

Relative sea-level rise

Vulnerability, risk and research priorities

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Relative sea-level rise is the increase in mean sea-level, at any given coastal location, compared to the level of a reference point on the adjacent land surface. The process leads to an increase in frequency and severity of marine inundations of low-lying coastal land and, in the absence of engineering intervention, to long-term inundation. The assessment of relative sea-level rise is difficult, due to the large number of contributory processes involved, on global, regional and local scales.

At the end of the last glacial period, global (eustatic) sea-level began to rise. About 10 thousand years ago the global level was about 60 metres below present. Sea-level rise was rapid at first (20 metres every thousand years) then slowed down after about 6000 years before present. However, the possibility of future accelerated sea-level rise, as a consequence of man-induced global climate change, is now a major threat to coastal lowland communities. The forecast for total eustatic sea-level rise over the next 100 years ranges from 31 centimetres in the best case scenario to 110 centimetres in the worst.

Regional circumstances may exacerbate relative sea-level rise in some coastal areas. For example, regional neotectonic subsidence may have been occurring over millions of years at some sites. Also acting at the regional scale are processes associated with isostatic readjustment of the Earth's crust, such as downwarping in

response to sediment loading. At the local scale, natural physical processes and human interventions may lead to land subsidence over the short term, at rates in excess of those predicted for eustatic sea-level rise. Subsidence related to local sediment consolidation is important in this respect. The over-abstraction of groundwater and dewatering of the sediments due to surface loading are particularly important contributors.

While the vulnerability of coastal areas to relative sea-level rise can be geographically defined and quantified, the multigenic nature of this hazard (as discussed above) makes risk assessment difficult. The likely incidence and severity of relative sea-level rise, in terms of the rates and the changes

of those rates with time, may be poorly known. While one coastal area may be stable, a large area elsewhere may be subject to marine inundation. Therefore it is important to understand how coastal lowlands have developed in relation to rising sea-levels in the past and how these responses are likely to differ in the future as man's influence increases. The BGS is presently studying these aspects as part of its Coastal and Estuarine Evolution Core Programme activity. The BGS holds extensive datasets that allow the evolution of coastal lowlands to be evaluated in terms of their sea-level history, allowing modern data to be placed into a long-term context. Combination of these data with data on eustatic sea-level change, surface elevation (digital terrain mapping techniques) and future land-level change (for example, geotechnical consolidation of lowland sediments) provides a powerful tool to predict responses to, and quantify the risk of, future relative sea-level rise in a range of possible vulnerability scenarios.

The Coastal and Estuarine Evolution research project is developing innovative and transportable methodologies and conceptual models of coastal evolution, particularly in the fields of:

- Relative land-level changes and flood risk
- Coastal erosion and sediment budgets
- Estuarine geomorphology

Flooded agricultural land at Salthouse, north Norfolk coast.