

New Light on an Old Science

As we seek solutions to the challenges posed by the world's coastal areas, it is important to take advantage of the expanding range of applications brought by new technologies to the venerable practise of geodesy.

I have recently had the opportunity to learn more than I ever imagined about geodesy, the study of the size and shape of the earth. As I explore orthometric heights, ellipsoids, equipotential surfaces, the geoid, and the international terrestrial reference frame, I begin to appreciate the benefits of this esoteric field of science. Advances in geodesy and related geospatial sciences, visualisation technologies such as virtual globes, and advances in accurate positioning have made it possible to know where things are to within a couple of centimetres! This level of accuracy and real-time positioning is invaluable for many activities, such as allowing ships to carry more cargo, confident of their clearance in shallow channels and under bridges.

Nearly two hundred years ago, when Meriwether Lewis and William Clark returned from their expedition of North American discovery, Thomas Jefferson recognised the crucial importance for the development of the United States of accurate maps and charts. He founded the US Coast and Geodetic Survey that in turn laid the foundation for safe and efficient transportation vital for commerce. More recently, GPS, GIS and remote-sensing techniques have revolutionised data provision for maps and charts at finer and finer spatial resolution.

Many of these advances have had an impact upon society exceeding their original intent. New applications of accurate positioning in coastal regions are leading to improved understanding of the impact of natural hazards, and strategies to mitigate them. High-accuracy digital elevation models with merged bathymetry, topography and water-level data from tide-gauge networks enhance storm-surge and coastal-flooding modelling. Improved understanding of coastal-elevation dynamics, especially subsidence, provides emergency managers with information on evacuation routes. Information based on elevation trajectories over time is crucial for infrastructure improvements.

In addition to their direct benefits for communities facing coastal hazards, these technologies have much to contribute to ecosystem management and habitat science. Land elevation in relation to local water level is a critical structural consideration in coastal habitats including tidal salt marshes, oyster reefs and submerged aquatic vegetation. Advances in geodesy and accurate positioning facilitate surveying at a spatial scale that enables the tracking of gradual change in coastal ecosystems, improving our ability to restore damage. Monitoring change in the land/water interface can serve as an early detection system for coastal ecosystem health, giving coastal-resource managers time to respond accordingly.

It is important in seeking solutions to challenges posed by the world's coastal areas to take advantage of applications brought by new technologies to the venerable practise of geodesy. The part they can play in building resilient coastal communities and sustaining healthy ecosystems can complement their already vital role in navigation and commerce.