Welcome!

Please join us for the next ATOC Colloquium on **Friday, January 24** from **11:00 AM–12:00 PM,** which will be held in **SEEC S228 and simulcast over Zoom**. This week's colloquium features **Dr. Siyuan Wang (NOAA CSL).** Please join us for conversation beginning at 10:45 AM and stay for lunch afterwards.

Advancing Wildfire Research using Large Eddy Simulation (LES) and Machine Learning

Wildfires affect weather and climate, with costly impacts on human health and properties. With record high heat and severe drought conditions in the western United States, wildfires have become a growing concern. Despite decades of research, wildfires are still challenging to represent in modern air quality forecast models. One fundamental reason is that the spatial resolutions at which air quality models are operated are much coarser than the spatial extent of most wildfires. As a result, several key processes in wildfires cannot be explicitly resolved especially in the early stage. Methods available to parameterize these processes remain highly uncertain and have major impacts on the plume transport and the impacts on air quality downwind. One of such poorly resolved processes is plume rise. It has been well documented that even state-of-the-art plume rise models are subject to large uncertainties and do not reliably predict plumes injected into the free troposphere. In this presentation, I seek to address some of these issues faced by large scale air quality models. An idealized Large Eddy Simulation (LES) model, coupled with simple yet representative chemistry, is used to study the turbulence-chemistry interactions in fresh wildfire plumes, with implications for air quality models with coarser grid resolutions. I also present the development of a new wildfire plume rise scheme, based on the idealized LES model. A machine learning framework, trained by this LES model, emulates the plume rise process considering the impacts of the fire-induced buoyancy, entrainment, and moisture processes (microphysics). Preliminary results show that this LES-trained machine learning emulator outperforms the benchmark model, a widely used physics-based plume rise model in terms of mean smoke injection height and smoke profile shape. We will use a wide array of observations to evaluate the emulator, including airborne lidar measurements, multiple sets of satellite-based aerosol/smoke layer height products, as well as meteorological radar (NEXRAD). In summary, this machine learning emulator for plume rise provides an accurate and computationally efficient solution for air quality models and chemistry-climate models.

Location: SEEC S228 & Zoom
Zoom:
https://cuboulder.zoom.us/j/4713174822
Password: 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.