Diurnal cycle of physical processes in NAME atmospheric columns

A NAME Climate Process Team activity
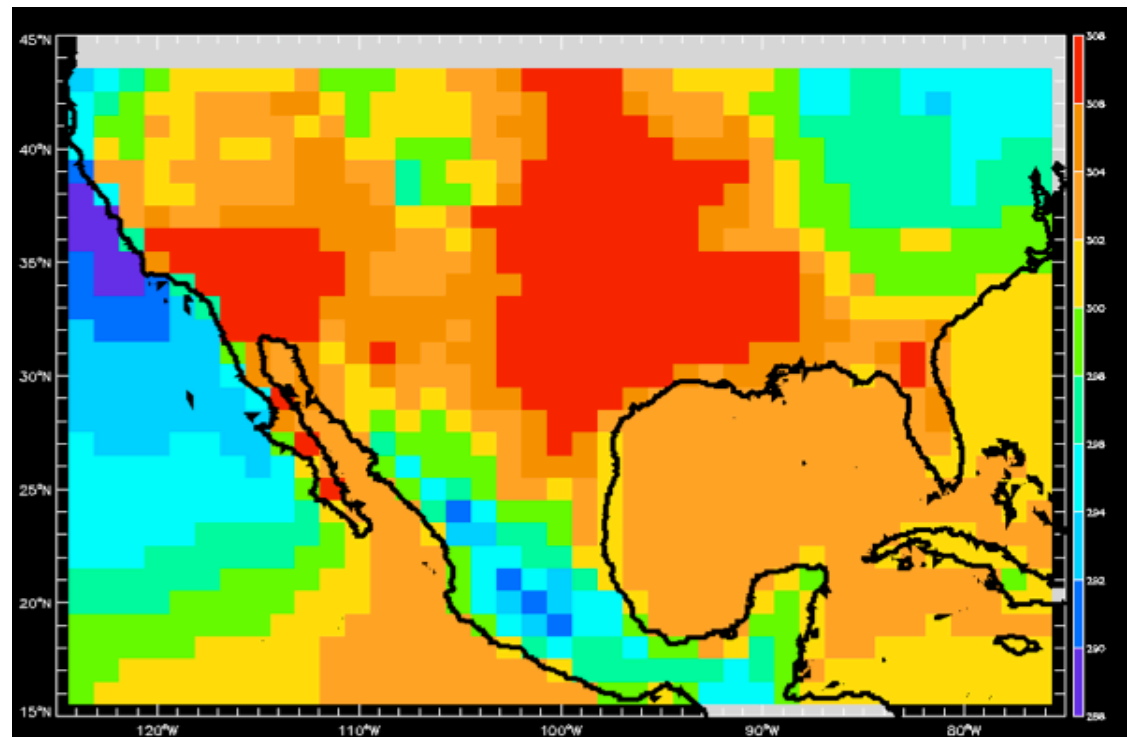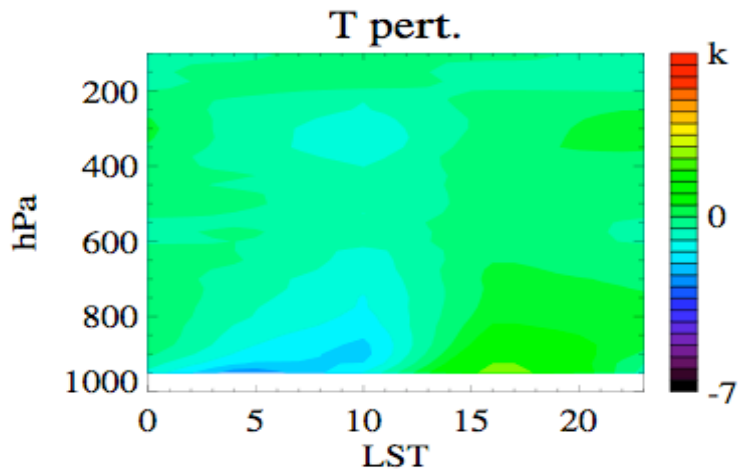
Patrick Kelly and Brian Mapes

