ATOC COLLOQUIUM

Welcome!

Please join us for the next ATOC Colloquium on **Friday, April 14** 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, **Vikas Hanasoge Nataraja, Ziqi Yin, and Ethan Murray**. Please join us for coffee beginning at 10:45 AM and stay for lunch from Illegal Pete's.

Vikas Hanasoge Nataraja ▸ Using Machine Learning to Improve Cloud Retrievals

Cloud optical properties play an important role in determining the cloud radiative effect (CRE), surface energy budget, and heating profiles. Cloud optical thickness (COT), in particular, is important for the shortwave CRE. Accurately predicting the COT will help to improve our understanding of the Earth's energy budget. Current algorithms for COT retrieval from passive satellite imagery assume that clouds are homogenous within a pixel and neglect the so-called "3D effect" of clouds. We present a machine learning model that takes into account the spatial context in satellite imagery to retrieve the COT more accurately. Our model uses radiance fields from just a single wavelength and is robust to various optical depths even when trained on a highly constrained and limited data set. Testing on synthetic and aircraft imagery has shown that the model is grounded in physics and is self-consistent with the radiance fields.

Ziqi Yin ▸ High-resolution, Fully-Coupled Simulations of the Greenland Ice Sheet in a Future, Strong Warming Scenario

The Greenland Ice Sheet (GrIS) is rapidly losing mass in response to global warming, and its mass loss is driven both by atmospheric warming, increasing surface melt and meltwater runoff, and oceanic warming, leading to glacier speedup and enhanced ice discharge. Constraining future GrIS mass loss therefore calls for a unified and coupled model infrastructure employed at high horizontal resolution, allowing to resolve individual glacier basins and detailed atmospheric processes such as orographic precipitation. We will present results of a set of fully coupled CESM2.2-CISM2.1 simulations, in which a variable-resolution grid that features $\frac{1}{4}°$ regional refinement over the Arctic is used to represent the atmosphere and land. An idealized warming experiment simulating a scenario with atmospheric CO2 increasing 1% per year until quadrupling the pre-industrial level and then held fixed, is carried out after a 180-year pre-industrial simulation. We will present results on how the GrIS mass balance and surface mass balance change and briefly cover the impact of these changes on the climate. A comparison between our results and a lower-resolution simulation using the $1°$ grid will also be discussed.

Ethan Murray ▸ Aircraft Measurements of Convective Eye and Eyewall Clouds in Tropical Cyclone Sam

Novel aircraft-based observations are used to diagnose the evolution of an intense tropical cyclone's inner core. Six flights into Tropical Cyclone Sam in 2021 resulted in excellent lidar, radar, and in situ data coverage throughout the storm. Radar data provide a view into the cyclone's overall precipitation structure, while detailed lidar data highlight Sam's thermodynamic profile and low level clouds in the eye and eyewall. These observations display the variety of convective and stratiform clouds, along with their thermodynamic environments, within the inner core. In situ observations confirm the thermodynamic changes in Sam, and measurements of horizontal vorticity mixing explain how the cyclone's structure evolves over time.

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.