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Hydrological excitation of polar motion determined from CMIP6 climate models

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Climate models provide important information to understand how the climate has changed in the past and how it can evolve in the future. Such models simulate in detail the physics, chemistry and biology of the atmosphere, oceans and land hydrosphere. Climate models are developed and constantly updated by a number of modelling groups around the world. A large number of models makes it necessary to store them in one place, so that they can be easily accessed and compared. The objective of the Coupled Model Intercomparison Project phase 6 (CMIP6) is to make the multi-model output publicly available in a standardized format. This framework aims to improve our understanding of climate changes resulting from both natural factors and changes in radiative forcing. The CMIP6 models are useful in many scientific applications regarding evolution of processes occurring in the atmosphere, ocean and continental hydrosphere.

In this study, we use the chosen climate models to assess the role of land hydrosphere changes in polar motion. The mass variations of land water storage impacts the Earth's inertia tensor and causes disturbances of the pole motion. Such temporal variations of polar motion due to continental hydrosphere are described with hydrological angular momentum (HAM). Here, we use soil moisture and snow water equivalent variables, which are delivered by CMIP6 simulations, to compute time series of HAM. We then analyse HAM variability in a wide variety of oscillations, taking into account trends, seasonal, short-term non-seasonal and long-term non-seasonal changes. We consider past changes in HAM but also analyse its future evolution. This will allow to determine how future changes in the terrestrial hydrosphere will affect the movement of the pole. The consistency between HAM obtained from various CMIP6 models is assessed as well.