Geophysical Research Abstracts
Vol. 18, EGU2016-2601, 2016
EGU General Assembly 2016

Angular momentum budget of the radiational S_1 ocean tide

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The balance of diurnal S_1 oceanic angular momentum (OAM) variations through torques at the sea surface and the bottom topography is validated using both a barotropic and a baroclinic numerical tide model. This analysis discloses the extent to which atmosphere-driven S_1 forward simulations are reliable for use in studies of high-frequency polar motion and changes in length-of-day. Viscous and dissipative torques associated with wind stress, bottom friction, as well as internal tidal energy conversion are shown to be small, and they are overshadowed by gravitational and pressure-related interaction forces. In particular, the zonal OAM variability of S_1 is almost completely balanced by the water pressure torque on the local bathymetry, whereas in the prograde equatorial case also the air pressure torque on the seafloor as well as ellipsoidal contributions from the non-spherical atmosphere and solid Earth must be taken into account. Overall, the OAM budget is well closed in both the axial and the equatorial directions, thus allowing for an identification of the main diurnal angular momentum sinks in the ocean. The physical interaction forces are found to be largest at shelf breaks and continental slopes in low latitudes, with the most dominant contribution coming from the Indonesian archipelago.