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Combining Sentinel-1A/B InSAR and high-resolution topography in the study of coastal megacities

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Today, the joint phenomena of rapid urbanization and population growth has resulted in an increase in the number of cities of over 10 million inhabitants, or megacities, worldwide. While western megacities such as Los Angeles have been relatively stable in recent years, the developing world saw an increase from two to thirteen between 1975 and 2000 (http://www.igbp.net). In 2011, sixteen of the 23 global cities that fell into that category were coastal (UN-DESA 2012). Their growth is often coupled with unplanned urbanization and sprawl, with important effects on coastlines, demographics and ecosystems (Angel et al. 2011; Allison et al., 2016). The associated risk is exacerbated by anthropogenic coastal subsidence processes and sea-level rise due to climate change, potentially increasing inundation, flooding, storm surges and infrastructure damage. Ground deformation phenomena, either uplift and/or subsidence, can arise from volcanic and tectonic processes, hydrocarbon exploitation, groundwater pumping and shallow compaction of sediments, particularly along coastal deltas. A better understanding of the processes affecting coastal megacities can be achieved through the combination of satellite and ground-based measurements. Here we combine both high-resolution topography, in the form of optical digital surface models (DSMs), and differential interferometric synthetic aperture radar (DInSAR), to better characterize the effects of local and regional subsidence, coastal erosion, sea-level rise and urbanization in several megacities from around the developing world. DInSAR time series from Sentinel-1A/B images, coregistered to high-resolution DSMs, are used to constrain local and regional ground deformation, while those same DSMs can be used to better model inundation due to sea level rise. Here we present results for a number of cities, including but not limited to Mumbai, Lagos and Dhaka.