

Global water budget from the atmosphere, land and ocean on seasonal and inter-annual timescales using GRACE data

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In order to study the global water mass balance, we utilize data for the water mass variations in the ocean, land and atmosphere. So far altimeter data have been used mainly to monitor such variations in ocean; however, it is not straightforward to obtain real changes in ocean mass because altimeter observes sea level height variations including steric changes. On the other hand, GRACE (Gravity Recovery and Climate Experiment) can directly observe changes in mass. Since its launch in 2002, GRACE results on time variable gravity fields have been published, for example, seasonal land hydrological cycles (e.g. Tapley et al., 2004) and secular gravity decreases due to ice melting induced by global warming (e.g. Tamisiea et al., 2005, Chen et al., 2006). Recently, ocean mass variations also started to be reported from GRACE (e.g. Chambers et al., 2004, Fenoglio-Marc et al., 2006).

To discuss global water budget, here we try to calculate water content in the atmosphere from NCEP (National Centers for Environment Prediction), land from GLDAS (The Global Land Data Assimilation System) and ocean from GRACE. GRACE data are composed of monthly Stokes' coefficients up to degree/order 60 from 2002/4 to 2007/10. We computed time series of water thickness equivalent (WTE) for the ocean mass variation from GRACE, where we applied the ocean function which showed the shape of ocean (1 for ocean and 0 for land). In addition, we examine the contributions of each ocean basins (e.g. North Atlantic, Pacific and so on). We also calculate the water content in the atmosphere from NCEP and on land from GLDAS model outputs. By combining 3 independent data sets, we can examine the budget of the global water mass balance, and we do so on seasonal and inter-annual timescales.