Effect of predicted global warming on the Earth's rotation

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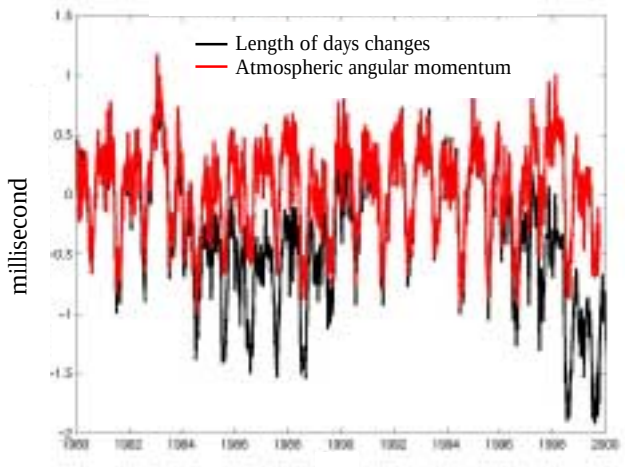
Global geophysical fluids (atmosphere, ocean, core and hydrology) are known to be the major causes of the Earth's rotation fluctuations. In particular, at frequencies from diurnal to interannual, the atmosphere and the ocean are responsible for nearly all the variability of the length-of-day. Figure 1 shows the evolution of the length-of-day (lod) and of the atmospheric angular momentum (AAM) for the years 1980-2000.



We see very good agreement between the lod and the AAM variation at a broad range of frequencies. The disagreement at low frequencies is attributed to the effect of the fluid core.

Besides the effect on the lod, the ocean and the atmosphere also affect the orientation of the Earth rotation axis in Earth and space (precession, nutation and polar motion).

Global scale meteorological phenomena, for instance ENSO, give observable perturbations of the length-of-day. For example, the 1982-83 El-Nino generated a large maximum of the length-of-day. This implies that, during this event, the Earth was rotating slower than usual. It can thus be expected that the predicted changes in the general atmospheric circulation, associated with the CO_2 increase, will affect the Earth rotation at an observable level.

Our project aims at evaluating the impact of global warming on the Earth's rotation rate and the orientation of the Earth's rotation axis in space and in Earth, using coupled climate models.

The CMIP database, including a broad selection of coupled models forced by the same increasing-CO_2 scenario, would be a very good starting point for our study and the archived data give all the information needed.

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