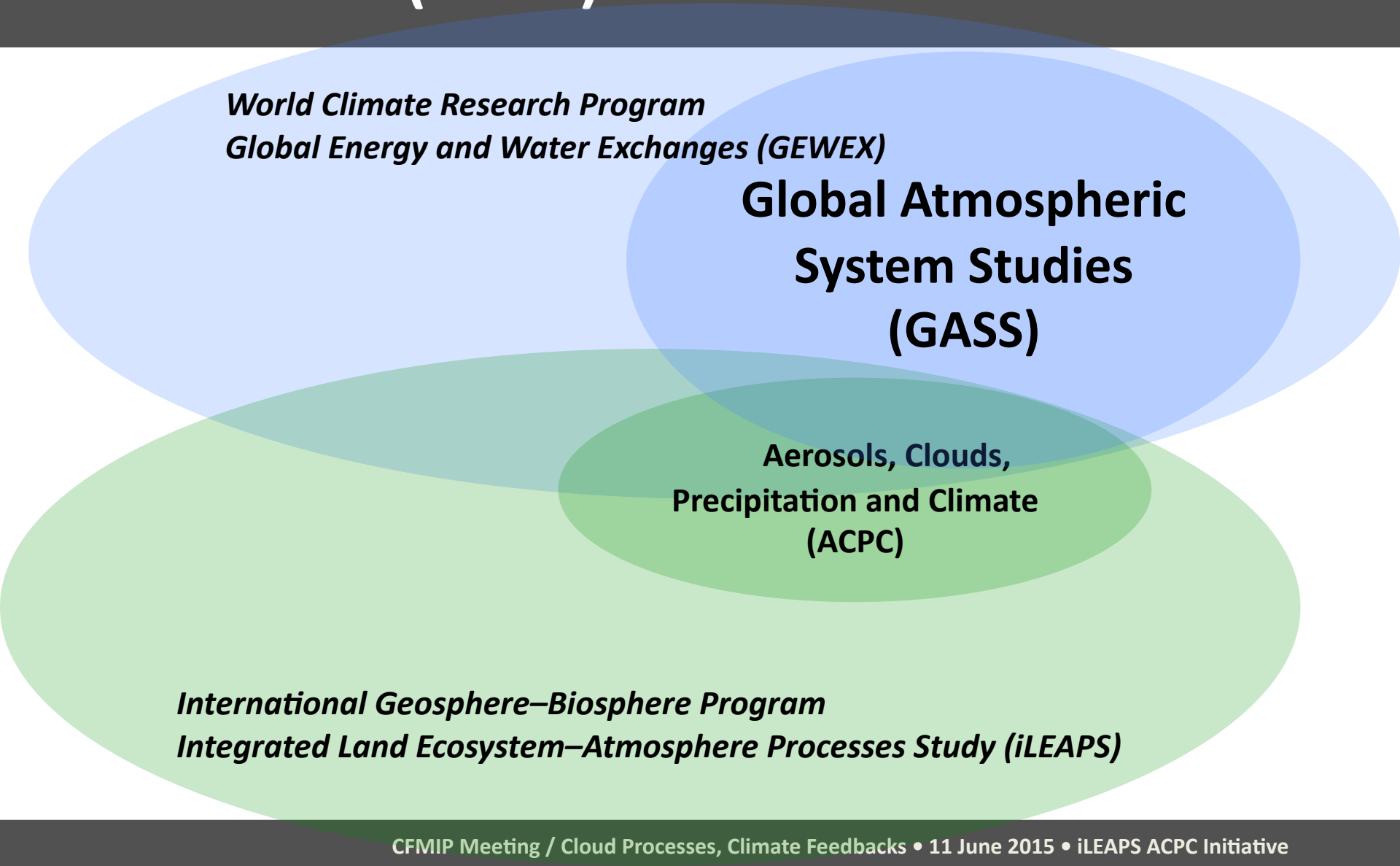
The Aerosols, Clouds, Precipitation and Climate (ACPC) Initiative



