Motivation

- Satellite observations demonstrated positive and systematic correlation between cloud fraction (CF) of liquid water clouds and aerosol optical depth (AOD).
- Drop-size-dependent evaporation rates may be responsible for changes of cloud size and CF.
- Can we observe strong relationship between cumulus CF and AOD from surface observations?
- Does this relationship depend on cloud size?

Case Study: MPL images for clean (top) and polluted (bottom) day

Summary

- We developed five-year climatology of fair-weather cumulus macrophysical (Berg and Kassianov, 2007) and aerosol optical properties.
- Relationship between CF and AOD appear to be time dependent: Positive/neutral (in morning) and negative (afternoon).
- Small and large clouds appear to have opposite response to increase of AOD: Positive (small clouds) and negative/neutral (large clouds).

Five-Year Climatology: 2000-2004

Relationship between CF and AOD as function of time of day (left) and horizontal cloud size L (right)

Measurements

- Cloud properties come from the ARM Active Remotely Sensed Clouds Locations (ARSCL) value-added product (VAP).
- Aerosol and thermodynamical properties are obtained from Aerosol Observing System (AOS)/MFRSR and SMOS, respectively.
- Surface measurements are accompanied by satellite (MODIS) observations.

Approach

- Collect data during 5 summers: 2000-2004 (single cloud layer, relatively non-absorbing aerosols).
- Develop climatology of fair-weather cumulus and combine it with available AOD dataset.
- Select a few days with similar thermodynamical properties and different AOD (e.g., 5 and 8 July, 2002).
- Perform statistical analysis.

Case Study (5 and 8 July, 2002): Satellite Data

Difference between AOD (thermodynamical properties) is large (small) Clouds fade away afternoon on July 8 (polluted day)

Case Study: TSI images for clean (left) and polluted (right) day


Contact Information: Evgeni.Kassianov@pnl.gov