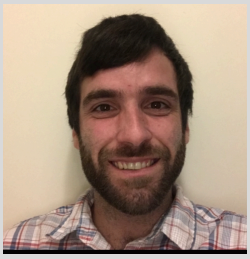
Welcome!

Please join us for the next ATOC Colloquium on **Friday, September 16** from **11:00 AM–12:00 PM,** which will be held in **SEEC S228 and simulcast over Zoom**. This week's colloquium features ATOC graduate students, **Lucas Howard and Jonah Shaw**, as well as **NCAR ASP Postdoctoral Scholar, Margaret Duffy**. Please join us for coffee beginning at 10:45 AM and stay for lunch from Illegal Pete's afterwards.

Lucas Howard ▸ A Hybrid Data Assimilation Method Using a Convolutional Neural Network and the Ensemble Kalman Filter



Accurate state initialization using data assimilation is a key contributor to forecast skill. The increasing availability of high-resolution data provides opportunities to leverage these datasets to improve model initialization and subsequent forecast skill. However, the sheer quantity of this data presents challenges for traditional data assimilation schemes and are often prohibitively expensive to incorporate into models. Machine learning (ML) methods potentially provide a means of addressing these challenges since, once trained, a ML model runs quickly compared both to forecast models and traditional DA schemes. In this proof-of-concept study, we demonstrate that a relatively simple convolutional neural network (CNN) can be successfully trained "offline" using analysis states generated by the ensemble Kalman filter (EnKF). We then employ a hybrid method using the CNN for high-resolution observations and EnKF for low-resolution observations and demonstrate that it produces improved accuracy in analysis and forecasts. We also calculate SHAP values, an "explainable AI" technique, to identify and explain the dynamics and variability of the Lorenz system identified by the CNN.

Jonah Shaw ▸ Emerging Changes in Arctic Outgoing Longwave Radiation

Strong positive climate feedbacks in the Arctic cause surface temperatures to rise much faster than the global average and modify the top-of-atmosphere (TOA) energy budget. With the Arctic climate strongly controlled by annual cycles in solar insolation, sea ice extent, cloud properties, and meridional heat transport, seasonal trends observed at the TOA capture changes in climate processes active at different times of the year. Using two decades of continuous observations of longwave irradiance from the CERES satellite mission and model simulations from the CESM1 Large Ensemble, we investigate seasonal trends in the Arctic longwave energy budget. We find that changes in Outgoing Longwave Radiation emerge from internal variability earlier for fall months than spring months. We trace this seasonality to differences in the internal variability of outgoing longwave radiation.

Margaret Duffy ▸ The Influences of Atmospheric Parameters and SST Warming Pattern on Radiative Feedbacks in CAM6

Radiative feedbacks modulate Earth's response to warming, yet have a large spread across GCMs. When evaluated using an atmospheric GCM, the uncertainty in the feedbacks comes from 1) uncertainty in model physics and 2) differences in the sea surface temperature (SST) warming pattern. Here we compare the influences of uncertainty in model physics and SST pattern on the feedbacks in the Community Atmosphere Model (CAM6). Sensitivity to both model physics and SST pattern is greatest over the tropical West Pacific.

Zoom: https://cuboulder.zoom.us/j/97845417945 **Passcode:** ATOC

About the ATOC Colloquium

The Department of Atmospheric and Oceanic Sciences (ATOC) Colloquium is typically held **every other Friday** from **11:00 AM–12:00 PM**. Colloquia alternate between the following formats: (A) Full-length talk by a faculty member or invited speaker, (B) Three conference-length talks by graduate students or postdocs. If you would like to nominate a speaker (including self), please email the ATOC Colloquium Committee Chair, Prof. Andrew Winters (andrew.c.winters@colorado.edu). Please visit www.colorado.edu/atoc/colloquium for further details.