Geophysical Research Abstracts
Vol. 16, EGU2014-5412, 2014
EGU General Assembly 2014

Anomalous secular sea-level acceleration in the Baltic Sea caused by glacial isostatic adjustment

Giorgio Spada (1), Gaia Galassi (1), and Marco Olivieri (2)

(1) Dipartimento di Scienze di Base e Fondamenti (DiSBeF), Università di Urbino, Italy, (2) Istituto Nazionale di Geofisica e Vulcanologia (INGV), Bologna, Italy

Observations from the global array of tide gauges show that global sea-level has been rising at an average rate of 1.5-2 mm/yr during the last $\sim$ 150 years (Spada & Galassi, 2012). Although a global sea-level acceleration was initially ruled out, subsequent studies have coherently proposed values of $\sim$1 mm/year/century (Olivieri & Spada, 2012). More complex non–linear trends and abrupt sea-level variations have now also been recognized. Globally, they could manifest a regime shift between the late Holocene and the current rhythms of sea-level rise, while locally they result from ocean circulation anomalies, steric effects and wind stress (Bromirski et al. 2011). Although isostatic readjustment affects the local rates of secular sea-level change, a possible impact on regional acceleration have been so far discounted (Woodworth et al., 2009) since the process evolves on a millennium scale. Here we report a previously unnoticed anomaly in the long-term sea-level acceleration of the Baltic Sea tide gauge records, and we explain it by the classical post-glacial rebound theory and numerical modeling of glacial isostasy. Contrary to previous assumptions, our findings demonstrate that isostatic compensation plays a role in the regional secular sea-level acceleration. In response to glacial isostatic adjustment (GIA), tide gauge records located along the coasts of the Baltic Sea exhibit a small – but significant – long-term sea-level acceleration in excess to those in the far field of previously glaciated regions. The sign and the amplitude of the anomaly is consistent with the post-glacial rebound theory and with realistic numerical predictions of GIA models routinely employed to decontaminate the tide gauges observations from the GIA effects (Peltier, 2004). Model computations predict the existence of anomalies of similar amplitude in other regions of the globe where GIA is still particularly vigorous at present, but no long-term instrumental observations are available to support their existence. We confirm that a GIA correction for secular sea-level acceleration is not required in GSLA assessments because its average value is vanishingly small at the locations of the PSMSL tide gauges (Douglas, 1992). Nevertheless, GIA is contributing significantly on a regional scale, and therefore it should be recognized as one of the processes responsible for local, long–term sea-level acceleration. Reference: Bromirski, P.D., Miller, A.J., Flick, R.E. & Auad, G., 2011, J. Geoph. Res. 116, C07005; Douglas, B.C., 1992, J. Geoph. Res. 97, 12,699-12,706; Olivieri, M. & Spada, G., 2013, Global Planet. Change 109, 64-72; Peltier, W.R., 2004, Annu. Rev. Earth. Pl. Sc. 32, 111-149; Spada, G. & Galassi, G., 2012, Geophys. J. Int. 191, 1067-1094; Woodworth, P.L., White, N. J., Jevrejeva, S., Holgate, S. J., Church, J. A. & Gehrels, W. R., 2009, Int. J. Climatol. 29, 777–789.