Geophysical Research Abstracts
Vol. 16, EGU2014-7102, 2014
EGU General Assembly 2014

Precise computation of loading effects for various geodetic observations

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Because of the increased precision of geodetic observations, precise estimations of atmospheric, oceanic and hydrological loading effects are now required in order to correct these observations.
Loading effects can be computed in the spatial domain, i.e. using the Green's function formalism, or in the spectral domain using spherical harmonic decomposition. In both cases, a model of Earth gravito-elastic deformation, e.g. Love numbers, is required in addition to a general circulation model (GCM), describing the mass redistribution at the Earth surface. We quantify the different sources of errors, due to the two different approaches, different Earth models and different GCMs.
We compare the loading differences between operational atmospheric models, with high temporal (3 hours) and spatial (about 15 km) resolutions compared to reanalysis (ERA interim) models. Oceans do not react to pressure forcing similarly to the solid Earth, so a model describing the ocean response to pressure is required. A classical model is the Inverted Barometer (IB) approximation, stating that atmospheric pressure variations are fully compensated by static sea height changes. However at short periods, typically less than a month, the dynamics of the ocean response cannot be neglected. We show there the differences between the classical IB model and MOG2D batropic ocean model forced by air pressure and winds. We show how this model can be combined with classical non-tidal baroclinic ocean GCMs in order to take into account all oceanic loading effects.
Finally, we show that hydrological loading errors are mostly induced by errors in the continental water storage models.