GCSS ASTEX Lagrangian Case: SAM results

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CMMAP
Reach for the sky.

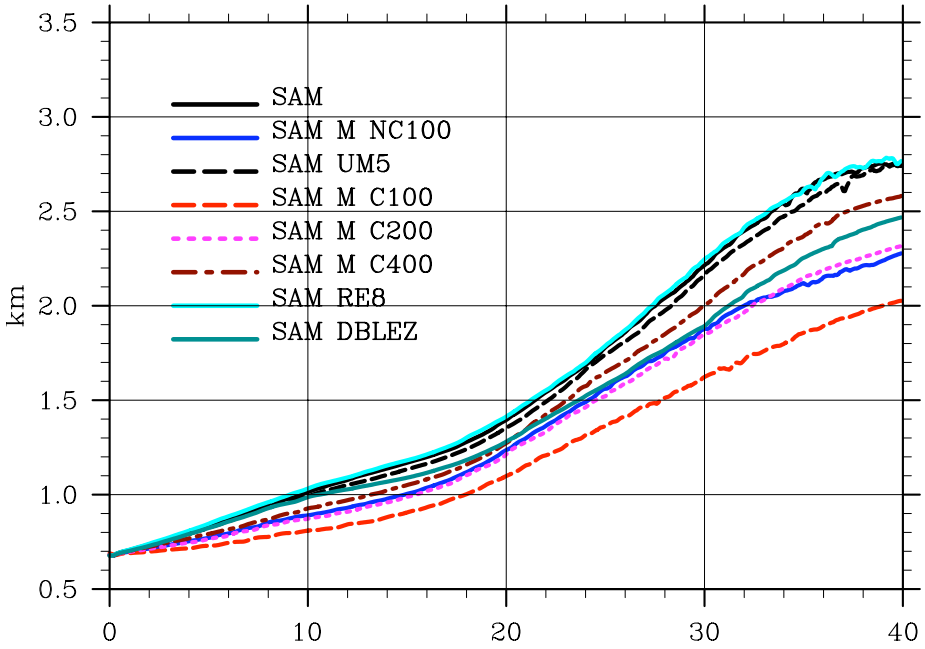
SAM Microphysics

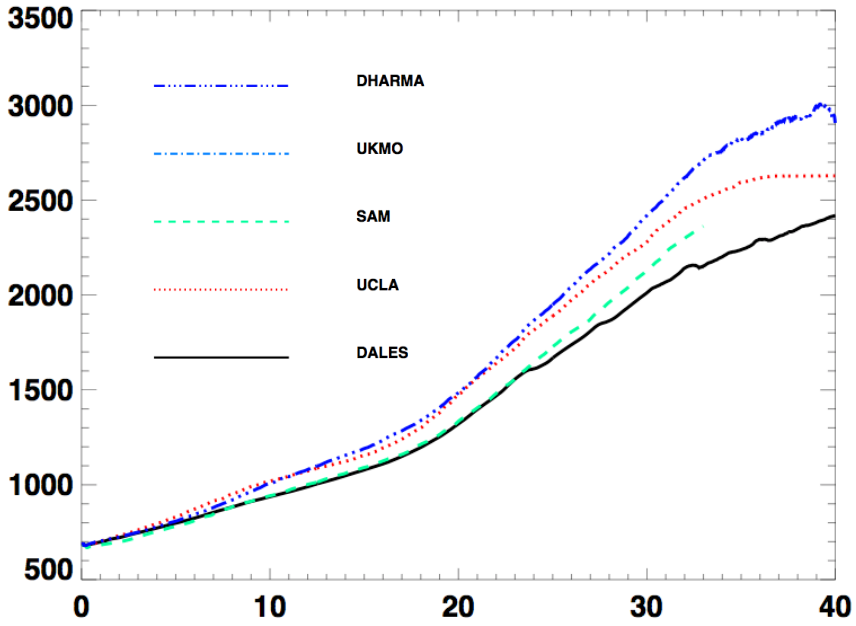
- SAM Default (SAM1MOM):
  - 1-Moment Micro;
  - Kessler-autoconversion;
- Morrison Microphysics (M2005):
  - 2-Moment;
  - KK2000 Autoconversion;
  - CCN activation at cloud base as f(w,CCN#)
  - specified or prognostic N_c;
  - CCN# = CS^k
- DRIZZLE Microphysics (Used by Peter Blossey):
  - 2-Moment;
  - KK2000 Autoconversion;
  - N_c is specified (100 cm^{-3})

