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Graph Deep Learning for Long Range Forecasting

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Deep learning-based models have been recently shown to be competitive with, or even outperform, state-of-the-art long range forecasting models, such as for projecting the El Niño-Southern Oscillation (ENSO). However, current deep learning models are based on convolutional neural networks which are difficult to interpret and can fail to model large-scale dependencies, such as teleconnections, that are particularly important for long range projections. Hence, we propose to explicitly model large-scale dependencies with Graph Neural Networks (GNN) to enhance explainability and improve the predictive skill of long lead time forecasts.

In preliminary experiments focusing on ENSO, our GNN model outperforms previous state-of-the-art machine learning based systems for forecasts up to 6 months ahead. The explicit modeling of information flow via edges makes our model more explainable, and it is indeed shown to learn a sensible graph structure from scratch that correlates with the ENSO anomaly pattern for a given number of lead months.