



Detections of a 6-year cycle in the Earth system

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A cycle of about 6 years has long been observed in the Earth's magnetic field, length of day, dynamic oblateness, polar motions and surface displacements and attributed to dynamical processes occurring in the core and at the core mantle boundary. Recently, a 6-year cycle has also been detected in the rate of change of the global mean sea level and the ice-mass contributions from Greenland and continental glaciers. In this study, we report new observations of a 6-year cycle in the terrestrial water storage estimates based on the satellite gravity missions GRACE and GRACE-FO, consistent with precipitation and global hydrological models. The causes for such oscillations in the climate system are still unexplained, but raise the question of the respective contributions of the Earth's deep interior and external surface fluid envelopes to the 6-year cycles reported in many geodetic variables. Indeed, while some of these 6-year fluctuations are convincingly attributed to Earth's deep interior processes, for some other variables, climate-related processes occurring in the surface fluid envelopes or at the Earth's surface may be more likely. This issue is exacerbated by an opposition of phase discovered between the angular momentum of the atmosphere and the length of day at around 6 years, suggesting that dynamical processes occurring in the Earth's core induce a rotation of the solid Earth and the atmosphere as a single system. An overview of the 6-yr cycle observed in different variables of the Earth System may therefore help to better understand potential links between the solid Earth and climate.