Experiments

- Control: SAM1MOM (r_{eff}=14 mkm)
- SAM1MOM + r_{eff}=8 mkm
- SAM1MOM + double resolution in the vertical (below 2.5 km);
- SAM1MOM + 5th-order FCT for all scalars;
- M2005 (r_{eff} computed):
  - N_c =100 cm^{-3}
  - CCN#=100 cm^{-3}
  - CCN#=200 cm^{-3}
  - CCN#=400 cm^{-3}
- dx=35 m; dz=5m below 2.5 km;
- domain top at 27 km;
- surface albedo depends on zenith angle.

Inversion height

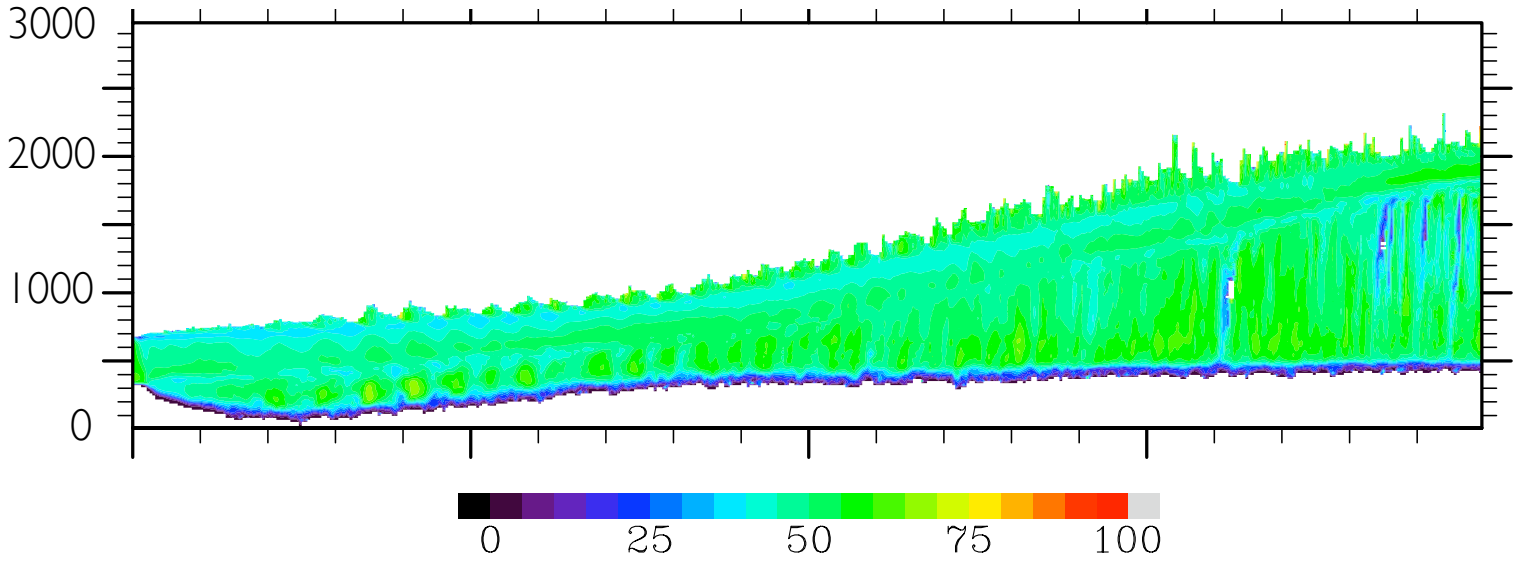




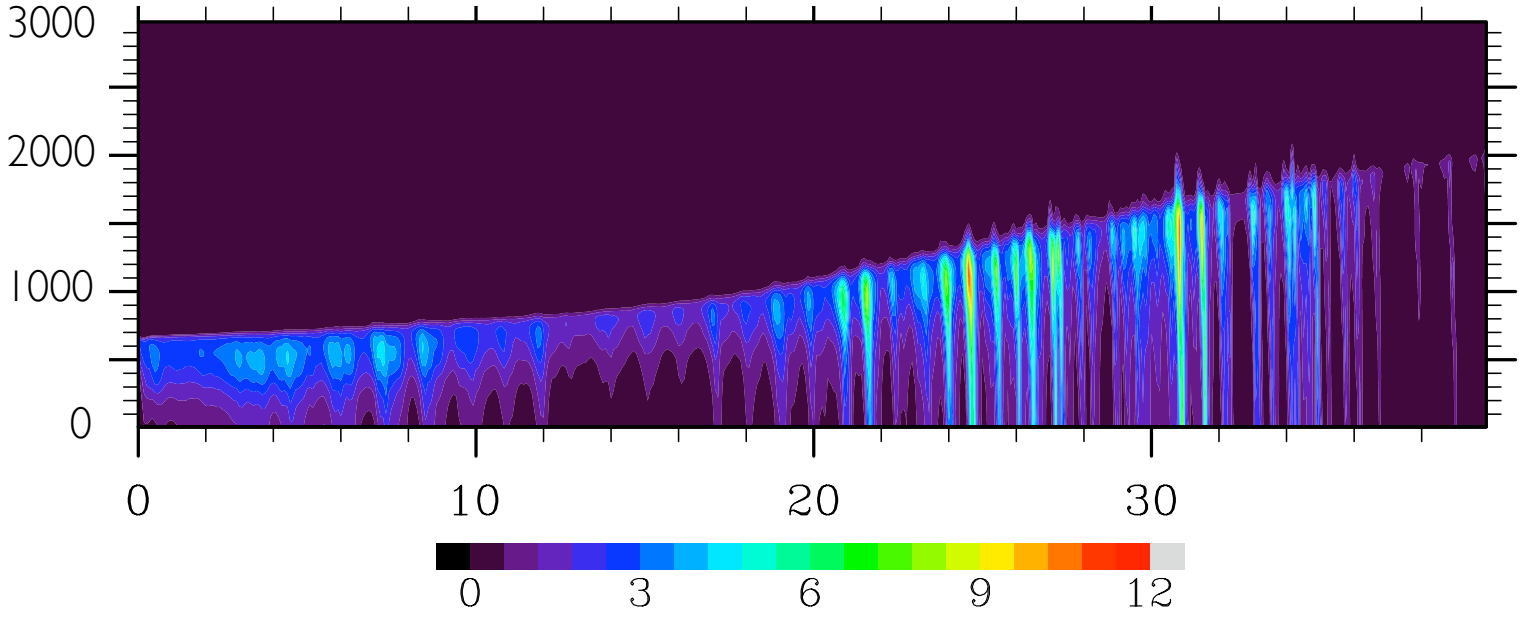
- No sensitivity to scalar advection scheme;
- No sensitivity to r_{eff}
- N_c =100 cm^{-3} is similar to CCN=100
- The higher vert. resolution, the slower the transition;
- The lower CCN# (higher drizzle rate), the slower the transition;

