S1 tidal contributions to changes in length-of-day: mean atmosphere-ocean excitation estimates and a possible modulation through ENSO

Authors:

Michael Schindelegger [(1)], David Salstein [(2)], David Einspigel [(3)]

(1) TU Wien, Austria, (2) Atmospheric and Environmental Research Inc., U.S.A., (3) Dublin Institute for Advanced Studies, Ireland

Oral presentation

Abstract:

Space geodetic determinations of Earth rotation reveal a 5-µs perturbation of changes in length-of-day (LOD) at the principal diurnal frequency of the solar S_1 tide. While consensus exists that the signal is excited by mass redistributions in the atmosphere-ocean system, a rigorous assessment of the problem is still lacking. Here, we use atmospheric angular momentum and torque data calculated from three modern-day atmospheric reanalysis fields, complemented by consistent solutions for the S_1 ocean tide from a barotropic time-stepping model. Superimposed atmosphere-ocean excitation values are found to exhibit a fair agreement with S_1 LOD harmonics from recent space geodetic Earth rotation determinations, but estimates of the atmospheric contribution to the total signal can be easily distorted through large spurious variabilities of the angular momentum terms. It is thus suggested to use the more stable torque quantities in gauging the diurnal atmospheric excitation of LOD. The study also addresses possible time variations of the geophysical model estimates. Specifically, we hypothesize that the seesawing of the tropical weather over the Pacific due to the El Niño-Southern Oscillation (ENSO) changes the diurnal cycle in the atmosphere and that modified S_1 pressure forces at the sea surface also alter the oceanic tide and its contribution to LOD. The likely magnitude of this climate mode imprint on high-frequency zonal Earth rotation variations is estimated by confronting the results from two dedicated S_1ocean tide simulations during both the cold and the warm phases of ENSO.

Scientific Topic:

Variations in Earth rotation *(Harald Schuh, Richard Gross)*

Presentation date time:

Wednesday, June 8, 2016 - 09:15 to 09:30