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Altimeter Data on a 1° x 1° Grid

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Introduction

In this report we provide a preliminary assessment of an altimeter derived 1° x 1° monthly mean wave height data set. This provides a higher spatial resolution than the more normal altimeter 2° x 2° monthly gridding scheme, the higher resolution was identified as necessary to enable investigations of wave climate variability in the seas around the UK coastline.

Altimeter Data

It is clear that one altimeter alone is unable to provide satisfactory monthly sampling (5 or more transects per month) of a 1° x 1° grid [*Cotton and Carter, 1994*]. Thus data from two (or more) altimeters must be combined. From the launch of TOPEX/Poseidon, September 1992, up to the present day we have continuous data from two satellites (TOPEX/Poseidon and ERS-1, then TOPEX/Poseidon and ERS-2) - and so we are able to generate a 1° x 1° monthly mean wave data set covering the period October 1992 to the present.

Monthly mean wave heights on a 1° x 1° grid have been separately generated from data from the individual altimeters. They have then been calibrated according to corrections derived in [*Cotton, 1998*], and combined. Weightings have been applied to the gridded means from each altimeter according to the number of transects of the grid square from each satellite.

Assessment

So far only a small subset of the final data set has been produced. Plates 1, 2 and 3 show the number of satellite transects per grid square over the December 1992, from TOPEX, ERS-1 and the combined altimeter data set. In plate 1 we can see that the TOPEX orbit results in some 1 degree grid squares receiving no sampling (dark blue, but that grid squares at the extreme northern limit of the TOPEX orbit receive ten or more transects in a month. ERS-1 provides a more sparsely, but perhaps more evenly sampled data set. Most 1° squares receive two or three transects. When the data from the two altimeters are combined we see that the vast majority of grid squares receive 5 or more transects, although there are gaps. Plate 4 provides a magnified view of the combined sampling around the UK, in figure 5 all squares with less than 5 transects have been coloured dark blue.

Firstly one should bear in mind that the pattern of sampled squares will alter slightly from month to month, as the most often used ERS-1 repeat cycle (35 days) is longer than one month. The TOPEX cycle repeats every 10 days, thus the only variability from month to month will be whether individual tracks experience three or four TOPEX repeat cycles.

The main purpose of this data set is to carry out an EOF variability analysis over the North Sea, English Channel and Western Approaches. We are already limited to a data set covering a period of 5 years and the EOF analysis requires continuous coverage of each grid square within this period. It is therefore important to devise a final gridding scheme which meets this requirement. The outstanding question is whether to simply use the 1° x 1° grid, and possibly relax the 5 transect constraint, or to combine together neighbouring grid squares in some regions to provide satisfactory coverage. It will be easier to answer this

question when ERS and TOPEX/Poseidon data for the whole period 1992-97 have been gridded and combined.

Conclusions

The final gridding scheme for the higher resolution EOF analysis of wave climate variability cannot be decided until the sampling throughout the whole of the 1992-97 period is established.

References:

Cotton, P.D., and D.J.T. Carter, 1994, Cross calibration of Topex, ERS-1, and Geosat wave heights. *J. Geophys. Res.*, 99, pp 25,025-25,033.

Cotton, P.D., 1998,'A Feasibility Study for a global satellite buoy intercalibration experiment', SOC research and consultancy report no. 26.

