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Title: Nontidal oceanic contribution to the leng-of-day change estimated from two different oceanic assimilation data

Abstract:

Although nontidal changes in the Earth's length-of-day (LOD) on timescales of a few days to a few years are primarily caused by changes in the angular momentum of the zonal winds, other processes can be expected to cause the LOD to change as well[1]. Here contributions of atmospheric winds, surface pressure, oceanic currents, and ocean-bottom pressure on LOD changing during 1992-2001 are evaluated from atmospheric angular momentum of four meteorological centers (National Centers for Environmental Prediction/National Center for Atmospheric Research, Japan Meteorological Agency, European Center for Medium range Weather Forecasts, and United Kingdom Meteorological Office), angular momentum of zonal winds in the upper atmosphere (10-0.3hPa) from the UKMO, and oceanic angular momentum from Estimating the Circulation and Climate of the Ocean (ECCO) and the Simple Ocean Data Assimilation (SODA) at seasonal time scale. Combining the atmospheric angular momentums (AAM) of four meteorological centers, the averaged AAM explained 98.96% variance of observed variation of LOD at seasonal scale. Based on the ECCO and the SODA oceanic assimilation sources, we examined 10 years of axial oceanic angular momentum (OAM) signals. The variances of LOD-AAM residual explained by OAM are 22.6% and 25.7% for the ECCO and the SODA, respectively. Though correlation between LOD-AAM residual and OAM (0.48 for the ECCO and 0.51 for the SODA) is not so high, they both exceed the 90% confidence level 0.45. From the results of amplitude spectrum analysis, the annual amplitudes of OAM are 12.5 and 7.1 milliseconds for the ECCO and the SODA, respectively, which are comparable with the annual term of LOD-AAM residual 15.2 milliseconds. But the semiannual amplitudes (4.0 milliseconds for the ECCO and 11.2 milliseconds for the SODA) are less than half of LOD-AAM residual 27.5 milliseconds, which suggests that we should further consider other sources, such as land-water, ice-sheet, etc. The regional differences between the ECCO and the SODA are obvious, but they yield mostly similar OAM. The contribution of upper atmosphere zonal winds to LOD is important as the atmospheric planetary momentum. They have the similar annual amplitude and phase, but for semiannual period, the contribution of upper atmosphere zonal winds is more important. Thus, both upper atmosphere zonal winds and atmospheric planetary momentum are non-negligible.

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