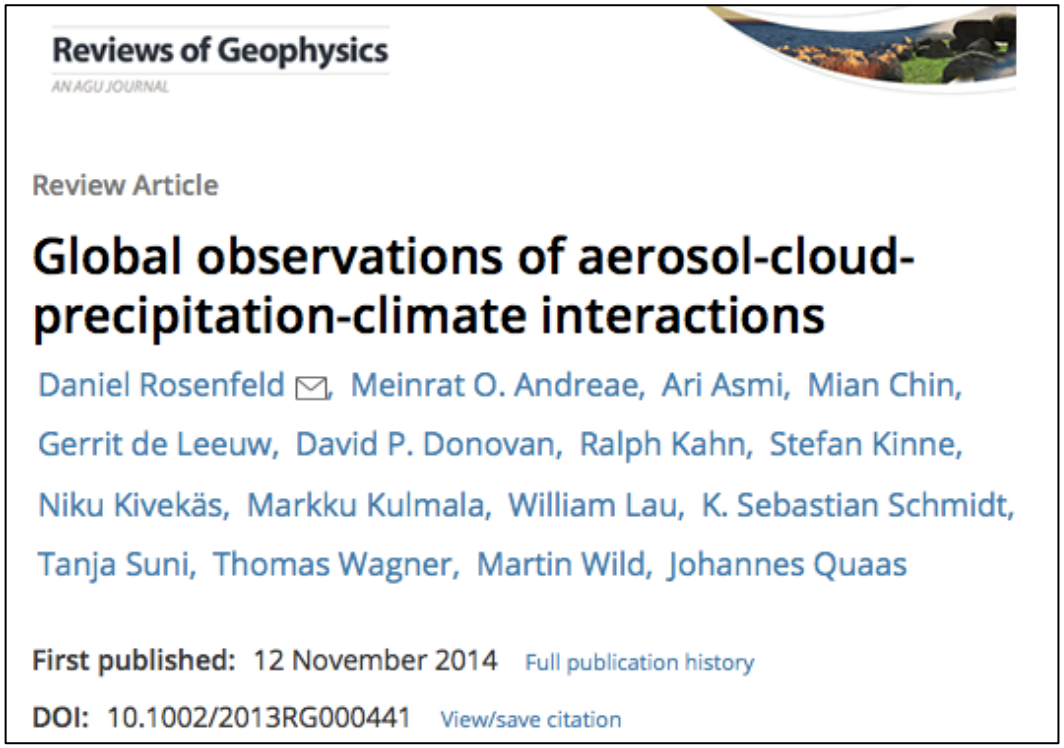
GEWEX and iLEAPS

- GEWEX panels
  - Global Atmospheric System Studies (GASS)
  - Global Land/Atmosphere System Study (GLASS)
  - GEWEX Hydroclimatology Panel (GHP)
  - GEWEX Data and Assessments Panel (GDAP)
- iLEAPS initiatives
  - Interdisciplinary Biomass Burning Initiative (IBBI)
  - Interactions among Managed Ecosystems, Climate, and Societies (IMECS)
  - Extreme Events and Environments (EEE)
  - Aerosols, Clouds, Precipitation and Climate (ACPC)
  - Bridging the gap between iLEAPS and GEWEX land-surface modelling
  - ...

ACPC

- Science
  - How do aerosol-precipitation interactions manifest themselves at the full range of temporal and spatial scales in the climate system?
- Co-chairs
  - Danny Rosenfeld
  - Johannes Quaas

"a route to progress is proposed here in the form of a series of box flux closure experiments in the various climate regimes"



Reviews of Geophysics
AN AGU JOURNAL

Review Article

Global observations of aerosol-cloud-precipitation-climate interactions

Daniel Rosenfeld, Meinrat O. Andreae, Ari Asmi, Mian Chin, Gerrit de Leeuw, David P. Donovan, Ralph Kahn, Stefan Kinne, Niku Kivekäs, Markku Kulmala, William Lau, K. Sebastian Schmidt, Tanja Suni, Thomas Wagner, Martin Wild, Johannes Quaas

First published: 12 November 2014 Full publication history

DOI: 10.1002/2013RG000441 View/save citation

2015 ACPC Workshop (April, NASA GISS)

- consider whether modern satellite measurements and other instrument advances enable useful mass, energy and water budget closure
- focus on regimes susceptible to aerosol influences that experience substantial aerosol perturbations
- awareness that experimental uncertainties are substantial (e.g. in OLR and RSW derived from geostationary satellites)
- carry out observation system simulation experiment (OSSE) approach in two target conditions
  - deep convection in the Houston region specifically
  - shallow convection in the VOCALS region as a proxy

