Interannual crustal load deformations induced by non-tidal oceanic mass variations around Japan

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The Japanese archipelago is surrounded by the four active ocean currents. Among them, the Kuroshio Current and the Oyashio Current are especially active, having various influences on the country, e.g. fishery, climate, and even the geodetic reference system. Satellite altimetry observes significant sea-level variations of about 10-20 cm in seasonal and interannual time scales off the coast of central Japan where the two active ocean currents collide with each other. Such active sea-level variations accompany mass redistributions on the Earth's surface, causing elastic load deformations of the crust. In this study, we focus on the interannual variation of sea-level driven by the ocean currents and investigate the impacts of the induced crustal load deformations on the height reference system in Japan. Satellite altimetry data acquired by TOPEX/POSEIDON and JASON satellites are used to obtain the time-series of the sea-level variations between 2001 and 2017. Here the effects of thermal expansions, salinity changes and Glacial Isostatic Adjustments are corrected for using the ALGO float data and the geophysical model because they don't bring any load deformation. The oceanic mass variations obtained are converted to the crustal load deformations following the method by Farrell (1972). Consequently, we have confirmed the crustal load deformations of about 6 mm in the vertical direction along the coast of central Japan during the studied period. In the same way, about 3 mm of the crustal load deformation has been confirmed at the origin of Japanese vertical datum located at the central Japan. Currently, the Japanese government is working on a realization of the new height reference system with several centimeter precision using the nationwide GNSS CORS and a gravimetric geoid model. For the purpose, the influences of the crustal load deformations caused by geophysical fluid variations like the oceanic currents should be carefully concerned.