Sea Level Budget along the East Coast of North America

[1]A. Pease, [2]J. Davis

[1]Augustana College, [2]Lamont-Doherty Earth Observatory of Columbia University

It is well known that global warming is forcing sea-level to change around the world. However, sea-level is spatially and temporally variable, so over time sea-level accelerates and the extent can vary along regions like the East Coast. The East Coast is an interesting place to study because the region is undergoing glacial isostatic adjustment from the LGM, and ocean dynamics/thermal expansion/salinity changes are causing a 'hot spot' for sea-level acceleration. The long term effects of sea-level change will affect the whole nation/economy, through increased erosion, flooding, and storms. Therefore, we analyzed tide gauge data, taken from 1955 to 2015, from 29 locations along the east coast of North America; in order to, aid in the completion of rate and acceleration sea level budget. A well-documented period of sea-level acceleration began around 1990. The sea level rate (referenced to epoch 1985.0) and acceleration (post-1990) are spatially and temporally variable, due to various physical processes, each of which is also spatially and temporally variable. To determine the sea-level budgets for rate and acceleration, we considered a number of major contributors to sea level change: ocean density and dynamics, glacial isostatic adjustment (GIA), the inverted barometer effect, and mass change associated with the Greenland Ice Sheet (GIS) and the Antarctic Ice Sheet (AIS). The geographic variability in the budgets for sea-level rate is dominated by GIA. At some sites, GIA is the largest contributor to the rate. The geographic variability in the budgets for sea-level acceleration is dominated by ocean dynamics and density and GIS mass loss. To achieve a reasonable fit, a scaling factor (admittance) for the combined contribution of ocean dynamics and density was estimated; this admittance may reflect the low spatial sampling of the GECCO2 model we used, or other problems in modeling coastal sea-level. The significant contributions of mass loss to the acceleration enable us to predict that, if such mass-loss continues or increases, the character of sea-level change on the North American east coast will change in the next 50–100 years. In particular, whereas GIA presently dominates the spatial variability of sea-level change, mass loss from Greenland and Antarctica will dominate it by 2050–2100; but, the long-term contribution of ocean dynamics and density remain more of a question.