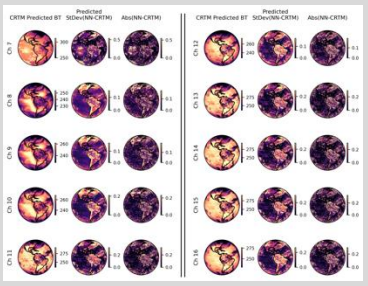
Welcome!

Please join us for the next ATOC Colloquium on **Friday, Apr. 18** from **11:00 AM–12:00 PM,** which will be held in **SEEC S372 and simulcast over Zoom**. This week's colloquium features three ATOC graduate students, **Mckenzie Larson, Lucas Howard, and Tina Geller.**

Mckenzie Larson ▸ What's up with this wind? It's actually downslope!

Downslope windstorms are common leeward of the Rocky Mountains across the High Plains of Colorado during October through March and can cause property damage and increased fire danger. On 30 December 2021, the Marshall Fire ignited during an intense downslope windstorm with a gust of 112 mph measured at the NSF NCAR Mesa Laboratory, resulting in the destruction of nearly 1100 homes in our community. The Colorado Front Range is renowned for two primary types of strong downslope winds: (1) chinooks that feature warm, dry winds and are often associated with the development of mountain waves, and (2) boras that are colder and often associated with the passage of a mid- and upper-level trough. We discuss the synoptic environments that are conducive to the formation of both flavors of downslope windstorms. Additionally, the strongest wind gusts associated with downslope windstorms along the Colorado Front Range are decreasing in intensity when compared to the 1960s, 1970s, and 1980s. We examine trends in downslope windstorm intensity measured at NSF NCAR and hypothesize causes for the apparent decrease in the strength of extreme windstorms.

Lucas Howard ▸ Probabilistic Emulation of the Community Radiative Transfer Model Using Machine Learning



The continuous improvement in weather forecast skill over the past several decades is largely due to the increasing quantity of available satellite observations and their assimilation into operational forecast systems. Assimilating these observations requires observation operators in the form of radiative transfer models. Significant efforts have been dedicated to enhancing the computational efficiency of these models. Computational cost remains a bottleneck, however, and a large fraction of available data goes unused for data assimilation as a result. To address this, we used machine learning to build an efficient neural network (NN) based probabilistic emulator of the Community Radiative Transfer Model, applied to the GOES Advanced Baseline Imager (ABI). We will present results from the trained NN emulator which predicts CRTM results as well as the corresponding error with respect to CRTM. Across all channels, the RMSE of the predicted brightness temperature is 0.3 K. For clear sky conditions the RMSE is less than 0.1 K for 9 out of 10 channels. The error predictions are generally reliable across a wide range of conditions. Explainable AI methods demonstrate that trained emulator reproduces the relevant physics, increasing confidence that the model will perform well when presented with new data. Future work will involve integrating the trained emulator into the Unified Foreword Operator (UFO) within the JEDI framework. Observing system experiments can then be performed to evaluate the new operator.

Tina Geller ▸ Variability in freshwater transport in Arctic Alaskan Lagoons

Circulation and freshwater transport in lagoons determine when and where nutrients from rivers are transported, which impacts local marine food webs and biogeochemical dynamics. Interacting processes like river inflow and winds cause circulation and freshwater transport to vary in space and time. For this study, we characterize the drivers and patterns of this variability in five connected lagoons around Kaktovik in Arctic Alaska for nearly ice-free conditions in 2019 using a regional ocean model (i.e., ROMS). These lagoons vary in river influence, shelf connectivity, and water depth. The model accounts for winds, rivers, shelf circulation, tides, and bathymetry and tracks neutrally buoyant tracers during six events of variable wind and river inflow. Preliminary results suggest that lagoon currents oscillated depending on the direction and magnitude of winds and shelf currents and generally ranged from zero to ~30 cm/s, with greater speeds at inlets and in lagoons more connected to the shelf. Overall, analysis of the tracers showed that freshwater was exported from the estuaries on timescales of days to weeks and its transport was also determined mainly by wind direction and speed, although river discharge was also influential. Wind events exported ~30-80% of freshwater tracers from the lagoon system in three days. Freshwater tracers were nearly gone from the lagoons within five weeks. Within the lagoons, water composition ranged from ~30-90% freshwater. Generally, smaller and more protected lagoons had lower salinities than larger lagoons more connected to the shelf. Overall, our results imply that the retention of nutrients in the lagoons, and associated impacts on biogeochemical cycling and food webs, varies depending mainly on wind and connectivity to the shelf.

Zoom: https://cuboulder.zoom.us/j/4713174822?omn=99132328283 **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.