Contribution ID: **36** Type: **Invited Talk**

Coupled atmosphere-ocean simulations with a parsimonious deep learning model

Monday 7 October 2024 17:15 (30 minutes)

A deep-learning model using convolutional neural nets is shown to produce physically realistic simulations of atmospheric and ocean circulations for the current climate state over 100-year autogressive rollouts. The model employs 10 prognostic variables above each cell on a 110-km resolution HEALPix mesh. The atmosphere and ocean are coupled asynchronously, with 6-hour and 2-day time-resolution in the atmosphere and ocean, respectively. The model is trained on both ERA5 reanalysis data and observations from the International Satellite Cloud Climatology Project (ISCCP).

The model's climatology from the 100-year rollout is compared to ERA5 reanalysis data to assess its low-frequency variability, with particular emphasis on the northern and southern annular modes, blocking, extra-tropical and tropical cyclones, and the south Asian monsoon. The performance of our DLESM on these measures equals or exceeds that of much more computationally intensive Earth-system models from the 6th Climate Model Intercomparison Project (CMIP6).

It is sometimes erroneously assumed that auto-regressively generated ML forecasts inevitably smooth with time. Our model maintains sharp representations of the atmospheric structure indefinitely. This is demonstrated in the figure below which shows an intense winter-time mid-latitude cyclone roughly 100 years (73,000 steps) after the start of the simulation together with an observed event. (Could not seem to insert the image.)

Primary author: DURRAN, Dale (University of Washington)

Presenter: DURRAN, Dale (University of Washington)

Session Classification: Machine Learning A