SAM M C100

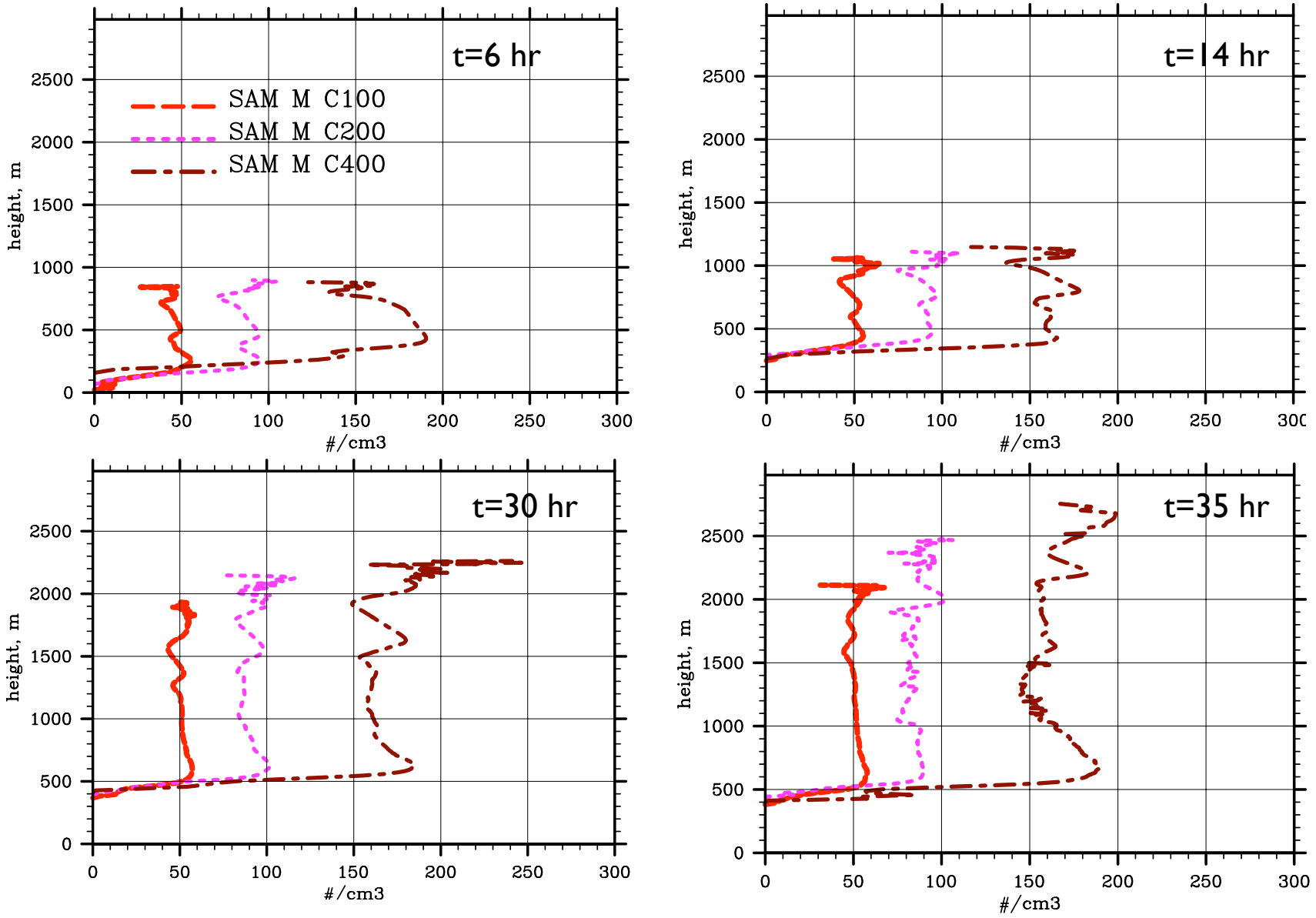
In-Cloud Droplet Concentration (#/cm3)



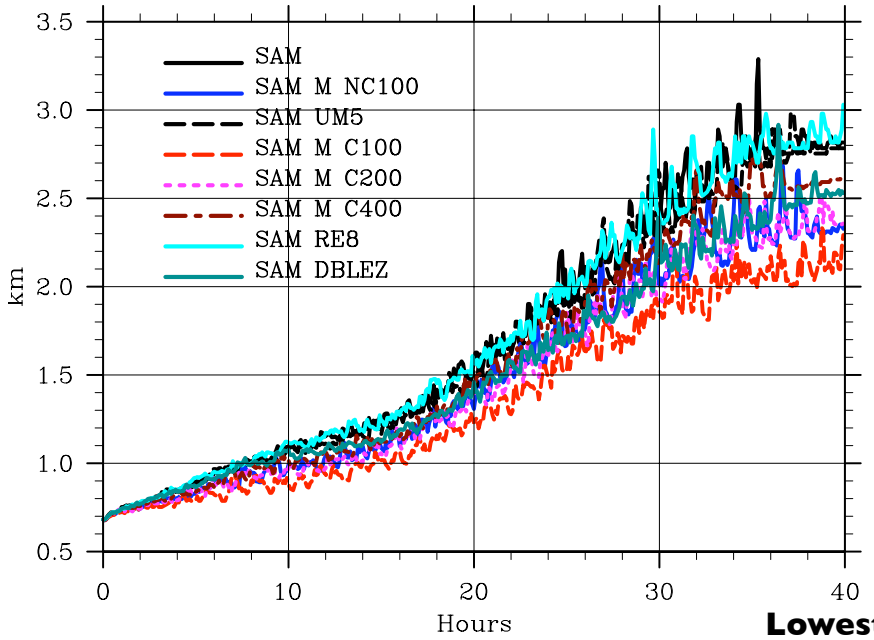
Precipitation Rate (mm/day)

