MLKD 2024
The First International Conference on
Machine Learning and Knowledge Discovery
Amirkabir University of Technology, December 18-19, 2024

Advancing Ocean Level Prediction with Machine Learning

Nilufar Makky* Ahmad Moradi†

Abstract

Effectively monitoring sea surface height (SSH) presents a considerable contemporary challenge. By proposing an integrated approach, this paper indicates the specific complexities associated with SSH monitoring in the Oman SeaThe methodology involves using radar altimetry data from Sentinel-3A, along with meteorological parameters such as sea surface pressure, temperature, precipitation, and sea-water vapor obtained from Google Earth Engine cloud-based platform (GEE). The acquired data from Sentinel-3A is meticulously corrected and analyzed to provide accurate and insightful insights into SSH within the specified region, focusing on the 4-month year 2023. This integrated approach enhances the precision and reliability of sea surface height monitoring in the challenging maritime environment of the Oman Sea. The research compares their efficacy in predicting SSH using machine learning algorithms, including Multilayer Perceptron, Support Vector Regression, Random Forest, Gradient Boosting, and K-Nearest Neighbors. Among these, the Random Forest model presents the better Mean Absolute Error of 0.0554, R-squared value of 0.9818, Root Mean Squared Error of 0.1101, and Mean Squared Error of 0.0121. This affirms the model's exceptional accuracy in capturing sea surface height dynamics, emphasizing the significance of incorporating meteorological parameters for a comprehensive understanding and accurate prediction of SSH in the Oman Sea. The findings suggest potential applications in improving operational oceanographic forecasting and advancing our knowledge of the intricate interactions between meteorological conditions and sea surface height variations.

Keywords: Sea surface height, Radar altimetry data, Oman, GEE, Sentinel-3A

*Remote sensing and GIS Department, College of Environmental Engineering, University of Tabriz (Corresponding Author), rsgis.nilufarmakki73@gmail.com

†Geodesy Department, College of Surveying, KNT University,amoradi@email.kntu.ac.ir