Title: Measuring rates of present-day relative sea-level rise in low-elevation coastal zones: A critical evaluation

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Abstract: Although tide gauges are the primary source of data used to calculate multi-decadal to century-scale rates of relative sea-level change, here we question the reliability of tide gauge data in low-elevation coastal zones (LECZs). Tide gauges measure relative sea-level rise (RSLR) with respect to the base of associated benchmarks. In coastal Louisiana, we find that benchmarks (n=35) are anchored an average of 21.5 m below the land surface. Because at least 60% of subsidence occurs in the top 5-10 m of sediment, tide gauges in coastal Louisiana do not capture the majority of subsidence affecting RSLR. Similarly, GPS stations in coastal Louisiana (n=10) are anchored an average of 14.3 m below the surface and also do not capture shallow subsidence. As a result, tide gauges and GPS stations in coastal Louisiana, and likely in LECZs worldwide, systematically underestimate rates of RSLR. Accurate measurements of RSLR are critical in order to evaluate the risk to coastal communities and infrastructure. A lack of reliable data will be increasingly problematic in southeast Asia in particular, where several large deltas that are home to major population centers are experiencing rapid subsidence. Existing plans for coastal adaptation may be dangerously insufficient to deal with potentially higher-than-realized rates of RSLR. LECZs may be less sustainable and at substantially higher risk of drowning over shorter timescales than previously expected.