Deep Learning for the Arctic: Short-Term Sea Ice Forecasts in the Kara Sea

In this study, we present an innovative Artificial Intelligence-based sea ice forecasting system designed to predict sea ice concentration and thickness up to three days in advance. By leveraging satellite imagery, marine and atmospheric forecast data, our system focuses on the Kara Sea with a high spatial resolution of 0.05x0.05 degrees. An inertial forecast, while useful, often falls short in capturing the dynamic and complex nature of sea ice behavior. Our AI approach significantly outperforms it addressing this limitation by integrating advanced data assimilation techniques and machine learning algorithms to enhance predictive accuracy. The system employs a novel neural network architecture, trained on extensive historical data sets, to discern patterns and relationships within the oceanic and atmospheric variables. By incorporating real-time satellite observations and forecast data, our model continuously refines its predictions, providing more reliable and timely information for decision-making in maritime operations and environmental monitoring. It is crucial for ensuring navigational safety and optimizing resource management in the Arctic region. Furthermore, the system's scalability and adaptability to other regions underscore its potential for broader application in the Arctic sea ice monitoring.

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