Abnormal Water Temperature Prediction using Deep Learning

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Sea water temperature is a critical factor influencing the circulation and ecosystems of Earth's oceans. Changes in water temperature near the Korean Peninsula due to global warming have led to abnormal water temperatures (high water temperature and low water temperature), resulting in ongoing damage to marine ecosystems and fisheries. Consequently, this study proposes a methodology to predict abnormal water temperatures. The study utilized the Long Short-Term Memory (LSTM), a deep learning model specialized in time series data prediction, taking into account the temporal characteristics of water temperature data. European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 data were employed to acquire water temperature data as training input for the LSTM model. Initially, the LSTM prediction model forecasts water temperatures near the Korean Peninsula for 1 to 7 days. Subsequently, the proposed abnormal water temperature prediction algorithm predicts high water temperature and low water temperature phenomena. To evaluate the accuracy of the proposed abnormal water temperature prediction algorithm, the F1-score metric was used. The F1-scores for high water temperature prediction in summer were 0.98 (1-day prediction) and 0.65 (7-day prediction), while for low water temperature prediction in winter, they were 1.00 (1-day prediction) and 0.91 (7-day prediction). As the prediction period increased, the LSTM prediction model exhibited a tendency to underestimate water temperature, consequently lowering the accuracy of the proposed abnormal water temperature prediction algorithm. Therefore, an analysis of the causes of underestimation in the LSTM prediction model will be conducted, and efforts will be made to enhance its performance.