Plates

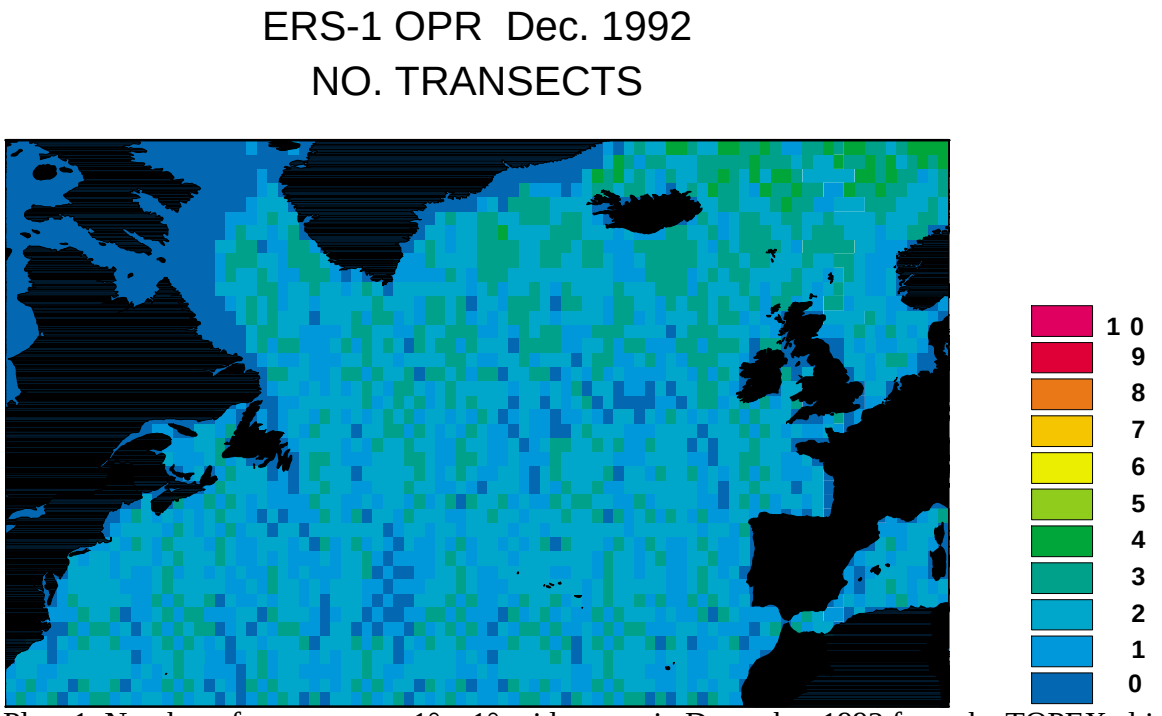

Plate 1: Number of transects per 1° x 1° grid square in December 1992 from the TOPEX altimeter.

TOPEX Dec. 1992
NO. TRANSECTS

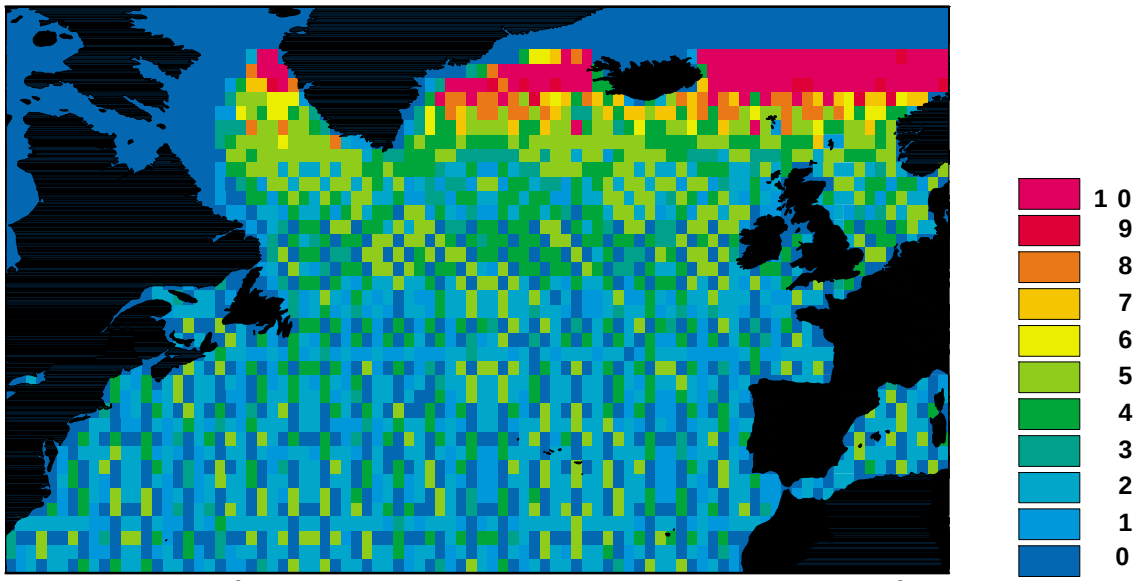

Plate 2: Number of transects per 1° x 1° grid square in December 1992 from the ERS-1 altimeter.

