THE FOOTPRINTS OF GLOBAL SEISMICITY IN RELATIVE SEALEVEL MEASUREMENTS

Estimates of secular sealevel changes from tide-gauge observations indicate a uniform rise in the range 1.4-2.0 mm/yr. The uncertainty on this figure mainly depends on the particular subset of observations employed, on their scatter, and on the method used to correct the data for vertical land movements due to glacial isostatic adjustment.

Recent observations from satellite altimetry over the decade 1993-2003 gave a larger rate (3.1 mm/yr after removing GIA effects) and, by allowing for measurements of sealevel on the whole oceanic surfaces, evidenced a strong nonuniform geographical distribution of sealevel changes, with some regions exhibiting rates about 10 times greater than the global mean and some other regions where the trend was inverted and negative variations up to 15 mm/yr were detected.

Since seismic events alter the equilibrium state of the solid Earth and perturbate its gravitational field, they are also likely to produce sealevel variations. We have analyzed the effect of seismic activity on sealevel variations by computing the time-dependent vertical crust movement and geoid change due to coseismic deformations and postseismic relaxation effects. By using comprehensive seismic catalogues we assessed the net global effect of seismicity on tidal sealevel measurements.

Depending on the viscosity of the asthenosphere, the contribution of earthquakes to the long-term sealevel changes amounts to at least 0.1 mm/yr. Thus, the climate-driven long-term sealevel changes deduced by tide-gauge observations may be slightly, but not negligibly, overestimated.

Estimates of sealevel rise coming from water volume increase due to ocean warming give a rate of about 0.5 mm/yr, and the rate due to mass increase from ice melting is thought to be even smaller. Therefore, the average contribution to RSL coming from seismic activity is comparable to the climatological factors and, in regions with strong seismotectonical activity, may represent a major contribution to RSL.

The satellite altimetry measurements, when compared with the global seismic driven signal, show a strong correlation between the geographical distribution of trend signs, while the absolute values of seismic RSL trends are much smaller in magnitude, but are still comparable with estimates of purely climatological factors. The physical processes underlying the observed correlation need a deeper analysis to be understood, but we have a strong indication that seismic and tectonic processes play an important role in the variation of global sealevel.

REFERENCES