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Assessing and Mitigating the Global Freshwater Crisis (6)

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APPLICATION OF RADAR REMOTE SENSING DATA FOR MONITORING OIL POLLUTION IN THE CASPIAN SEA

Abstract

The Caspian Sea is a highly sensitive ecosystem that has substantially degraded in the past decades because of anthropogenic and biological causes. Oil pollution is a major contributor to the degradation of the sea environment. As offshore oil extraction and maritime transportation of oil products continue to expand, there is a need for timely monitoring of the environmental situation in the Caspian Sea. In this regard, satellite imagery is the most sought-after among other methods and means of environmental monitoring. Satellite information complements data from other observation tools, such as aviation, maritime, and coastal, providing operational control of the environmental situation in areas of oil production and transportation. This article discusses the use of Synthetic Aperture Radar (SAR) data for detecting and studying oil spills at sea. Compared to traditional methods of monitoring oil spills, the use of remote sensing technology allows for quick and accurate determination of the areas affected by oil pollution. The use of SAR for detecting oil spills at sea has several advantages over optical range sensors. SAR is a fundamental tool thanks to its all-weather capability, which enables the acquisition of synoptic maps of the observed area with high spatial resolution and short revisit time. The use of freely accessible satellite radar images from the Sentinel-1 mission of the European Space Agency enables periodic monitoring of marine territories for detecting and studying the dynamics of oil spill spread over time. We conducted a series of analyses of Sentinel-1 images to detect oil spills. Analysis of the satellite radar image data allowed for the precise localization of areas affected by oil spills, determination of the coordinates of oil spill sources, and estimation of the total area of oil pollution. Space-based monitoring and modeling of the process of oil pollution spread on the sea surface make it possible to quickly analyze the situation, evaluate the possible consequences of pollution, and develop an operational plan for quick response to oil spills.