Advancing El Niño-Southern Oscillation ("ENSO") Ensemble Forecasting With Distillation-Based Learning

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In this paper, we present several key contributions to the field of climate science and machine learning, with a specific focus on the prediction of the El Niño-Southern Oscillation (ENSO) phenomenon. We introduce an innovative model that leverages the strengths of both machine learning and deep learning techniques to predict ENSO events. By applying a knowledge distillation approach, which allows us to distill the knowledge from a complex, computationally intensive model into a simpler, more efficient model. Finally, also utilize a self-distillation method and compare it to normal distillation and figure out how to apply that to further model optimization. Overall, our findings underscore the importance of employing advanced deep learning techniques, such as CNNs, and model optimization strategies, including distillation learning, for enhancing ENSO prediction accuracy and contributing to improved climate forecasting capabilities. The utilization of distillation learning methods with higher-resolution data such as ECMWF Reanalysis v5 (ERA5) holds promise for further advancements in AI-driven climate research. Rapid global warming phenomena call action for an accessible yet effective computational model for climate prediction, which brings ENSO to the scope of interest in this paper.

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