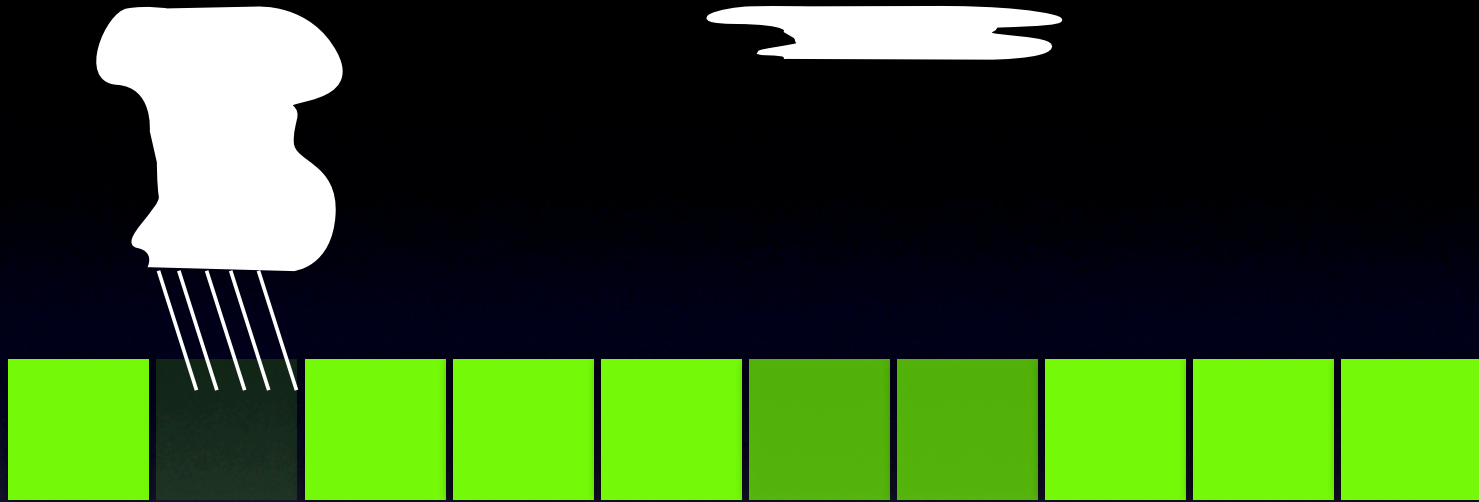# *Toward* Heterogeneous Land Surface in GigaLES 2
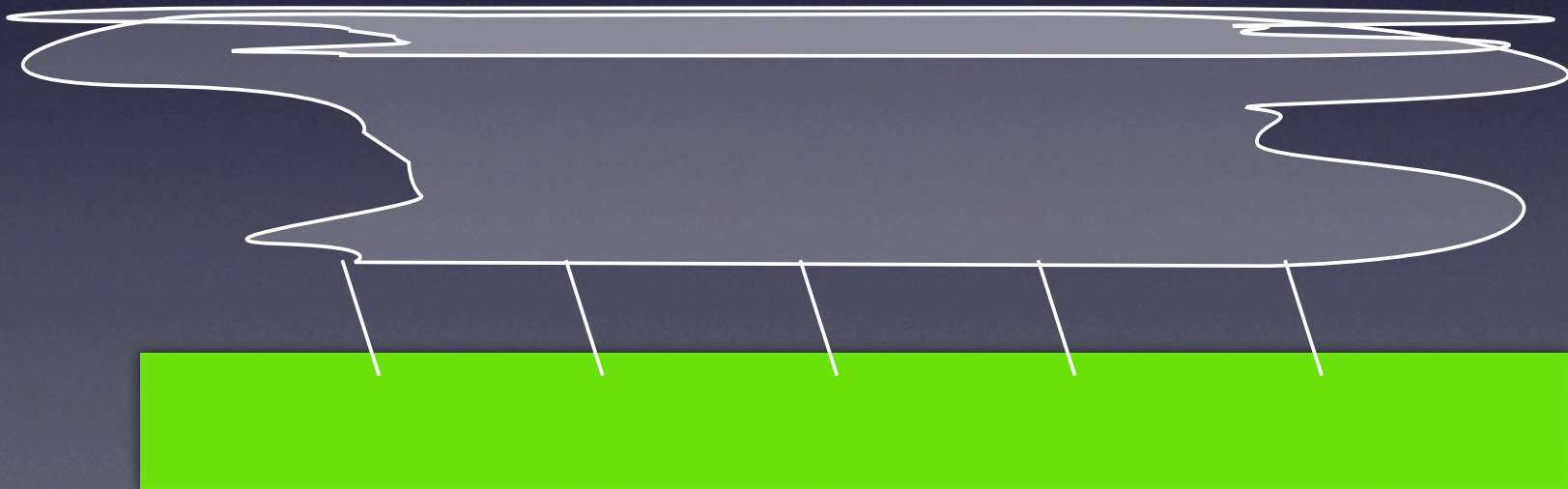
Don Dazlich
Ian Baker

