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Determination of steric level variations from a combination of altimetry and GRACE

D. Chambers (1)

(1) Center for Space Research, The University of Texas at Austin (chambers@csr.utexas.edu)

Theoretically, GRACE should observe non-steric ocean mass variations, while satellite altimeters observe the total sea level (SL) variations, which are a combination of steric and non-steric signals. Thus, one can subtract the ocean mass variations observed by GRACE from the total sea level observed by satellite altimeters (provided the mass variations are expressed in equivalent water level) in order to determine steric SL variations. This is useful for combining with steric SL computed from direct temperature/salinity profiles, or as a measure of steric SL where there are no direct observations. In practice, however, there are subtle corrections that need to be applied to either the GRACE or altimeter data in order to reconcile the two data sets. If this is not done properly, the resulting combination will be wrong.

Here we will describe how to properly combine the two data types, noting the important corrections that need to be applied to each. We demonstrate the importance of each correction by comparing the seasonal variation of steric SL from such a combination with that from the World Ocean Atlas 2001 (WOA01) climatology for wavelengths of 1000 km and longer. We will show that the combination with all corrections applied is much closer to the WOA01 climatology than if any correction is ignored.