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Numerical Weather Forecast Post-processing with Ensemble Learning and Transfer Learning

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Statistical approaches have been used for decades to augment and interpret numerical weather forecasts. The emergence of artificial intelligence algorithms has provided new perspectives in this field, but the extension of algorithms developed for station networks with rich historical records to include newly-built stations remains a challenge. To address this, we design a framework that combines two machine learning methods: temperature prediction based on ensemble of multiple machine learning models and transfer learning for newly-built stations. We then evaluate this framework by post-processing temperature forecasts provided by a leading weather forecast center and observations from 301 weather stations in China. Station clustering reduces forecast errors by 24.4% averagely, while transfer learning improves predictions by 13.4% for recently-built sites with only one year of data available. This work demonstrates how ensemble learning and transfer learning can be used to supplement weather forecasting.