Colorado State University
Land Surface Breakout -CMMAP Mtg Aug. 7

Multi-point (heterogeneous) land:

One-point (homogeneous) land:

The model

- **SiB3 ported into SAM6.10.4**

This CRM predicts momentum using the anelastic equations of motion. The prognostic thermodynamic variable is the liquid/ice water moist static energy. The model is configured to run with:
- Two-moment treatment of cloud microphysical processes predicting water vapor, and the mass and number of five condensed water species.
- RRTMG interactive radiation.
- 1.5 order closure of the turbulence kinetic energy budget to compute sub-grid scale fluxes.
- Ultimate Macho 5 scheme to advect all scalar quantities monotonically with 5th order accuracy.

- **multiple parameter files supported -**

    multiple biomes

    one biome - multiple parameter/restart files

   combination of the above.

The GigaLES-2 experiment

- ## Midlatitude Continental Convective Clouds Experiment (MC3E)

  Location – 97.5W, 36.5N

  Period – 22 Apr 2011 – 7 Jun 2011; 23 May – 26 May for 100m grid spacing.

  The CRM is forced with advective tendencies of temperature and water vapor derived from the field campaign observations.

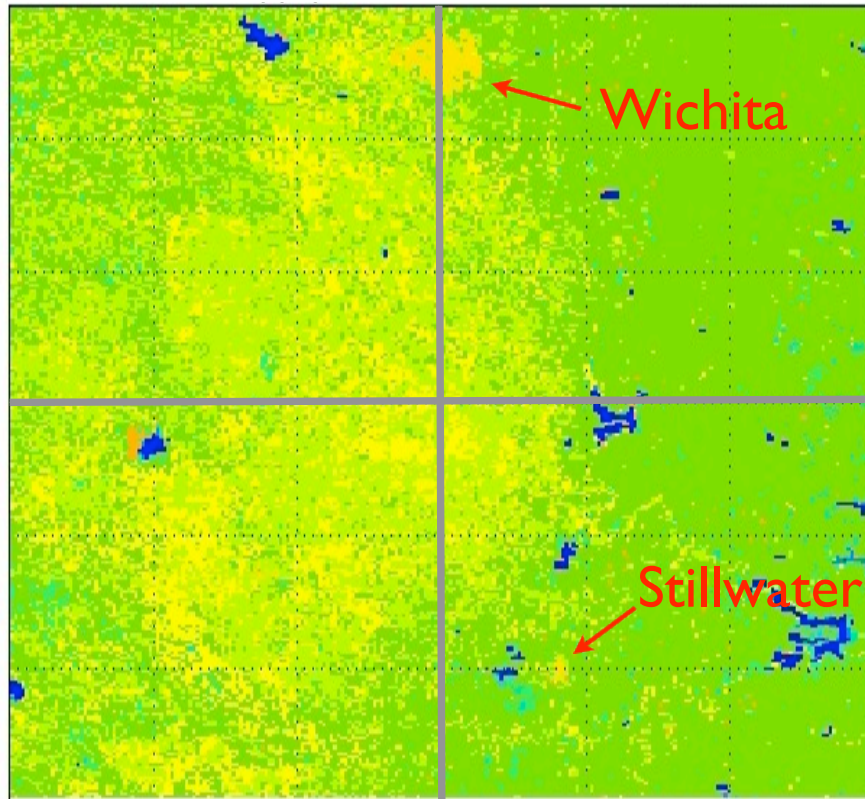- So far I have worked with 1.6km resolution, 205kmx205km, 64 layer domain.
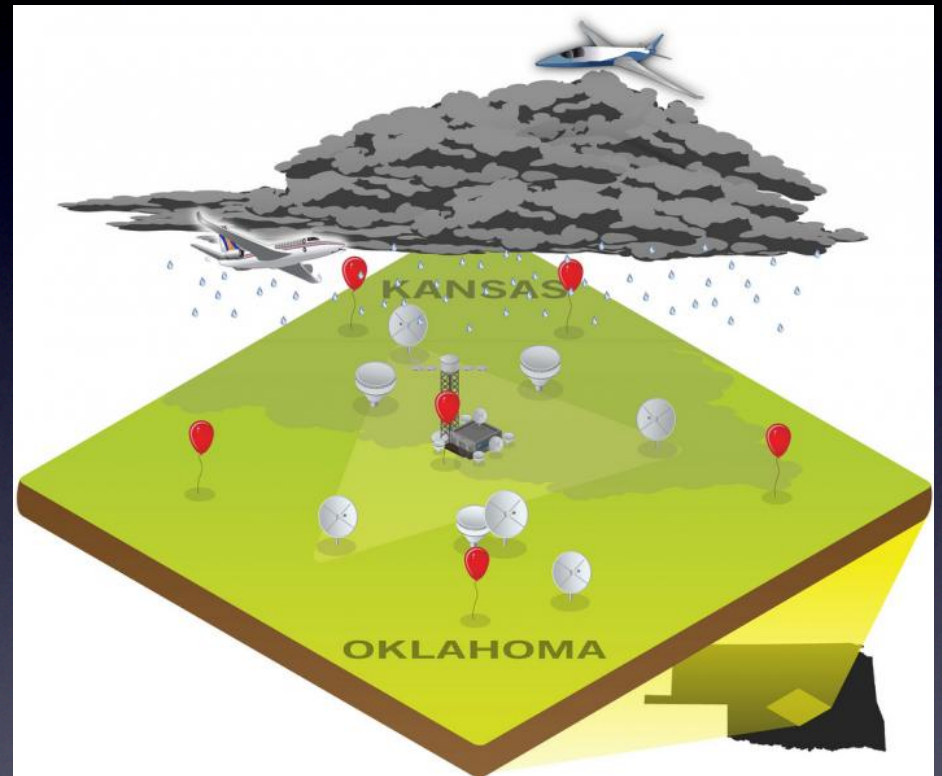
The Domain
Going from the real world to an idealized one

