1. **Annotated Bibliography and Research Question.**

* Annotated bibliography for 3 papers.
* Wu, P. C., Wei, M., & D’Hondt, S. (2022). Subsidence in coastal cities throughout the world observed by InSAR. *Geophysical Research Letters*, *49*(7), e2022GL098477.

The researchers use synthetic aperture radar data between 2014 and 2020 from C-band sentinel-1 A/B to measure subsidence rates in 99 coastal cities around the world. These rates found to be 10x or 15x higher than the mean sea level rising projected rates. The approach was typically by producing the interferograms using SNAP and then StaMPS software was used to extract time series for the ground displacement. Based on the authors point of view the high subsidence rate was related to human activities with respect to ground water extraction. This theory was not supported by enough facts or explanation which needs to be revised.

* Kanwal, S., Ding, X., Wu, S., & Sajjad, M. (2022). Vertical Ground Displacements and Its Impact on Erosion along the Karachi Coastline, Pakistan. *Remote Sensing*, *14*(9), 2054.

In the current study, the authors applied the TcpINSAR approach which is designed to monitor displacement in the changing landscapes of metropolitan areas to investigate ground displacements in Karachi coast. Observations over periods 2004-2010 and 2014-2016 were used to feed the models in the favor of producing time series. Additionally, the coast line erosion state was examined through land sat images using three statistical approaches (EPR, LRR, LMS). Their analysis showed the eastern sections of the studied area were dominated by erosion, whilst spatial heterogenous ground displacements along the coastline. Finally, rapid urbanization, reclaimed land constructions, fail drainage/sewerage networks and soil liquefactions are contributing factors in ground displacement and erosion.

* Gómez, J. F., Kwoll, E., Walker, I. J., & Shirzaei, M. (2021). Vertical Land Motion as a Driver of Coastline Changes on a Deltaic System in the Colombian Caribbean. *Geosciences*, *11*(7), 300.

The interrelation between vertical land motion and coastal line changes was examined by the authors through combination of satellite images and InSAR data for delta b in the Colombian Caribbean. Images and data between (2007-2022) and (2010-2020) for VLM and coastline changes were analyzed, respectively. sand supply, engineering constructions, coastline orientation are the possible drivers for the coastline changes (erosion and subsidence). It has been found that the local subsidence and erosion rates respectively.

* The recent paper that to build on.
* Wu, P. C., Wei, M., & D’Hondt, S. (2022). Subsidence in coastal cities throughout the world observed by InSAR. *Geophysical Research Letters*, *49*(7), e2022GL098477.
* The next step to advance this study.
* Select coastal site (Maurice River) and generate a time series of vertical displacement derived from interferometric synthetic aperture radar from the European Space Agency Sentinel-1 A/B satellites. The time series will range from 2014-2023.
* Define extreme events for the site from 2014-2023, identify all date/times associated with significant wave heights, peak coastal water levels and stream discharge.

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