



ATOC COLLOQUIUM

Welcome!

Please join us for the next ATOC Colloquium on **Friday, October 16** from **11:00 AM–12:00 PM**. This week's colloquium features **Hannah Zanowski (ATOC/INSTAAR)**, **Dillon Amaya (ATOC/CIRES)**, and **Jen Kay (ATOC/CIRES)**. Please use the following Zoom link to join us: <https://cuboulder.zoom.us/j/96833281435> Passcode: climate

Hannah Zanowski ► Arctic freshwater storage and export in CMIP6 models

We analyze Arctic freshwater storage and fluxes in 7 climate models from the Coupled Model Intercomparison Project phase 6 (CMIP6) over the historical period (1980-2000) and in two future emissions scenarios, SSP1-2.6 and SSP5-8.5. In both future scenarios the models show an increase in liquid (ocean) freshwater storage in conjunction with a reduction in solid storage and fluxes through the major Arctic gateways (Bering Strait, Fram Strait, Davis Strait, and the Barents Sea Opening) that is typically larger for SSP5-8.5 than SSP1-2.6. The liquid fluxes through the gateways exhibit a more complex pattern, with models showing a change in sign of the freshwater flux through the Barents Sea Opening and little change in the flux through the Bering Strait in addition to increased export from the remaining straits. Although the models broadly agree on the sign of future storage and flux changes, substantial differences exist between the magnitude of these changes and the models' Arctic mean states.

Dillon Amaya ► Are long-term changes in mixed layer depth influencing North Pacific marine heatwaves?

Climate model projections indicate that upper ocean stratification is expected to increase in response to continued greenhouse gas warming, shoaling the mean mixed layer depth (MLD) throughout much of the globe. Long-term shoaling of the mean MLD would result in a stronger ocean temperature response for the same surface heat flux forcing. This has significant implications for the likelihood and intensity of ocean temperature extremes (i.e., marine heatwaves) and their potential impacts on sensitive marine ecosystems. In this study, we investigate the influence of long-term MLD shoaling on marine heatwaves in the observational record and in future climate model projections, with a particular focus on the Northeast Pacific. We find that recent marine heatwaves, such as the summer 2019 Blob 2.0, and their impacts were likely amplified by multi-decadal shoaling of the mixed layer since 1980.

Jen Kay ► Quantifying the influence of cloud radiative feedbacks on Arctic surface warming using cloud locking in an earth system model

Understanding the influence of clouds on amplified Arctic surface warming remains an important unsolved research problem. Here, this cloud influence is directly quantified by disabling cloud radiative feedbacks or “cloud locking” within a state-of-the-art and well-documented model. Through comparison of idealized greenhouse warming experiments with and without cloud locking, the influence of Arctic and global cloud feedbacks is assessed. Global cloud feedbacks increase both global and Arctic warming by around 25%. In contrast, disabling Arctic cloud feedbacks has a negligible influence on both Arctic and global surface warming. Interestingly, the sum of noncloud radiative feedbacks does not change with either global or Arctic-only cloud locking. Notably, the influence of Arctic cloud feedbacks is likely underestimated, because, like many models, the model used here underestimates high-latitude supercooled cloud liquid. More broadly, this work demonstrates the value of regional and global cloud locking in a well-characterized model.

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. Jan Lenaerts (jan.lenaerts@colorado.edu). Please visit www.colorado.edu/atoc/colloquium for further details.