Focus

As a first step in a multi-model and observation comparison project, this poster examines data at Phoenix, mainly in August 2004,from the NCAR CAM model (T85 version), and some observations.
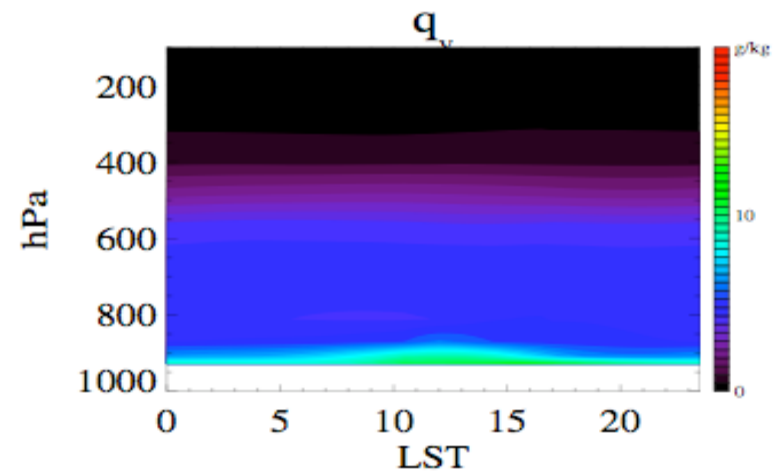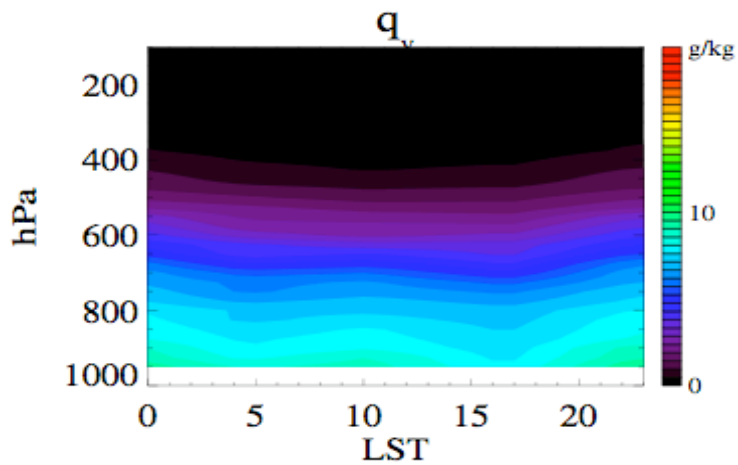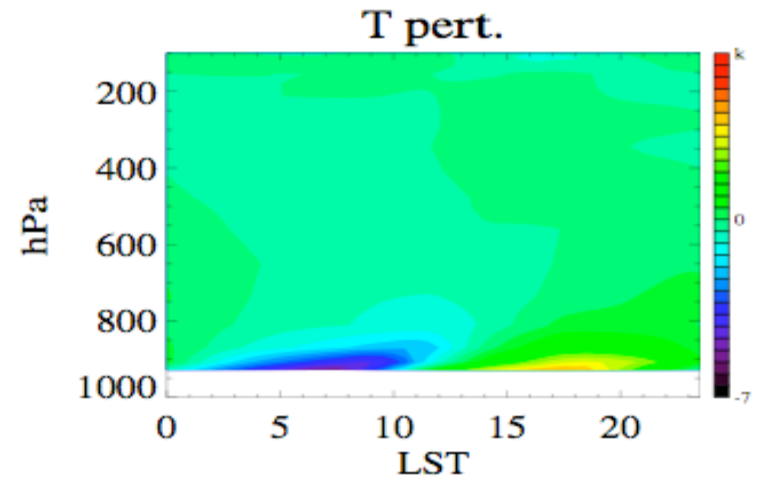
T85 Gridpoints and Radiative Temp

