



Regional Ocean Forecasting with Hierarchical Graph Neural Networks

The rise of accurate machine learning methods for weather forecasting is creating radical new possibilities for forecasting the state of the atmosphere at a fraction of the time and computational cost of numerical models. Extending these methodologies to oceanic systems is a natural next step. Our model, based on hierarchical graph neural networks, accounts for the irregular geometry of the sea surface and the diminishing cross-sectional areas at increased depths both during training and evaluation. Furthermore, we tailor external forcing for the regional ocean context by incorporating relevant surface-level variables from global atmospheric models and applying boundary forcing where water is exchanged with the ocean at large. Our approach is validated through experiments at a high spatial resolution using the operational numerical model of the Mediterranean Sea provided by the Copernicus Marine Service, along with both numerical and data-driven atmospheric forcings.

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