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Mass and motion terms of atmospheric and oceanic angular momentum contributions to polar motion excitation

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Motion of the Earth's pole is excited by processes internal to the Earth system - continually changing mass distribution in the geophysical fluids, atmosphere, ocean, and land hydrology. The mass redistribution and its movements within the Earth system excite the Earth's rotational changes mainly at seasonal or shorter timescales. The importance of atmospheric and oceanic angular momentum signals for polar motion excitation at seasonal and interannual timescales is well known. However, previous studies showed that the AAM due to pressure changes and winds, provided from different models, are slightly different, especially in $\chi 1$ component. The differences between various representations of ocean-bottom pressure and currents from different OAM models are apparent too.

An important technique for understanding Earth's rotational changes is the comparison of mass and motion terms of Atmospheric and Oceanic Angular Momentum from different models of AAM and OAM, which also leads to an assessment of their uncertainties, particularly in polar motion excitation.

Here, three time series of atmospheric equatorial excitations, $\chi 1$, and $\chi 2$, of mass and motion terms are used: Atmospheric Angular Momentum (AAM) of the National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) reanalysis model provided by the Sub-bureau for the Atmosphere of the Global Geophysical Fluid Centre (GGFC); Effective Atmospheric Angular Momentum (EAAM) obtained from GeoForschungsZentrum (GFZ); Atmospheric Angular Momentum (EAAM) obtained from the operational analysis of the European Centre for Medium-Range Weather Forecasts (ECMWF).

For nontidal Oceanic Angular Momentum (OAM), which contributes to Earth's polar motion variations, we use three different time series of oceanic excitations, $\chi 1$, and $\chi 2$, of mass and motion terms: effective angular momentum functions (EAMF) of the ocean calculated from 6 - hourly Max Planck Institute Ocean Model (MPIOM); two models running at the Jet Propulsion Laboratory (JPL) as part of their participation in the Estimating the Circulation and Climate of the Ocean (ECCO) consortium, ECCO kf079 and ECCO kf080 ocean model.

The main goal of this study is to extend the present understanding of the problem of inconsistency of mass and especially motion terms of different AAM and OAM models at seasonal time scales, as well as trying to explain the observed variations of polar motion determined by geodetic techniques. The errors in both AAM and OAM time series were calculated using different statistical method.