1. Motivation

Subgrid treatments for aerosols and their climate forcing are under-studied, whereas subgrid treatments for meteorological processes in atmospheric models have been studied extensively.

- Need to quantify trace gas and aerosol subgrid variability and document the severity of neglecting this issue.
- What processes contribute most to subgrid aerosol variability, e.g., terrain, relative humidity differences, emissions, non-linearity of chemical reactions?
- What impact does neglected subgrid aerosol variability have on climate simulations?

2. Methodology

Use WRF-Chem to simulate differences in variability between two grid spacings, one with spacing on the order of a climate model, 75 km, and one on the order of a cloud-scale resolving model, 3 km.

- High-resolution domain serves as a proxy for added variability that would be present in the real world.
- Simulations encompass MILAGRO field campaign, March 2006.

3. Impact of Scale on Aerosol Field

Impact of increased resolution on aerosol is to add small-scale variability, and often to reduce bias compared to coarser simulations.

4. Impact of Scale on Direct Aerosol Radiative Forcing

Subgrid errors in aerosol fields lead to errors in direct aerosol radiative forcing, which lead to uncertainty in climate predictions.

- Dust emission dominates signal in “all aerosol species” analysis.
- Plume structure downwind of Mexico City becomes evident in scale induced error when excluding dust.
- Neglecting subgrid variability results in >30% error over much of central Mexico in TOA direct aerosol radiative forcing, whole domain average over 2 weeks is ~10% error.
- Need to expand study to other megacities to assess sensitivity to topography, season, dominant pollution type, etc.

5. References
