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Deep learning for short-term temperature forecasts with video prediction methods

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This study explores the adaptation of state-of-the-art deep learning architectures for video frame prediction in the context of weather and climate applications. A proof-of-concept case study was performed to predict surface temperature fields over Europe for up to 20 hours based on ERA5 reanalyses weather data. Initial results have been achieved with a PredNet and a GAN-based architecture by using various combinations of temperature, surface pressure, and 500 hPa geopotential as inputs. The results show that the GAN-based architecture outperforms the PredNet. To facilitate the massive data processing and testing of various deep learning architectures, we have developed a containerized parallel workflow for the full life-cycle of the application, which consists of data extraction, data pre-processing, training, post-processing and visualisation of results. The training for PredNet was parallelized on JUWELS supercomputer at JSC, and the training scalability performance was also evaluated.