Emerging Technologies in Coastal Science and Engineering

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The last few decades have seen an incredible emergence of new technologies to address coastal science and engineering challenges. In my own career, the introduction of carrier-phase GPS receivers in the early 2000s enabled high-accuracy point measurents to be undertaken on-the-fly for the first time. This opened up new opportunities to rapidly collect 2D transect information of coastal change, or be mounted to an all-terrain vehicle for pseudo 3D measurements. In the subsequent two decades, the scale, frequency and type of of data collection has increased exponentially. This has seen the emergence of innovative technologies such as multi-rotor and fixed wing UAVs, continuously-scanning Lidar, Uncrewed Surface Vehicles, crowd-sourced smartphone data and much more. With every new technology the lens of observing has grown ever sharper, enabling features to be resolved at the scale of small footprints in the sand, or rapid changes in bed level during a single swash cycle.

Now in 2021 we are at the cusp of (or have already entered?) a new era defined by satellites and machine learning. While the satellite era has been around since the 1970s, a number of innovations have seen an enourmous paradigm shift in a very short period of time: 1) the increased availability of satellite imagery on platforms like Google Earth Engine or Geoscience Australia's Open Data Cube; 2) cloud computing facilities to analyse these data from a simple desktop computer; 3) advanced remote sensing algorithms; and 4) new satellite missions with enhanced sensors and coverage. Some notable uses of this technology in the field of coastal science and engineering already include national and global-scale analyses of sandy shoreline trends, seamless 3D data collection of the entire coastal zone and broad-scale coastal teleconnections with climate cycles like ENSO.

This keynote talk to open the special session on Emerging Technologies in Coastal Science and Engineering will present an overview of technological developments over the past two decades and reflect on how new technologies might be applied in the coming years to improve coastal decision making.

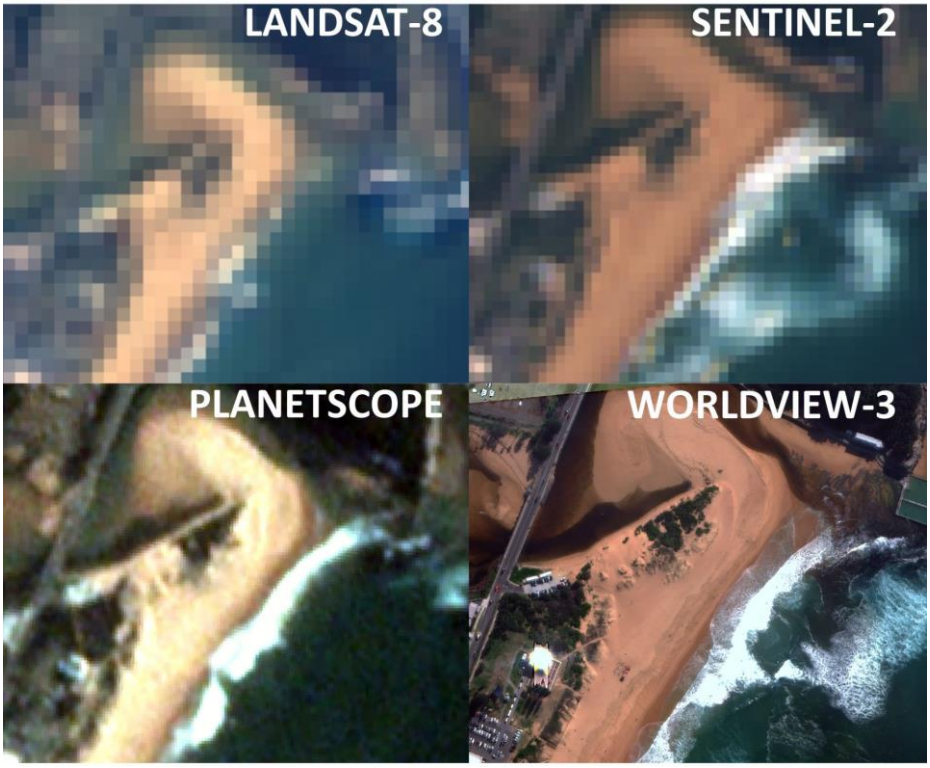

Figure 1 A sharpening of focus of satellite remote sensing on the coast, from Landsat-8 (15 m pixel resolutions) to Worldview-3 (0.3 m resolution). Adapted from Turner et al., (2021)

Keywords: satellite remote sensing, coastal monitoring, machine learning, shoreline detection, citizen science