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Closure of the Earth's angular momentum budget observed down to four days

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Short period variations in the Earth's rotation rate, length-of-day (LOD), are driven mainly by the atmosphere with smaller contributions by the oceans. Previous studies have noted a lag of atmospheric angular momentum (AAM) with LOD that would imply another source. We examine AAM from the European Centre for Medium-Range Weather Forecasts (ECMWF) and the National Centers for Environmental Prediction (NCEP) reanalysis series, along with oceanic angular momentum (OAM) from the ECCO consortium; land hydrological effects made no discernible impact. The NCEP reanalysis together with OAM produces a significant lag with LOD, while the ECMWF reanalysis AAM with OAM shows no phase lag. We find significant coherence with LOD variations down to periods of 4 days; coherence losses at shorter periods likely arise from the inverted barometer assumption and unmodeled dynamical processes. Thus the inclusion of core effects is not needed to balance the axial angular momentum budget on sub-seasonal time scales.