REMOTE SENSING IS A VALUABLE TOOL FOR MARINE SCIENTIFIC RESEARCH

Dr. Ambreen Afzal

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Remote sensing, a rapidly evolving subject in today's scientific and technological advancements, holds a crucial role in assessing various factors and contributing significantly to swift development. Efficient planning for any developmental project requires prompt, timely, and dependable information.

Remote sensing utilizes different methods to gather information, categorized based on variations in electromagnetic fields, force fields, and acoustic wave fields. Electromagnetic methods encompass Aerial Remote Sensing, satellite Remote Sensing, Multiband Aerial Photography, Microwave Remote Sensing, and Radar. Force field methods involve Gravity Meter, Magnetometer, and Galvanometer. Acoustic wave field methods include Ultrasound, Bat, and Ultrasonic phenomena.

Coral reefs face a global decline, emphasizing the need for monitoring to assess disturbances' impact and track recovery or deterioration. Field surveys offer precise data but are limited to localized scales, making them cost-effective for frequent reef-scale monitoring. Satellite-based remote sensing serves as a valuable alternative, providing comprehensive areal coverage that compensates for the detailed accuracy of a single-point field survey, enhancing statistical power for inferring large-scale patterns.

Satellites containing altimeters possess the ability to accurately track fluctuations in sea level. The data collected by satellites helps scientists forecast and respond to sea-level rise, which is driven by the melting of polar ice and the thermal expansion of seawater.

Satellites can sense the color of the ocean, providing an understanding of the flow of phytoplankton and, by extension, the health of marine ecosystems. Detecting chlorophyll concentration supports scientists in evaluating the influence of contamination and climate transformation on these vital organisms.

Spatial monitoring of the movement of fishing vessels, governments, and organizations can enforce fishing regulations and combat illegal, unreported, and unregulated (IUU) fishing practices. It is important for maintaining the sustainability of marine resources and protecting endangered species.

In some remote areas, altimetry data have been used instead of traditional measurements. For instance, in Tibet, where some lakes are at high altitudes and less affected by human interference, changes in their water levels are often due to natural factors like monsoons, El Niño events, or climate change.

Although radar altimetry has limitations in terms of resolution and timing for monitoring land-based water, advancements in sensor technology and the reliability of measurements have broadened its use in hydrology. This progress has led to the development of the Surface Water and Ocean Topography (SWOT) mission, which uses new technology to provide a global inventory of terrestrial water bodies like lakes, reservoirs, wetlands, and rivers. It focuses on those with surface areas exceeding 250 m by 250 m and rivers wider than 100 m.

The majority of Earth's water cycle is influenced by the oceans, so it's crucial to understand the role of land-based water. This water on land directly impacts human activities like farming, food consumption, and industry. At the same time, human actions, such as groundwater pumping and reservoir storage, affect these land-based waters.

Monitoring continental waters, especially during floods or droughts, is challenging because there are countless water bodies worldwide, and traditional measurement tools are becoming less accessible. To address this, satellite measurements, particularly from radar altimeters, have become valuable. These altimeters can observe changes in the water levels of lakes, rivers, and floodplains.

The MODIS satellite captures data across 36 spectral bands, ranging from 0.4 µm to 14.4 µm, with high radiometric sensitivity. Its scanning pattern covers ±55 degrees and achieves a 2,330-km swath, providing global coverage every one to two days. The system includes a rotating scan mirror assembly, an afocal telescope, and objective assemblies for different spectral regions. It uses a passive radiative cooler to maintain low temperatures, ensuring optimal performance for its infrared bands. MODIS also features onboard calibrators and was integrated into Terra (EOS AM-1) in 1999 and Aqua (EOS PM-1) in 2002, offering valuable insights to a diverse user community worldwide.

Landsat's satellite continuous and lengthy data record allows to monitor alterations, including those associated with a warming planet. Landsat has documented the retreat of the majority of the world's mountain glaciers and ice caps, the breaking apart of polar ice shelves, declines in coral reefs, and provides a reference point for identifying forthcoming changes.