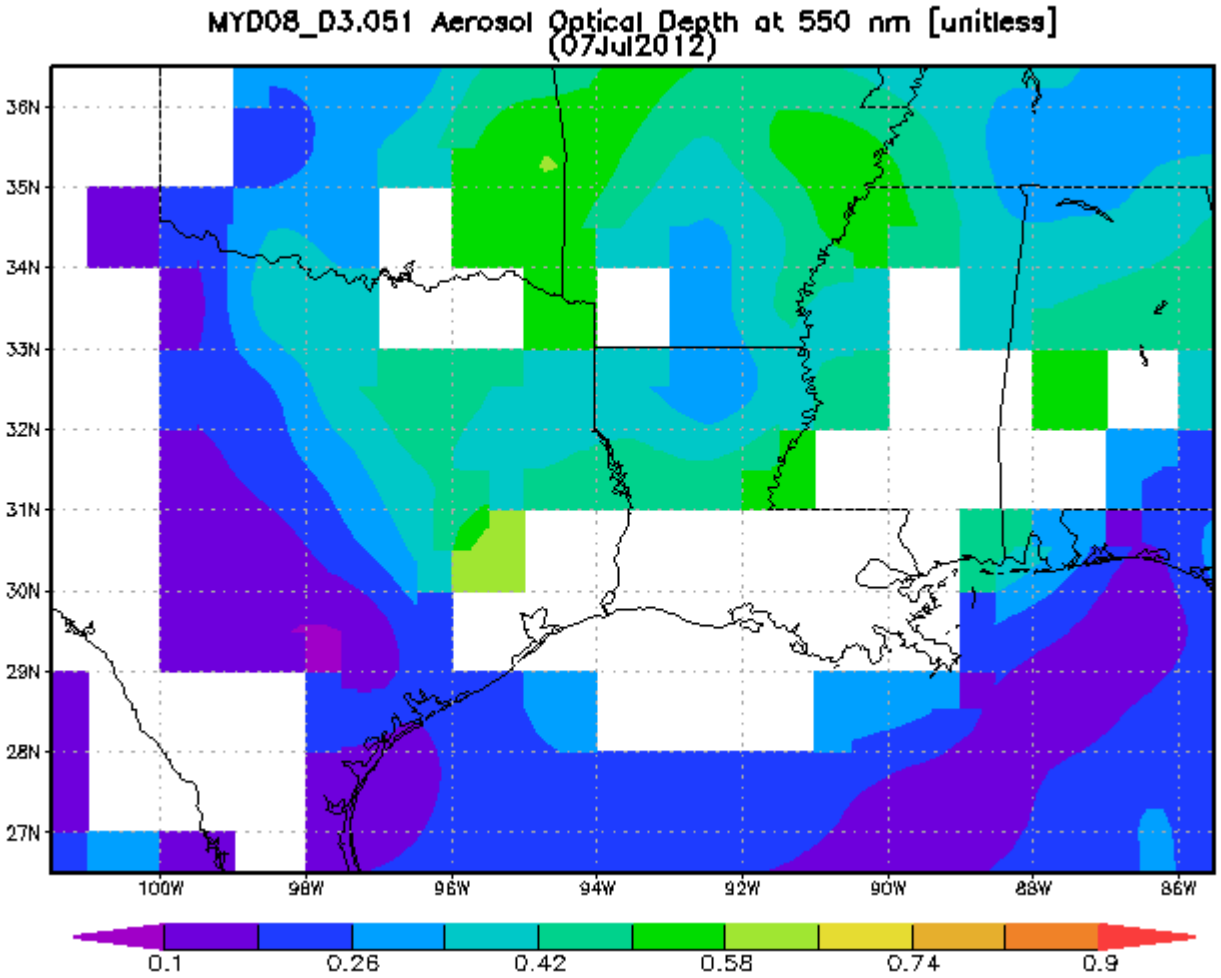
Shallow convection: VOCALS (Rob Wood et al)