Mar 25, 2013

MODIS 1-km vegetation type

ARM/CART region

Wichita

Stillwater

Ian identified 4 biomes occurring for at least 1% of the domain:
Deciduous forest (SiB biome 2)
Grassland (SiB biomes 6 and 7) - green
Agriculture (SiB biome 12) - yellow

The domain is roughly 2° longitude x 2° latitude. We broke it up according to the 1° degree NCEP and GPCP forcing used to spin up offline SiB with prognostic phenology for 28 years to set SiB prognostic variables for the start of the MC3E IOP.

4 biomes times 4 forcing regions (different parameters and prognostic field values) gives 16 different surface types.

Simulating a real domain with a cyclic-boundary condition model

- Avoiding discontinuities at boundaries

- Avoiding discontinuities at other imposed scales - in this case the 1° spinup forcing

- We used 'fuzzy' 1° squares and random biome distribution with at the 800m scale.
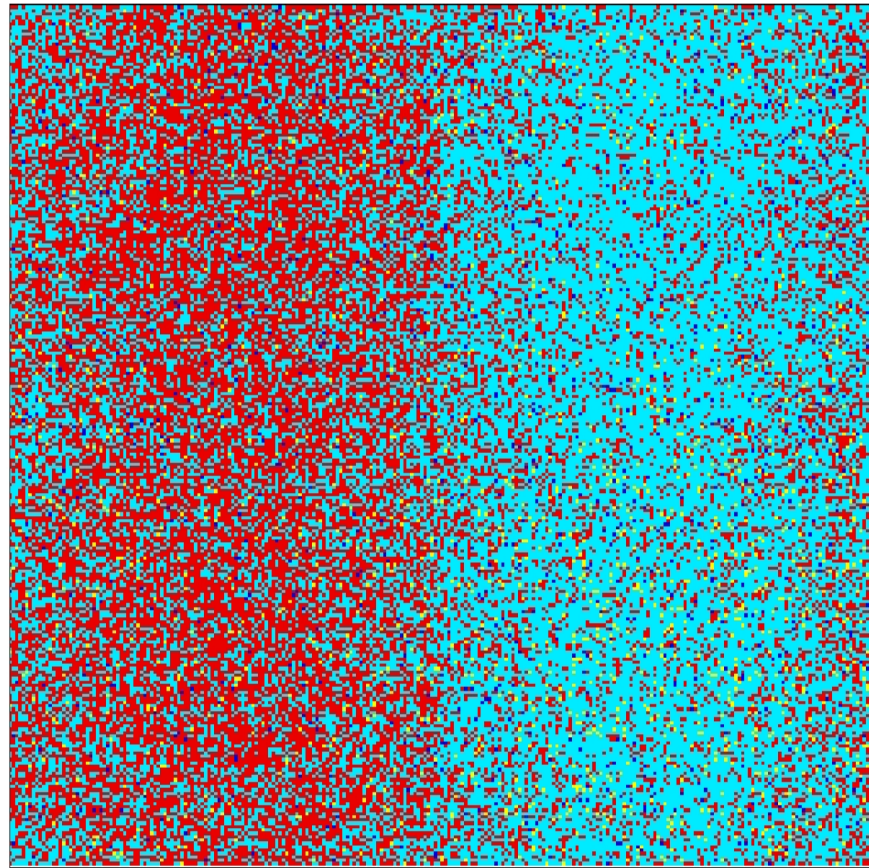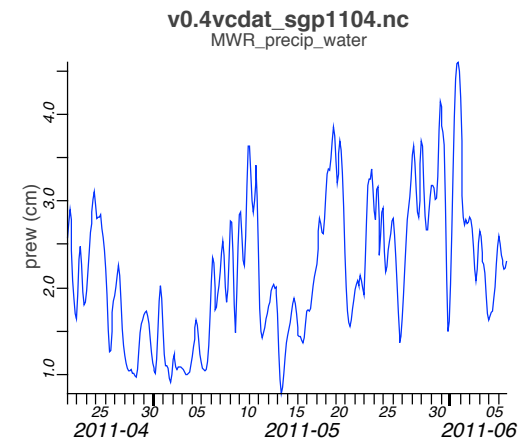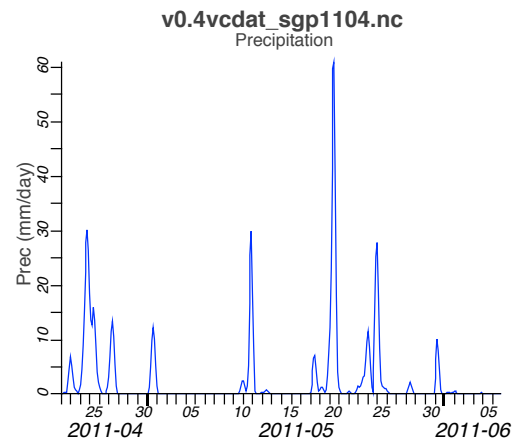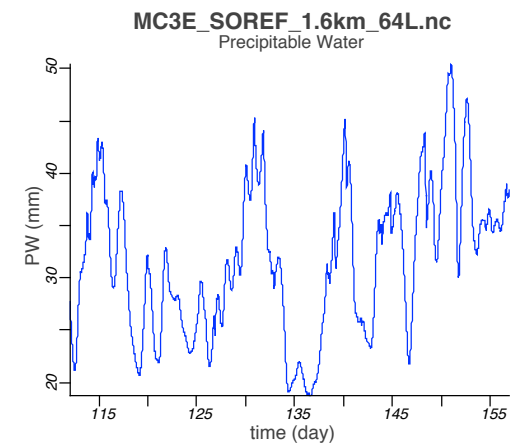
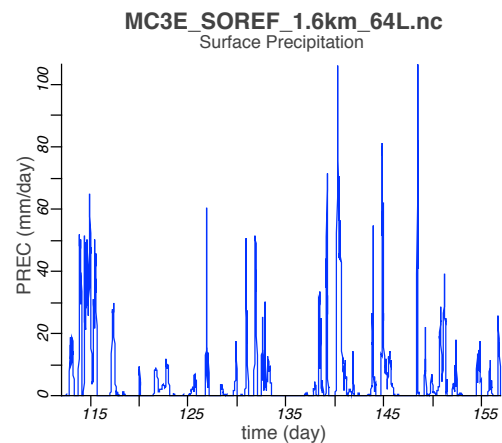Forest   Grassland   Agriculture

