

Welcome!

Please join us for the next ATOC Colloquium on **Friday, Oct. 30** 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/postdocs, **Chaehyeong Lee, Peter Effertz, and Leah Bertrand**. Please join us for conversation beginning at 10:45 AM.

Chaehyeong Lee ▸ Effects of Satellite Sea Surface Salinity Assimilation on the Representation of Upper-Ocean Thermohaline Structure and Variability in the NASA GEOS-S2S-2 Model.



Recent satellite-based sea surface salinity (SSS) observations enable real-time assimilation, and their potential benefits for weather forecasting and climate prediction have received increasing attention. However, a comprehensive assessment of how SSS assimilation affects the upper-ocean thermohaline structure and variability remains lacking. Here, we evaluate the impact of assimilating satellite SSS observations in the NASA Goddard Earth Observing System Subseasonal-to-Seasonal prediction system version 2 (GEOS-S2S-2). A simulation including SSS assimilation is compared with a control simulation without SSS assimilation, and both simulations are evaluated against observations across seasonal and shorter timescales. Assimilating satellite SSS observations improves the three-dimensional salinity structure of the upper ocean and produces corresponding changes in subsurface temperature despite daily sea surface temperature relaxation, demonstrating that surface salinity observations influence the ocean vertical structure. At seasonal timescales, SSS assimilation improves the amplitude and phase of upper-ocean variability, including enhancing the representation of upper-ocean heat content. At daily timescales, regional evaluations where observations are available show improved thermohaline variability, including a more accurate representation of subsurface temperature anomalies during the 2014–2016 Northeast Pacific marine heatwave. Overall, assimilating satellite SSS observations reduces global and regional root-mean-squared differences in monthly deseasonalized anomaly fields (compared with gridded observations) by up to 34%, highlighting the potential of satellite SSS assimilation to improve subseasonal-to-seasonal ocean prediction and the representation of climate variability.



Peter Effertz ▸ Updated Trend model in Total and Partial Column Ozone: Comparing Dobson, Satellite Overpass, and Ozonesonde Records

Stratospheric ozone shields life on the surface from harmful ultraviolet radiation, and tracking its recovery under the Montreal Protocol requires long, well-characterized records of both the total column and the vertical profile, such as NOAA's Global Monitoring Laboratory long continuous record. This talk presents an update on total column ozone (TCO) trends, the quantity most directly tied to surface UV exposure, along with trends in the partial column ozone. Trends are derived using an optimized LOTUS (Long-term Ozone Trends and Uncertainties in the Stratosphere) regression model that accounts for natural and dynamic variability so that the remaining trend can be attributed as chemically driven in response to the Montreal Protocol. To assess the robustness of the derived trends, I compare three independent measurement approaches: Umkehr retrievals from NOAA Dobson spectrophotometers, COH satellite overpass data, and ozonesonde profiles. Positive trends in total column ozone are clearest in the southern hemisphere mid-latitudes and in the upper stratosphere globally, where trends of 1-2% per decade were derived with high confidence. Examining individual monitoring-station trends while accounting for regional dynamical variability improves model fit, reduces uncertainty, and, in some cases, reveals more positive trends. The results offer a consistent, multi-instrument view of ozone changes since 2000, with implications for interpreting observed recovery and for continued ozone monitoring.

Leah Bertrand ▸ Explaining surface radiation change 2001-2023 on Alaska's North Slope



Changes in surface radiation are a key contributor to Arctic surface warming. However, the details of Arctic surface radiation change are not fully known due to a lack of multi-decadal observations. Here, we leverage 23 years (2001-2023) of ground-based observations at two neighboring coastal tundra sites on the North Slope of Alaska (NSA) to explain surface radiation change. US Department of Energy Atmospheric Radiation Measurement (ARM) and National Oceanic and Atmospheric Administration (NOAA) facilities in Utgiagvik, Alaska have documented radiation change amidst local warming (0.9 K/decade since 2001). Surface downwelling longwave radiation increases year-round. Shortwave downwelling and net radiation decrease during sunlit months (April-September). Decreasing net shortwave radiation is driven by changing cloud properties and increasing surface albedo over exposed tundra in mid-summer. Increasing downwelling longwave radiation during both sunlit and dark months (October-March) is driven by atmospheric warming, increasing water vapor, and changing cloud properties. Atmospheric warming and increasing water vapor explain about half the total observed increase in downwelling longwave radiation, while changing cloud properties explain the rest. These results reveal substantial surface radiative changes on the NSA, where cloud radiative effect changes amplify surface warming during dark months and dampen it during sunlit months.

Zoom: https://cuboulder.zoom.us/j/4713174822 **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.