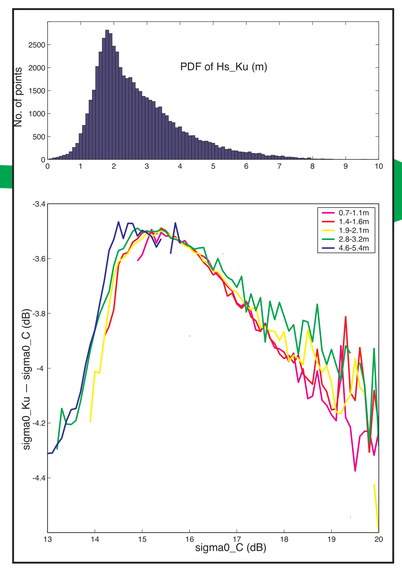


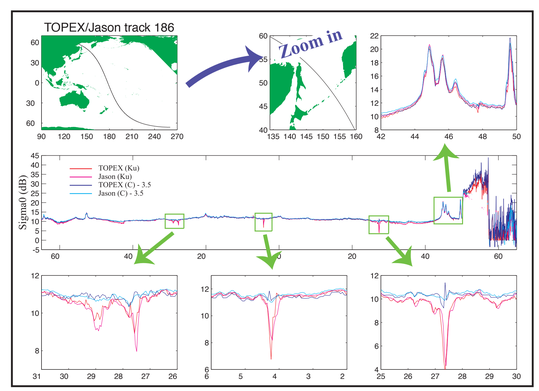
Observations of σ^0 changes

The blue (red) lines show the mean offset at the peak for TOPEX (Jason), and the black (pink) are the results for smoothing by a 13-point filter.

The relative offset between σ^0_{Ku} and σ^0_C seems more stable for TOPEX than Jason; this analysis cannot show whether the variations in performance are in the C- or Ku-band.







Rain work at last!

The middle plot in the upper panel to the left shows the near-simultaneous values of σ^0 for TOPEX and Jason along one particular pass. I assume many other people will be looking at the σ^0 comparisons of the two satellites in general, or in 'rain-free' conditions, so I concentrate here on how well the sharp changes in σ^0 match-up.

The fourth case (top right) shows high σ^0 values in the sheltered waters (the locations do not coincide with islands). The other three examples show pronounced attenuation of σ^0_{Ku} by rain (with data from the MWR for one case shown in the lower panel). Also note that the C-band values for Jason do not seem to show the 'tracker response' noted for TOPEX.

Observations:

i) The Jason σ^0 values appear larger than for TOPEX; this is probably becuase due to an inconsistency in my treatment of the atmospheric correction.

ii) The two curves for $\Delta\sigma^0$ ('sigma0 discrepancy') as a function of σ^0_C have similar shapes, but peak in slightly different positions (again probably becuase of an inconsistency in treatment of atmospheric correction).

iii) The form for the scatter about the mean is very similar for TOPEX and Jason, but at low winds (high σ^0) the scatter for Jason appears greater than for TOPEX.

Preliminary investigation of how the sigma0 discrepancy curves vary with wave height for Jason. Behaviour seems similar to that published for TOPEX.