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## Towards improving numerical sea ice predictions with data assimilation and machine learning

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In this presentation we highlight recent developments in the implementation of Machine Learning (ML) algorithms into the large-scale sea ice model, SIS2. Specifically, we show how a Convolutional Neural Network (CNN) can be used to systematically reduce global sea ice biases during a 5-year ice-ocean simulation. The CNN has been trained to learn a functional mapping from model state variables to sea ice concentration Data Assimilation (DA) increments. Therefore, during model integration, the CNN ingests information about the numerical model's atmosphere, ocean, and sea ice conditions, and predicts the appropriate correction to the sub-grid category sea ice concentration terms (without seeing any actual sea ice observations). We also show how this combined DA+ML approach leads to a natural framework for augmenting training data for neural networks; one which can lead to significant improvements in online performance, without the need for direct online learning. The bias reductions over the 5-year simulation period for this CNN correction scheme are even competitive with the bias reductions achieved from DA. These findings therefore suggest that our approach could be used to reduce systematic sea ice biases in fully coupled climate model predictions on seasonal-to-climate timescales.