# Leveraging SAR and SWOT for Flood and Water Mapping - Opportunities and Challenges□□

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**Key words:** Geoinformation/GI; Hydrography; Remote sensing; Risk management

**SUMMARY**

Floods are one of the most devastating natural disasters globally, necessitating advanced monitoring and analysis tools to mitigate their impacts. Synthetic Aperture Radar (SAR) systems like Sentinel-1 and the Surface Water and Ocean Topography (SWOT) satellite, with their radar-based capabilities, offer significant advantages over traditional optical systems like Landsat for flood monitoring and water observation. This study highlights the critical attributes of SAR and SWOT, including their temporal resolution, spatial coverage, return periods, and ability to penetrate cloud cover, enabling consistent observations during flood events. By contrast, Landsat, despite its long-term data archive spanning over 50 years, is limited by its optical nature, rendering it ineffective under cloud cover and during high-frequency flood events. Sentinel-1, with a spatial resolution of 10 meters and a revisit time of 6-12 days, provides detailed and frequent surface water extent data, even in adverse weather conditions. SWOT, launched in 2022, offers unprecedented capabilities in measuring water surface height with a spatial resolution of 50-100 meters and a temporal resolution of 21 days, making it invaluable for tracking flood dynamics and river hydrology. Landsat, while providing a 30-meter spatial resolution and a revisit time of 16 days, is hampered by its reliance on optical imagery, which limits its effectiveness during cloudy conditions or rapid flood events. The comparative analysis leverages Sentinel-1 SAR and SWOT datasets to showcase their ability to detect and monitor floods in Queensland, Australia, specifically focusing on the Flinders River catchment as a representative study area. The analysis highlights the spatial and temporal advantages of radar systems in mapping flood inundation, demonstrating their superiority in capturing rapid changes in water extent compared to Landsat and other water mask products. For instance, SWOT's ability to measure surface water height complements SAR’s capability to delineate water extent, providing a more comprehensive understanding of flood dynamics. The findings emphasize the limitations of Landsat in flood scenarios, including reduced temporal coverage and susceptibility to cloud interference. By contrast, the radar-based systems

ensure consistent and accurate data acquisition, even during extreme weather conditions. This study underscores the transformative role of SAR and SWOT in flood risk assessment and water resource management, paving the way for more robust and actionable insights in hydrological studies. The integration of these datasets holds immense potential for improving flood modeling, early warning systems, and long-term water management strategies globally.Keywords: Flood monitoring, Synthetic Aperture Radar (SAR), Remote sensing, Water surface height, Hydrological studies, and Water resource management