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Assessing the Calibration and Performance of Attention-based Spatiotemporal Neural Networks for Lightning Prediction

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Lightning is a chaotic atmospheric phenomenon that is incredibly challenging to forecast accurately and poses a significant threat to life and property. Complex numerical weather prediction models are often used to predict lightning occurrences but fail to provide adequate short-term forecasts, or nowcasts, due to their design and computational cost. In the past decade, researchers have demonstrated that spatiotemporal deep learning models can produce accurate lightning nowcasts using remotely sensed meteorological data, such as radar, satellite, and previous lightning occurrence imagery. However, these models are generally designed to predict lightning occurrence an hour or more in advance, leaving a forecasting gap in the sub-hour timeframe. This research develops novel sequence-to-sequence attention-based and non-attention-based spatiotemporal deep learning neural networks that ingest multi-modal, remotely sensed weather data to produce a time series of lightning nowcasts in the sub-hour interval. Furthermore, model error is uniquely incorporated into the model developmental process, resulting in more reliable predictions. Comparing the performance of these models to models seen in previous literature shows that the novel models perform comparably to, if not better than, prior lightning nowcast models. Additionally, the results show that adding attention mechanisms benefits specific model architectures more than others.

Type of presentation

Talk

Classification

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Attention, Neural Networks, Spatiotemporal

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