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The hydrological cycle and sea level variations

M. E. Tamisiea (1), E. M. Hill (1), R. M. Ponte (2), J. L. Davis (1)

(1) Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA, (2) Atmospheric and Environmental Research, Inc., Lexington, MA, USA (mtamisiea@cfa.harvard.edu / Phone +1-617-496-7645)

Creating a consistent framework for understanding sea level change over a range of time scales requires inputs from ocean dynamics, knowledge of freshwater flux between the oceans and continents, and an understanding of how crustal deformation and time-variable gravity caused by changing loads on the continents impact local observations of sea level. In this presentation, we discuss the sea level variations resulting from the hydrological cycle, which is the primary signal in the time-variable gravity field. Only static sea level variations are considered. On annual time scales, the hydrological cycle contributes to the variation of sea level through both global and local effects. Previous studies have shown that the exchange of water between the oceans and the continents is the dominant contribution to the globally-averaged, non-steric annual sea level variation. We find that crustal motion and variations in gravity impact local measurements of sea level, producing significant differences from the global signal in both the amplitude and phase. These predictions of the hydrological cycle's influence on satellite altimetry and tide gauge observations are determined using a self consistent model that simultaneously accounts for freshwater flux, crustal motion and gravity variations. We also examine initial results of extracting this signal from a set of global tide gauges.