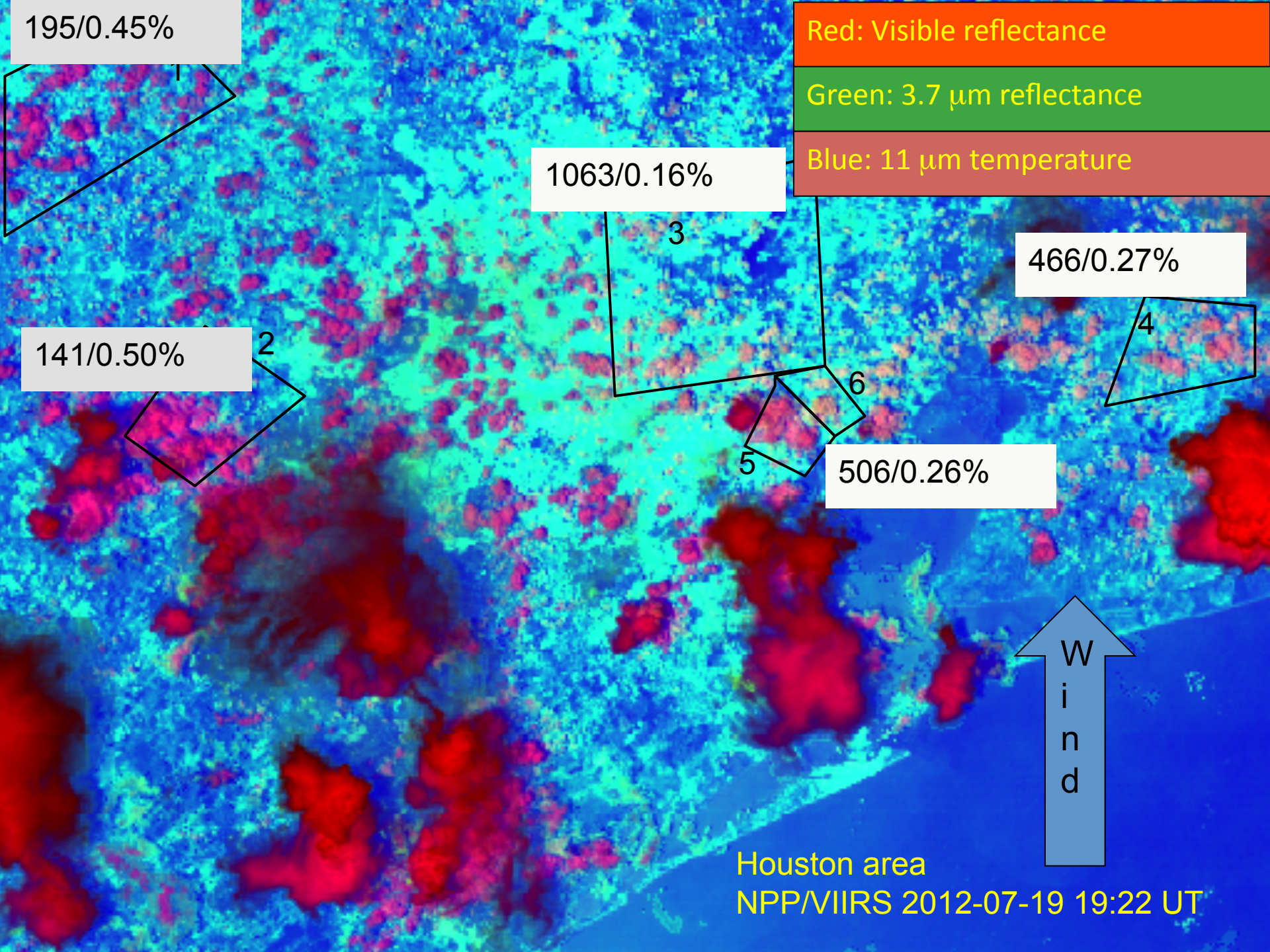
- iterative modeling study
  - What is the magnitude of model-derived *aerosol-induced perturbations* to regional energy and moisture budgets?
  - Do models agree on the geographical and temporal variability in these perturbations?
  - Does spatiotemporal variability in the current climate inform us about these aerosol-induced perturbations?
  - What processes contribute to modeled energy and moisture budget perturbations?
  - Are budget perturbations in LES and regional models consistent?
  - Are perturbations observable using current and future planned satellite and field observations?
- regional climate models with interactive aerosols spun up from VOCALS emissions dataset (all, natural-only)
- LES at 50-100-m resolution, $(25\ km)^2$ domain, periodic BC, Eulerian or Lagrangian using mesoscale model results
- diagnostics to include energy and water budgets, cloud and aerosol quantities, satellite simulator output

Deep convection: Houston (Rosenfeld et al)

- modeling study
  - assess the value of a field campaign to study the microphysics of convective updrafts in a region of substantial aerosol perturbation and high susceptibility (warm cloud base, pristine upwind condition, weak synoptic forcing)
  - within NEXRAD dual- polarimetric radar network and lightning mapping array coverage, airborne aerosol measurements, portable X- and C-band dual-polarimetric radars, and satellite data analysis (no such data set to date)
- WRF-Chem simulations with 300-500 km on a side, initialized using reanalysis, AERONET/satellite/DISCOVER-AQ-informed aerosol, and prognostic aerosol and ice nuclei (Hoose, Stier)
- diagnostics to include water, energy and aerosol budgets, satellite simulator, and forward simulation of polarimetric radar variables (using HUCM bin microphysics) and lightning

Deep convection: Houston (Rosenfeld et al)




195/0.45%
1
Red: Visible reflectance
Green: 3.7 μm reflectance
Blue: 11 μm temperature
1063/0.16%
3
466/0.27%
4
141/0.50%
2
6
5
506/0.26%
Wind
Houston area
NPP/VIIRS 2012-07-19 19:22 UT

Interested?

- this is an unfunded activity
- great for graduate students and post-docs!
- run a case
- prepare input data sets (DISCOVER-AQ aerosol, ice nucleation)
- participate in forward simulation
  - COSP
  - dual-polarimetric radar (X-, C-, S-band)
  - other satellite observations
- participate in model evaluation/analysis
  - general evaluation of simulated cloud and precipitation physics (drizzle, deep convection)
- contacts: Rob Wood, Danny Rosenfeld