Warming up with 1.6km resolution

- 1.6km MC3E run for entire IOP with large-scale forcing (data is 3-hour average, model is 1/2 hourly).
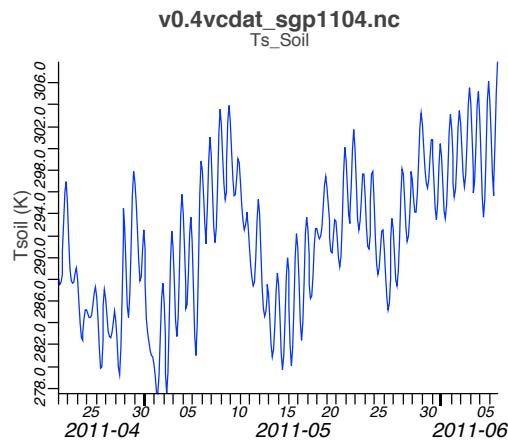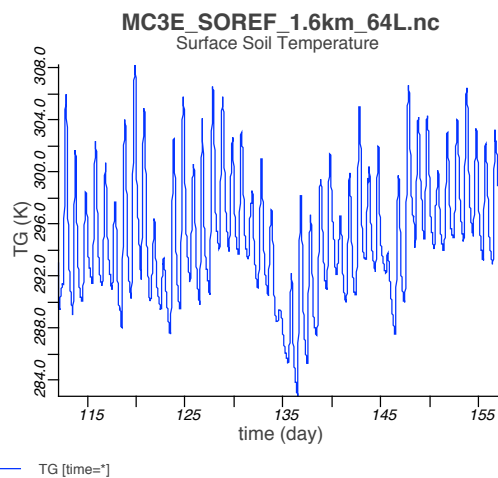
obs

SAM

Warming up with 1.6km resolution

- 1.6km MC3E run for entire IOP with large-scale forcing (data is 3-hour average, model is 1/2 hourly).

obs

SAM

Early period is too warm - appears to be due to atmospheric forcing.

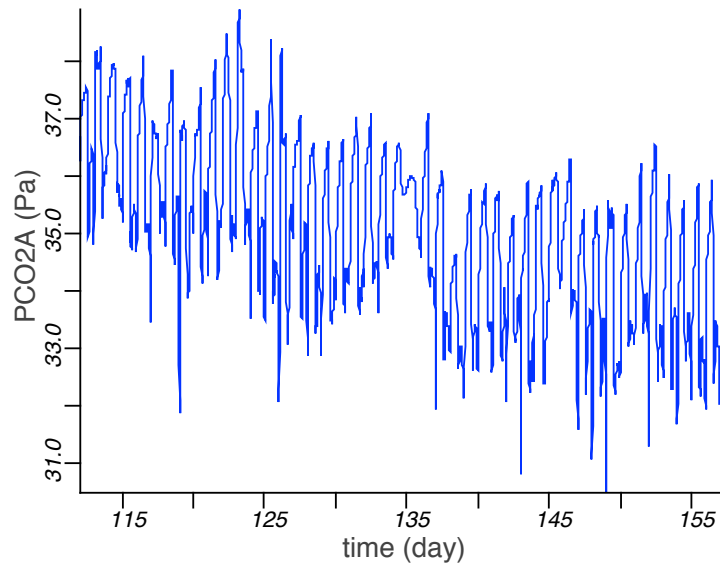Initially, surface was too dark (13.5% model vs. 19% OBS albedo). The soil reflectances were adjusted upward by 0.2 to correct this.

Warming up with 1.6km resolution

Model initialized with 385ppm, no large-scale forcing from outside the domain.

MC3E_SOREF_1.6km_64L.nc
Canopy air space CO2 partial pressure

MC3E_SOREF_1.6km_64L.nc
CO2
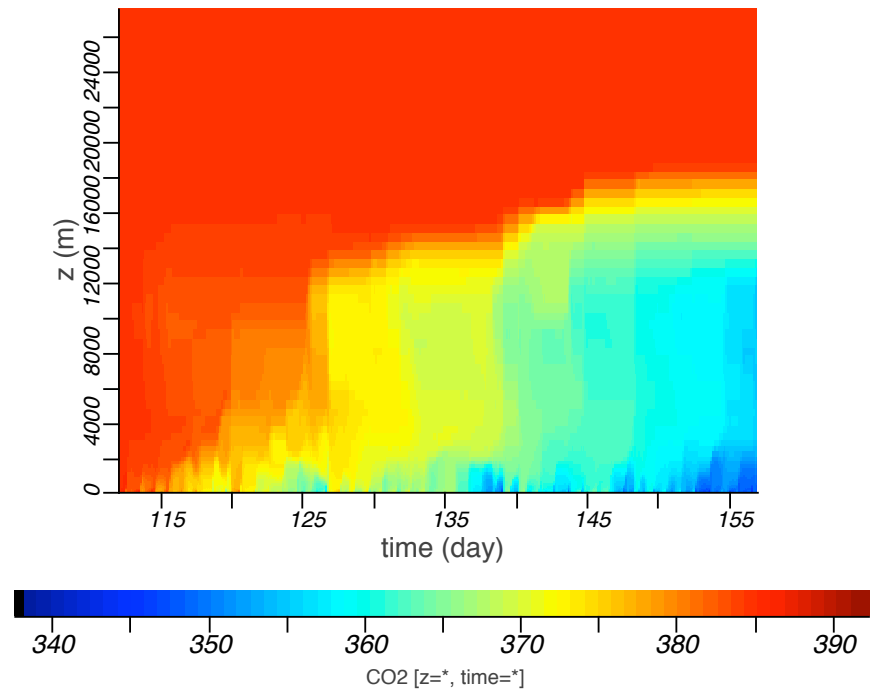
How long to reach heterogeneity from uniform initialization?

