Geophysical Research Abstracts, Vol. 7, 02891, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02891

Estimates of the ocean circulation obtained by constraining an ocean model by altimetric and geoid information together with in situ data

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This paper will summarize ongoing ocean syntheses efforts that brings together altimetric and geoid fields, in situ data and a numerical model using data assimilation. Over the last decade, ocean data assimilation has made a remarkable progress,to the point that it is now feasible to perform mathematically rigorous global ocean data synthesis in a routine manner as a core strategy for climate research. In analogy to atmospheric re-analysis, this effort sometimes is referred to as reanalysis. However, in the absence of analyses in the ocean, the term data synthesis seems more appropriate. To date, several ocean syntheses are being run routinely over the period 1992 through present. Applications of syntheses range from mesoscale and coastal ocean state estimates to the ocean as part in climate system with applications ranging from estimating ocean transports, mixing, surface fluxes to impacts on biogeochemistry. Results will be presented that illustrate the use of ocean data assimilation in testing the consistency of existing geoid information and their error bars. We will also show recent results that illustrate the impact of modern GRACE geoid fields in improving estimates of the ocean mean and time-varying circulation.