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

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Seminar Details

Friday, February 7, 2025 2:30pm – 4:00pm

UH Campus Classroom & Business Building Room CBB 108

Online via Zoom https://www.cive.uh.edu/research/seminars

ABSTRACT:

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 and the Ganges-Brahmaputra Delta have been highlighted as being at risk from sea-level rise. 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 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 resolution, we process datasets of the Sentinel-1 satellite and derive a high-resolution InSAR velocity field over coastal Bangladesh, sufficient to resolve villages versus fields. Our results show consistency between InSAR, campaign GNSS, and RSET measurements, and confirm the importance of the surface landscape dynamics as observed by these measurements.

BIOGRAPHY: Dr. Michael S. Steckler is a Lamont Research Professor and Associate Director of the Marine and Polar Geophysics Division at LDEO. He is a geophysicist working mainly on sedimentary systems with projects related both to tectonics and earthquakes, and to sea level and stratigraphy. One major research interest is vertical motions of the Earth's surface and their preservation in the sedimentary record. He uses multiple types of field measurements, particularly GNSS, and numerical modeling. His primary field area is Bangladesh, as well as the surrounding countries of India and Myanmar, where he has been working for almost 25 years. He is also working in Jamaica. Over the years, his research has included projects in Italy, Turkey, Egypt, Israel, Jordan, Mexico, Haiti, Spain, France, Canada and New Jersey. Dr. Steckler received his B.S. degree from the Massachusetts Institute of Technology, and his Ph.D. degree from Columbia University. After a postdoc at the University of Cambridge, he returned to Lamont where he has worked since 1982.