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Mapping subsidence in Lagos, Nigeria with Sentinel-1A/B Satellite Radar

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Over 10 percent of the worlds' population lives less than 10 meters above sea level(McGranahan et al,. 2007), at risk for rising seas and sinking coasts. In addition, coastal inhabitants preferentially live in locations that are subsiding (Nicholls et al,. 2021), representing a flooding threat to people and infrastructure in coastal cities. Findings from the Intergovernmental Panel on Climate Change(IPPC) outline the risks and impacts of sea level rise on flooding and identify a knowledge gap regarding the combined effects with coastal subsidence. When drivers of subsidence combine, they can generate sinking rates of 6-100mm/yr, an order of magnitude larger than the 3-10mm/yr for sea level rise (Erkens et al., 2015).

Access to C-band Synthetic Aperture Radar (SAR) data through the European Space Agency (ESA) Sentinel-1A/B satellites and the upcoming NASA-ISRO SAR (NISAR) mission provides increased opportunities for differential interferometric synthetic aperture radar (DInSAR) monitoring. Here we provide results from a dockerized supercomputer workflow that rapidly generates DInSAR pairs from Sentinel-1 imagery using the JPL/Caltech/Stanford InSAR Scientific Computing Environment (ISCE) processing software (Rosen et al., 2012) at ~10 meter resolution. Results from this workflow are used to create a time series of subsidence for Lagos, Nigeria, where rapid urban growth has led to accelerated subsidence throughout the city.