The model has too little humidity, so a too-cold and thin nocturnal boundary layer develops...
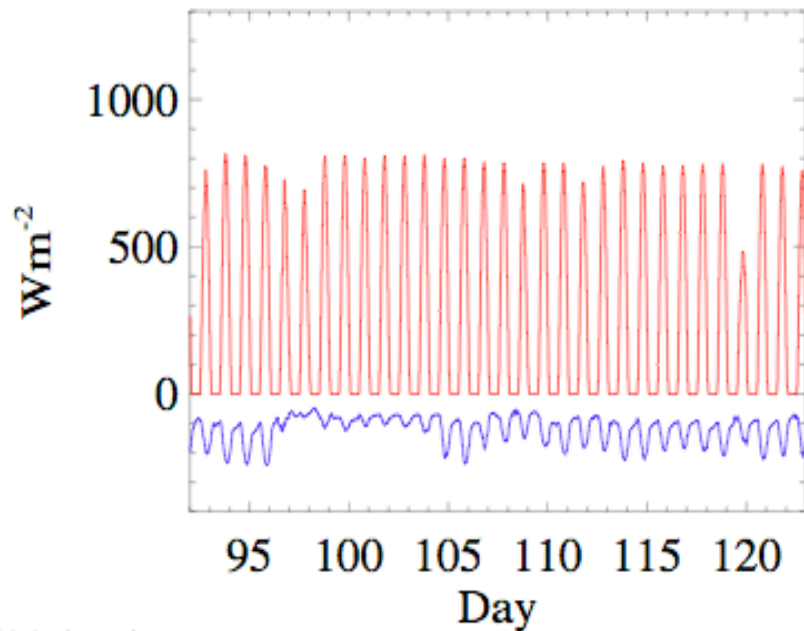

Observation

CAM Model

Obs.phoenix.aug

CAM.phoenix.aug

...While the model does have convective rain on some days, there are no cloud shadows cast on the ground...
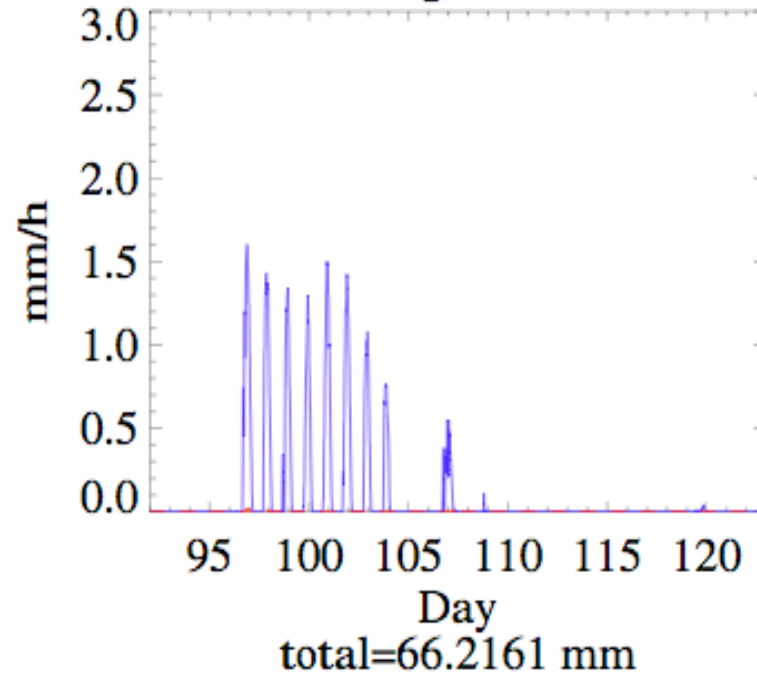

