

## ACOM Seminar

# Improving Analysis and Prediction of Chemical Tracers and Sources with Non-Gaussian, Nonlinear Ensemble Data Assimilation

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Date: Thursday, Nov 30<sup>th</sup>, 2023, 11:00 am – 12:00 pm (MT)

Link: <https://operations.ucar.edu/live-acom>

## ABSTRACT

NCAR's Data Assimilation Research Testbed (DART) has been used for many years to produce ensemble analyses and forecasts for chemical concentrations and sources in both WRF-Chem and CAM-Chem by ACOM scientists. A few results from each model will be presented.

Data assimilation for atmospheric chemistry is particularly challenging. Most affordable assimilation algorithms assume that the probability distributions for model variables are approximately Gaussian while the relations between different variables are linear. However, chemical concentrations are known to have troublingly non-Gaussian distributions resulting from their fundamental boundedness, the affects of advection, and the nature of chemical reactions. The relations between the concentration of a given species and other model variables are also often strongly nonlinear. Assimilation for source estimation faces all these challenges and more.

Novel and efficient ensemble assimilation methods that work with arbitrary distributions (not just Gaussian) and can represent many types of nonlinearities are now available in DART. Simple idealized examples will demonstrate how these can significantly improve assimilation results for tracers. Examples from a low-order tracer advection and source model provide a more comprehensive demonstration of the enhanced capabilities of the new methods. A few preliminary results from ACOM scientists exploring the methods with CAM-Chem will conclude the presentation.