

An Investigation of Recent Observed Changes in the Earth's Oblateness

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Beginning in 1998, large changes in the Earth's oblateness have recently been detected using Satellite Laser Ranging (SLR). These changes are consistent with mass moving from the higher latitudes into the equatorial region, and are the largest such changes observed since SLR started tracking the phenomena in the late 1970s. We have conducted a comprehensive investigation into the source of these changes. We have compared SLR results from several different research groups, and concluded there is no problem with the data analysis. We have considered a variety of possible geophysical sources including tide modeling errors, atmospheric mass redistribution, and ocean mass redistribution. Of these, the ocean appears to be the most likely source of the observed oblateness changes. Specifically, the changes appear to be concentrated in the Pacific Ocean. The observed oblateness variations are highly correlated with the Pacific Decadal Oscillation (PDO). We investigated the mass variations in the oceans using two different sources: 1) the ECCO ocean model, and 2) TOPEX/Poseidon sea level measurements corrected for steric sea level change using buoy observations. These results explain a significant fraction of the observed oblateness changes, but are somewhat smaller in magnitude. Detailed results from these calculations will be presented.