COMBINED E1 & TOP Dec. 1992
NO. TRANSECTS

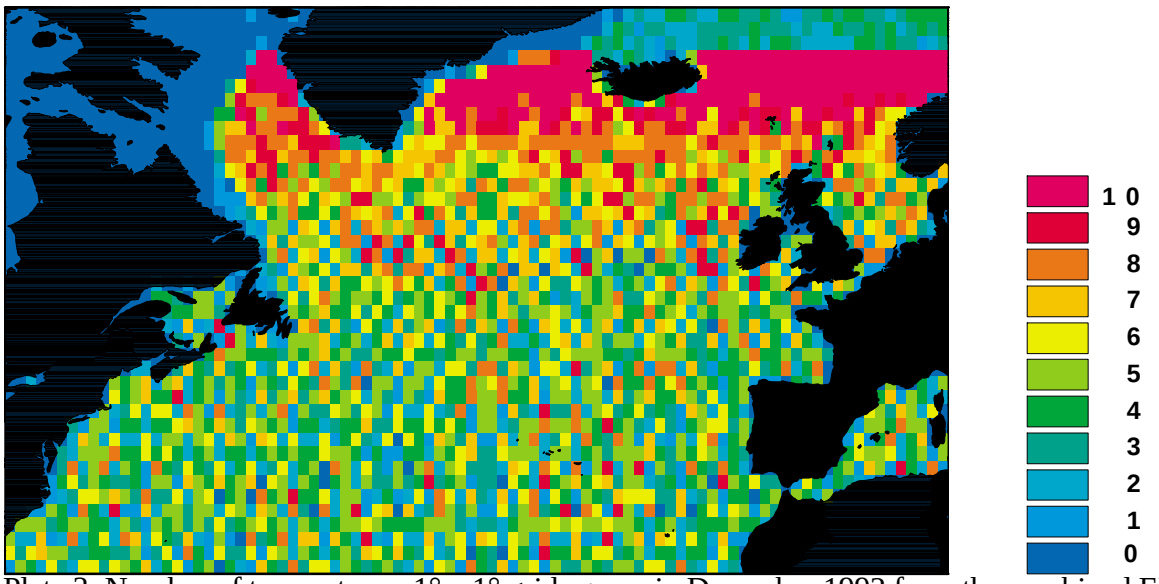

Plate 3: Number of transects per 1° x 1° grid square in December 1992 from the combined ERS-1 and TOPEX data set.