Top row - 4 biomes x 4 spinups
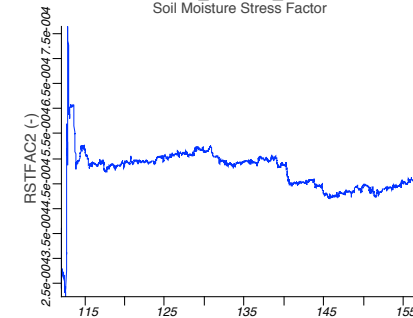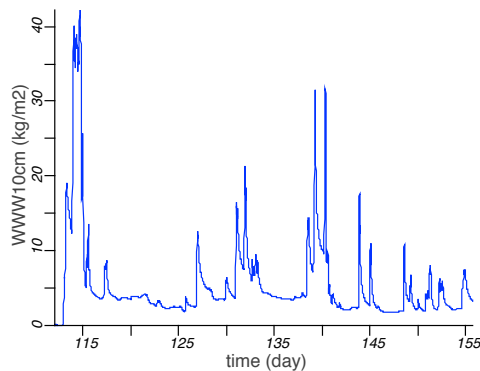## Lower row - Biome 6, 1 spinup
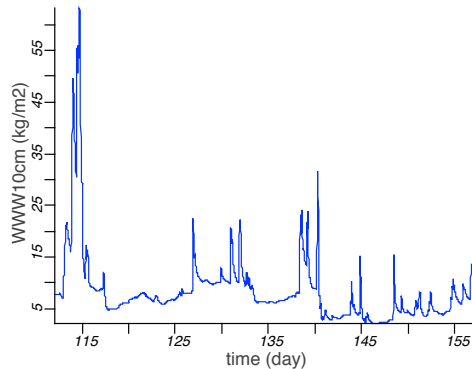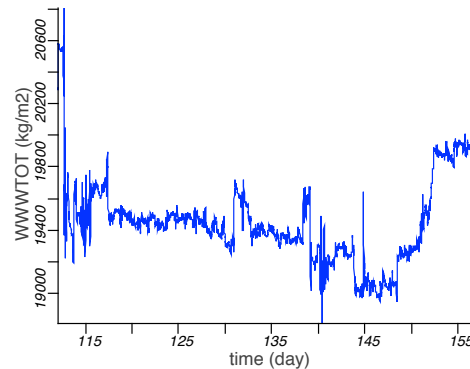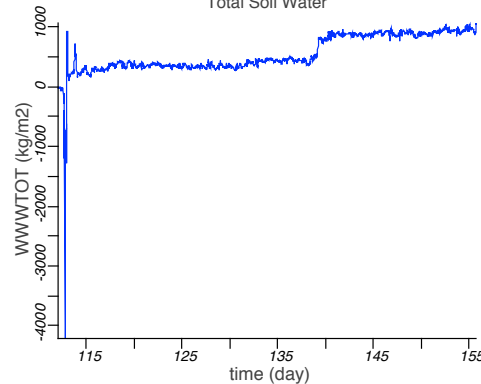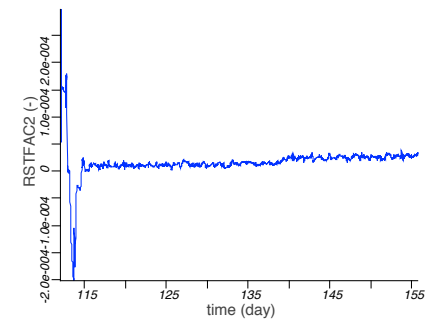
Soil moisture evolution