net SW & IR

CAM.phoenix.aug

—— SW   —— IR

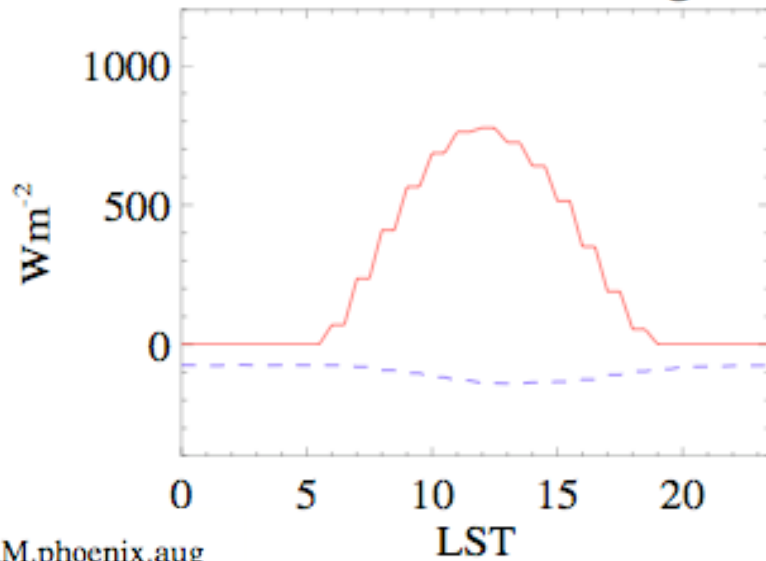Radiation defined positive incoming

Precipitation

total=66.2161 mm

—— Stratiform   —— Convective + Stratiform

...The surface radiation budget is almost the same on days with and without convective rain...
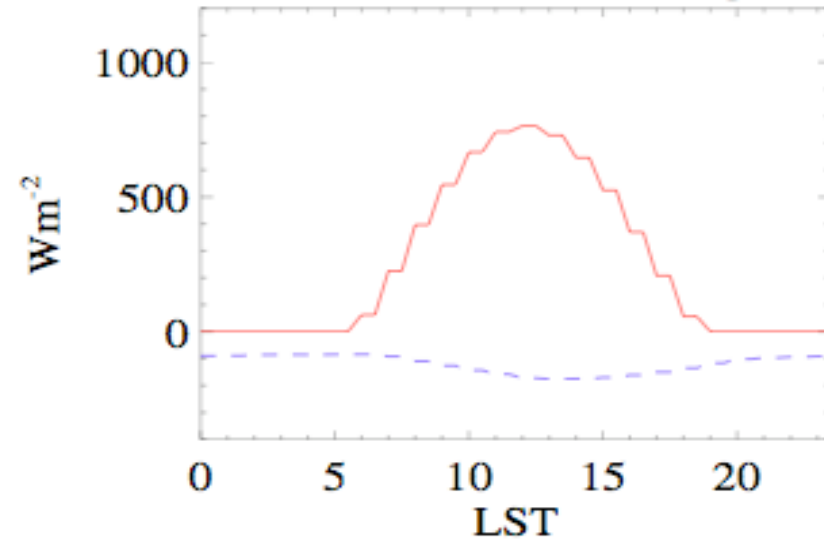
Wettest 10 Days

Driest 10 Days

...but a stratiform rain day can really cut down the insolation...

