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Using Synthetic Aperture Radar Images to Monitor Sand Dredgers in Taiwan Strait

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With the unique geological setting, Taiwan Strait was formed by shallow bathymetry and gentle topography composed of sandy substrate types. The depth of this area seldom exceeds 100 m, and it could be shallower than 20 m in the Taiwan Shoal area. Therefore, in recent years, there have been frequent cases of illegal sand dredgers around the central of Taiwan Strait. Apart from destroying marine ecology, the greatest problem of illegal sand pumping is the consequential retreat of the neighboring coastline.

To address this problem, the objective of this research aims to take advantage of Synthetic Aperture Radar (SAR) technology in satellite remote sensing, and to monitor the spatiotemporal hotspots of unidentified vessels. SAR instruments have the advantages of superior penetration, high resolution, and independent from sunlight, making it a great tool for ocean object detection. This research uses Sentinel-1 SAR imagery as data source. We take Taiwan strait as study area and focused on Taiwan Shoal and the offshore of Matsu islands, which are the regions with higher number of cases of illegal sand dredging in recent years. The workflow is composed of four steps: image preprocessing, land masking, prescreening, and ship discrimination. Our preliminary results show that the developed algorithm can automatically detect targets over a specific size (>30 m), with an accuracy of >80% compared with the manually identified results. The hotspot of sand dredgers is changing in locations in the last three years, with the peak number occurred in 2019. It is concluded that Sentinel-1 SAR image has the ability to serve as a tool for ship detection.