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Towards an end-to-end data-driven weather model

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Weather forecasting systems have not fundamentally changed since they were first operationalised nearly 50 years ago. They use traditional finite-element methods to solve the fluid dynamical flow of the atmosphere and include as much sub-grid physics as they can computationally afford. Given the huge amounts of data currently available from both models and observations new opportunities exist to train data-driven models to produce these forecasts. Traditional weather forecasting models are steadily improving over time, as computational power and other improvements allow for increased spatial resolution, effectively incorporating more physics into our forecasts. However these improvements are best seen in the prognostic variables of weather forecasting: e.g. velocity, temperature, pressure. For other quantities of arguably greater importance, for example precipitation, these improvements come at a slower pace.
The current boom in machine learning (ML) has inspired several groups to approach the problem of weather forecasting. Here we will provide an overview of the latest attempts at this from local now-casting of precipitation up to global forecasts of atmospheric dynamics. We will then present our latest efforts towards a multi-model system leveraging existing numerical models to incorporate physical understanding within a data-driven machine learning approach for skilful forecasting of global precipitation over several days.

Thematic area

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