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Centennial signals in atmospheric angular momentum and its seasonal variations projected from a CMIP6 multi-model ensemble

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Rising temperatures due to climate change are suspected of driving long-term changes in atmospheric angular momentum, leading to secular variations in length of day. The magnitude of the change is naturally dependent on the intensity of the warming. The Earth's climate response, including atmospheric circulation changes from winds and from mass redistribution to several scenarios that simulate possible future anthropogenic drivers of climate change, is provided within the Coupled Model Intercomparison Project Phase 6 (CMIP6). The scenarios are constructed from a combination of new future societal development pathways, the Shared Socioeconomic Pathways (SSPs), and the Representative Concentration Pathways RCPs (identified by approximate radiative forcing levels of X.X Wm^{-2} in 2100).

In this work, we analyze the projected impact of global change on atmospheric angular momentum and the related excitation of length of day from historical and 21st century simulations. We use the output of 11 models for five 21st century scenarios (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5), ranging from very mild to quite extreme future climate changes. Our focus is on investigating linear trends in time series of axial atmospheric angular momentum and the temporal evolution of seasonal amplitudes. The high emission scenario, associated with more intense global warming, would lead to a slight gain in the annual amplitude and an overall increase in axial atmospheric angular momentum. The corresponding length of day change would come up to about 18% of the effect of tidal friction.