

# **Estimating subsidence, sedimentation and elevation change in coastal Bangladesh using InSAR and surface measurements.**

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Coastal regions are vulnerable to rising seas, increasing storm magnitude, and decimation of ecologically-fragile areas. Deltas are particularly sensitive to the balance between sea-level rise, tidal amplification, land subsidence, and organic and inorganic sedimentation that determine surface elevation. Bangladesh has been highlighted as being at risk from effective sea-level rise that combines eustatic ocean levels, subsidence, and tidal amplification. Integrating measurements from different methods can provide a more complete understanding of factors controlling spatially and temporally varying subsidence rates. We have determined subsidence, elevation change and/or sedimentation rates from a suite of different methods in coastal Bangladesh (e.g., stratigraphic wells, historic buildings, vertical strainmeters, RSET-MH, continuous GNSS, and a campaign GNSS resurvey of geodetic monuments). We obtain varied rates as each type of measurement provides an estimate relative to a different datum, with variation across four dimensions (areal, depth, and temporal). Thus, measurements of land subsidence are like the fable of the blind men examining an elephant, where each system measures only part of the story. We attribute the spatial differences to lithology, edaphic effects, and Holocene sediment thickness. Furthermore, we find that subsidence and sedimentation rates in areas of active sedimentation, such as rice fields and mangrove forests, are greater than buildings and structures with deep foundations. To supplement these surface change point measurements and explore variations at greater spatial resolution, we process datasets of Sentinel-1 spanning from late 2014 to 2023 and derive a high-resolution InSAR velocity field over coastal Bangladesh, sufficient to resolve villages versus fields. We incorporate a new Worldview DEM referenced to ICESat-2 altimeter data and improved InSAR algorithms for phase unwrapping, atmospheric correction, and solid Earth tide correction to achieve a better retrieval of ground deformation. Our preliminary results show consistency between InSAR and continuous GNSS observations and confirm the effects of surface landscape observed by the other measurements.

Land subsidence, Bangladesh, coastal hazards, InSAR, elevation change