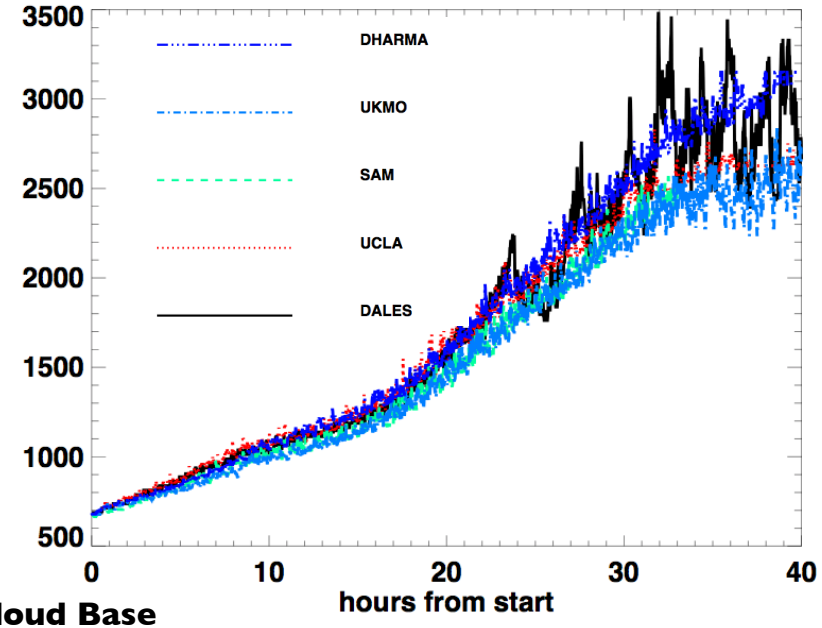


In-Cloud Droplet Concentration

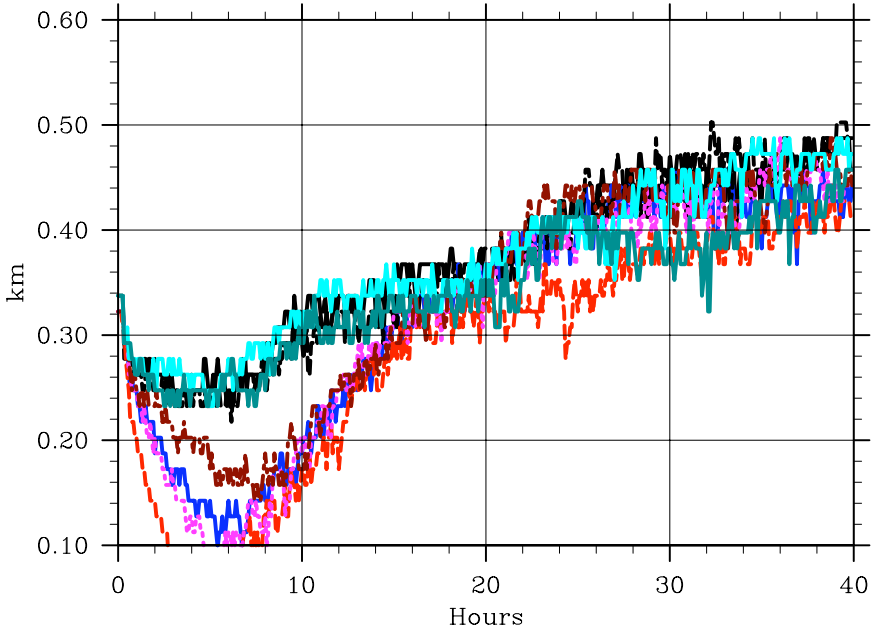