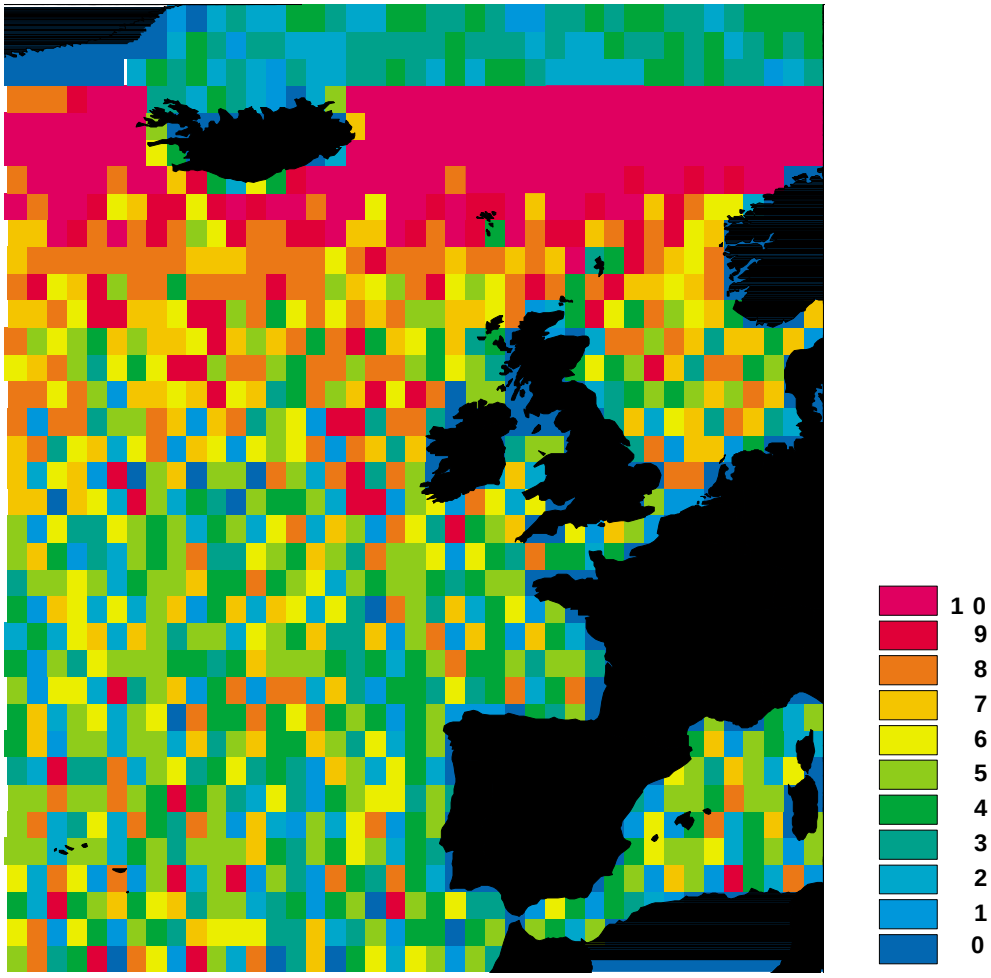

Plate 4: Plate 3 magnified to focus on sampling around UK coastal seas.

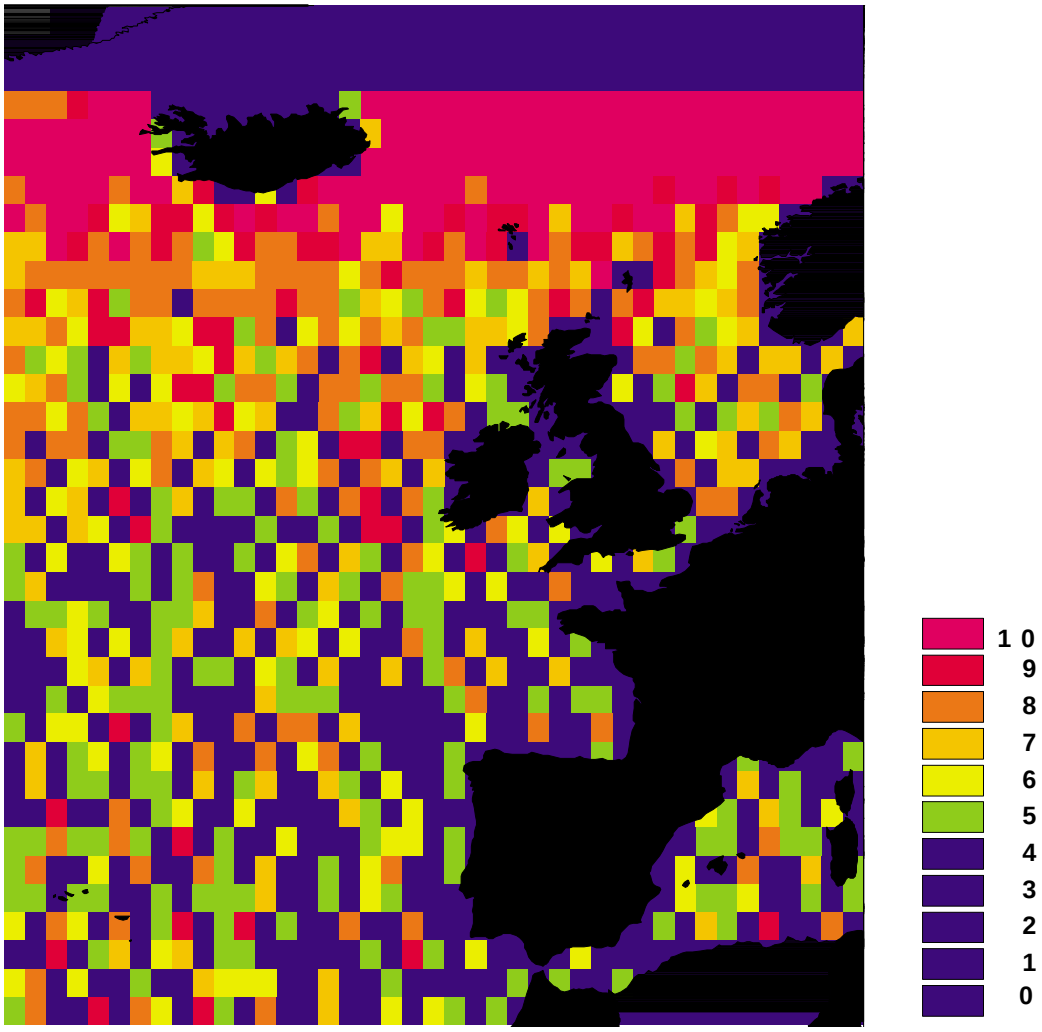

Plate 5: As plate 4, all grid squares with less than 5 transects are coloured dark blue.