CAM.phoenix.jun

net SW & IR — Wm^{-2} vs Day

Precipitation — mm/h vs Day
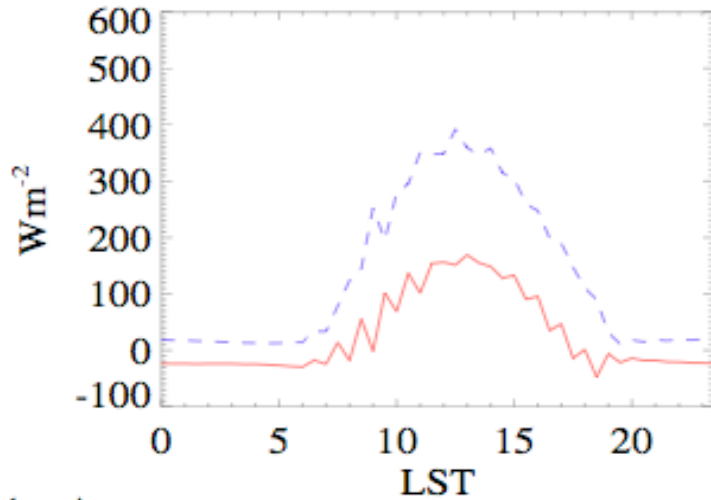
total=1.1787 mm
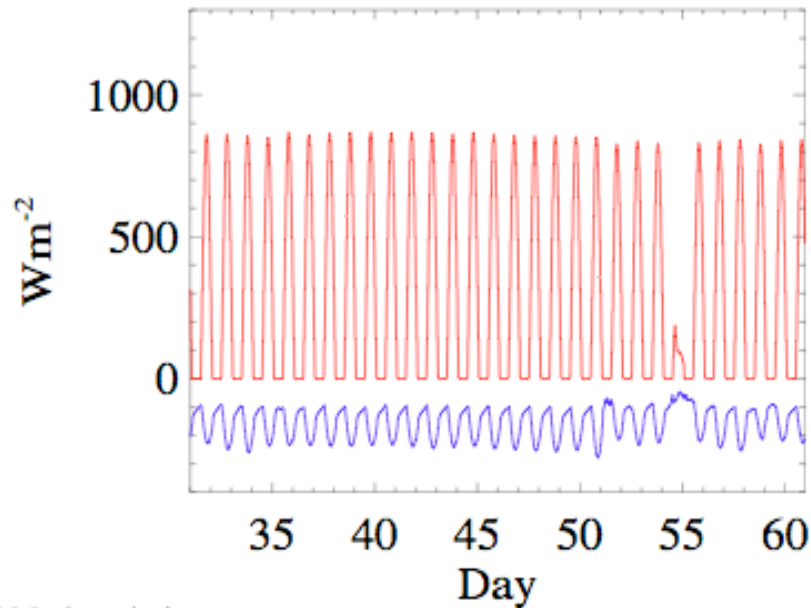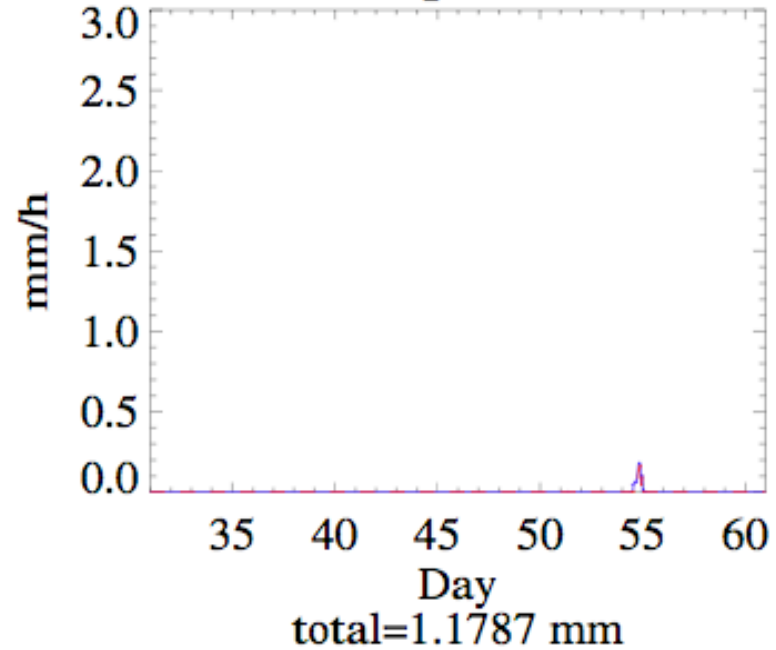
SW IR

