Welcome!

Please join us for the next ATOC Colloquium on **Friday, Sept. 12** from **11:00 AM–12:00 PM,** which will be held in **SEEC S228 and simulcast over Zoom**. This week's colloquium features three ATOC graduate students, **Ash Gilbert, Genevieve Clow and Sean Leister.**

Ash Gilbert ▸ Observed Winds Alone Cannot Explain Recent Arctic Warming and Sea Ice Loss

Since the 1980s, observations show the Arctic surface has warmed four times more than the global mean. Over the Arctic Ocean, this recent large warming is connected to sea ice loss. While earth system models are useful tools for prediction, exact replication of observed Arctic warming and sea ice loss is not expected in freely-evolving models because of internal climate variability. Previous studies have shown that historical hindcasts with model winds nudged to reanalysis can reproduce recent Arctic warming and sea ice loss. However, the influence of observed winds on these recent Arctic changes in absence of anthropogenic forcing has not been assessed. Here, we show that nudging to recent (1980-2023) observed winds alone in a pre-industrial model experiment does not reproduce the magnitude of observed warming and sea ice extent loss. This means that the large-scale winds are not the primary driver of recently observed large Arctic trends. Yet, the winds do partially reproduce the interannual, seasonal, and spatial variability, especially in spring. We also show that in a pre-industrial climate simulation, these results are largely independent of mean state sea ice thickness. In short, the observed winds drive part of the Arctic temperature and sea ice variability but not long-term trends.

Genevieve Clow ▸ Detectability of phytoplankton biomass extremes using simulated satellite chlorophyll observations

Phytoplankton are the foundation of the marine food web and play a key role in the global carbon cycle. When their productivity deviates from expected patterns, the impacts can cascade through the ecosystem. While extreme phytoplankton events have been documented, our understanding of their global characteristics and impacts remains limited. Phytoplankton populations are often studied using satellite-derived chlorophyll. However, retrieval issues leave extensive data gaps, and surface chlorophyll and total biomass are frequently decoupled. To investigate the detectability of daily phytoplankton biomass extremes, we utilize a satellite simulator in the Community Earth System Model: the Chlorophyll Observation Simulator Package (ChlOSP). In this talk, I will introduce ChlOSP, explain how it enables us to study the detectability of phytoplankton extremes, and share insight into how well satellites capture these events.

Sean Leister ▸ Climate-wildfire coupling drives hemispherically distinct responses and reduced climate variability in CESM2

Wildfires are an important component of the Earth system, as they alter Earth's energy imbalance by releasing atmospheric aerosols and changing surface albedo. In turn, climate conditions, such as temperature, humidity, and wind, also influence wildfire activity. While a growing body of evidence suggests that wildfires can result in substantial climate responses across the globe, the coupled response has gone largely unstudied. Adding onto this uncertainty, most current Earth system models do not couple wildfires to the broader climate system. Here, we analyze novel simulations using the Community Earth System Model version 2 (CESM2) in which biomass burning emissions are explicitly simulated by the land model and coupled to the atmosphere. These simulations are then compared against simulations in which such emissions are prescribed. We show that when wildfires are coupled, a broad range of interconnected responses occur, primarily via aerosol-cloud interactions. Strong contrasts between hemispheres are identified in the climate response, as biomass aerosol burdens increase across much of the Southern Hemisphere but decrease generally in the Northern Hemisphere, leading to hemispherically asymmetric responses in cloud albedo and absorbed solar radiation. Furthermore, wildfire-climate coupling is found to drive persistent reductions in interannual variability across much of the globe. Ironically, these reductions are associated with more frequent and variable boreal wildfires and aerosol burdens. The broad range of responses identified herein emphasize the importance of understanding wildfire's fundamental role in the climate system and the potential shortcomings of simulations in which wildfire emissions are prescribed.

Zoom: https://cuboulder.zoom.us/j/4713174822?omn=99341251732 **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–Noon**. 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. If you would like to nominate a speaker (including self), please email the ATOC Colloquium Committee Chair, Prof. Jianghanyang (Ben) Li (Jianghanyang.li@colorado.edu). Please visit www.colorado.edu/atoc/colloquium for further details.