Stratiform Convective + Stratiform

Radiation defined positive incoming

...The Bowen Ratio changes dramatically from wet to dry days, implying strong soil moisture feedbacks...
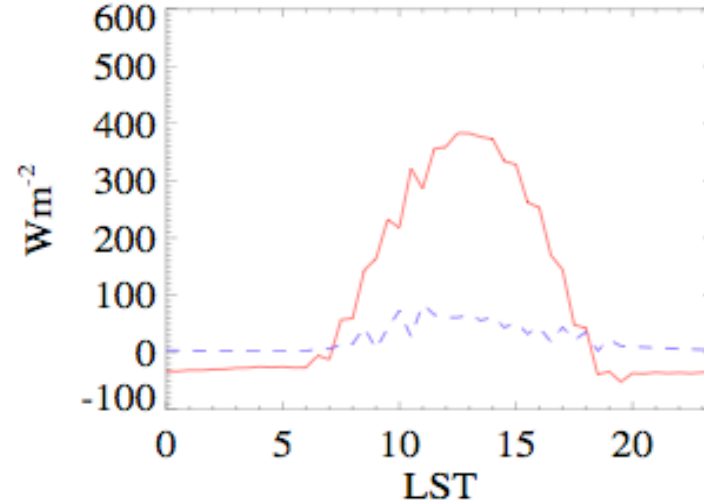

Wettest 10 Days

SFC Heat Fluxes

CAM.phoenix.aug

SHF   LHF

Driest 10 Days

SFC Heat Fluxes

SHF   LHF

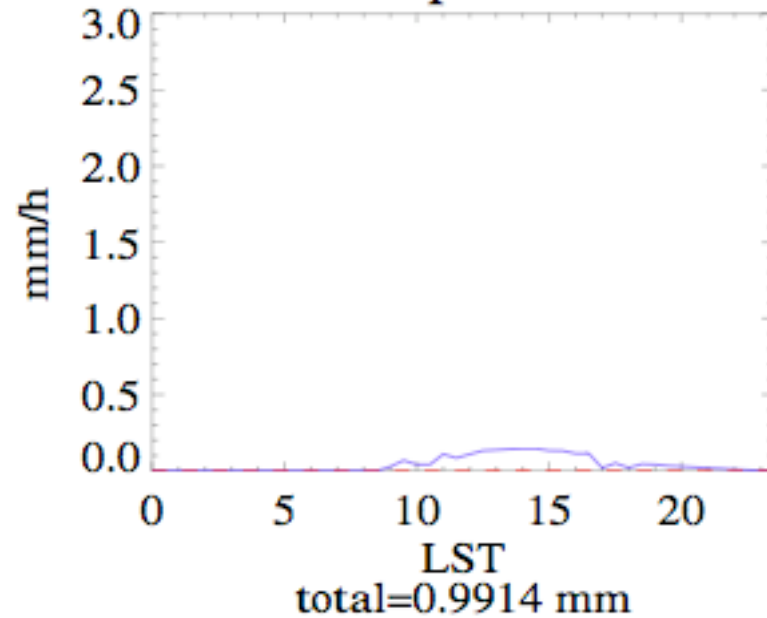# …and the peak of diurnal rain is around 3pm local time…

Wettest 10 Days

Driest 10 Days

Precipitation — CAM.phoenix.aug — total=4.8760 mm

Precipitation — total=0.9914 mm

Stratiform   Convective + Stratiform   Stratiform   Convective + Stratiform

Conclusions - CAM T85

Near the surface, a dry bias in the model results in unrealistic large diurnal temperature oscillations in the boundary layer.

Although days of heavy convective rainfall caused tiny decreases of insolation relative to clear sky, light stratiform rain reduced it a great deal.

The effect of rainfall on the Bowen ratio (latent vs. sensible flux ratio) is very large, in accordance with CAM's very strong soil moisture feedback (noted in several talks this week).

Model diurnal precipitation peaks in mid-afternoon.

Future Work

- Make identical plots for more models - We expect 8, both regional and global

- Make identical format plots for observations - seeking precipitation and surface radiation budget data especially (GOT ANY??)