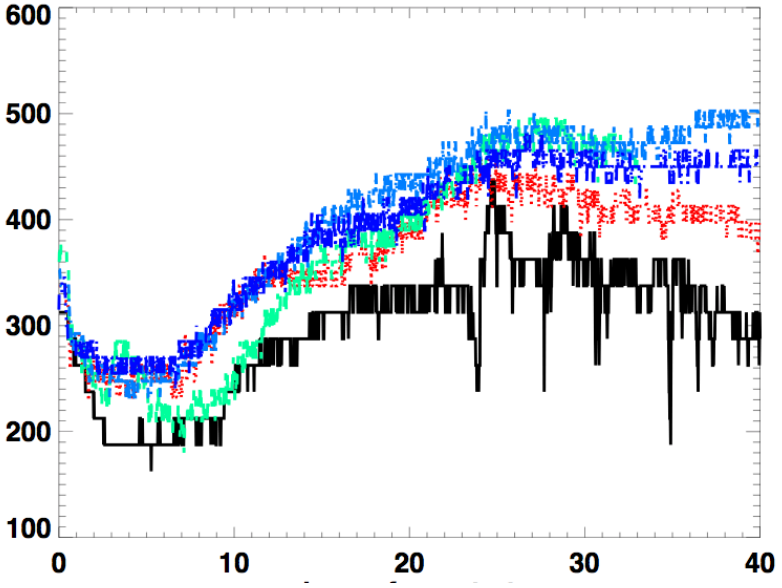
Highest Cloud Top



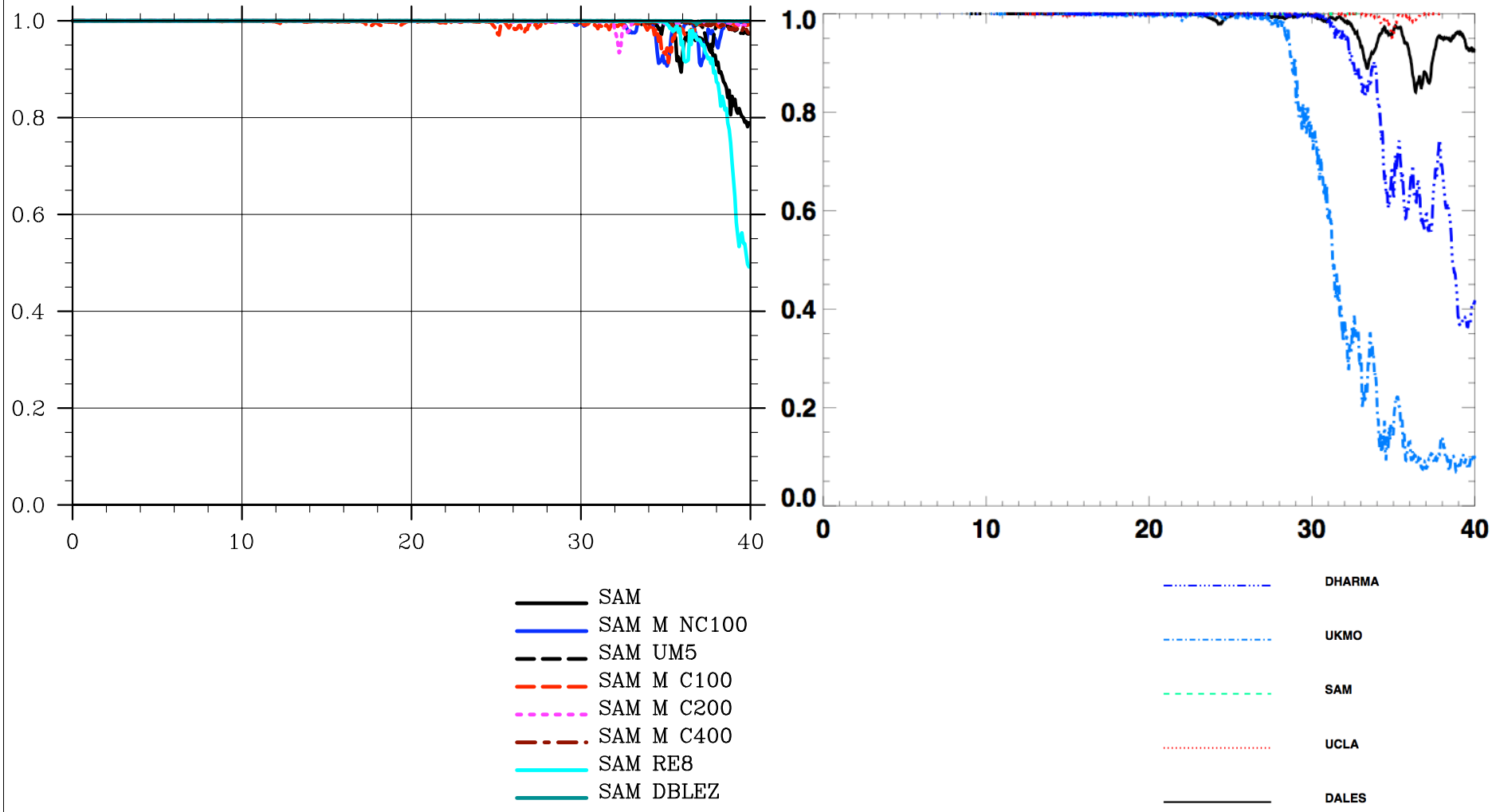


Lowest Cloud Base

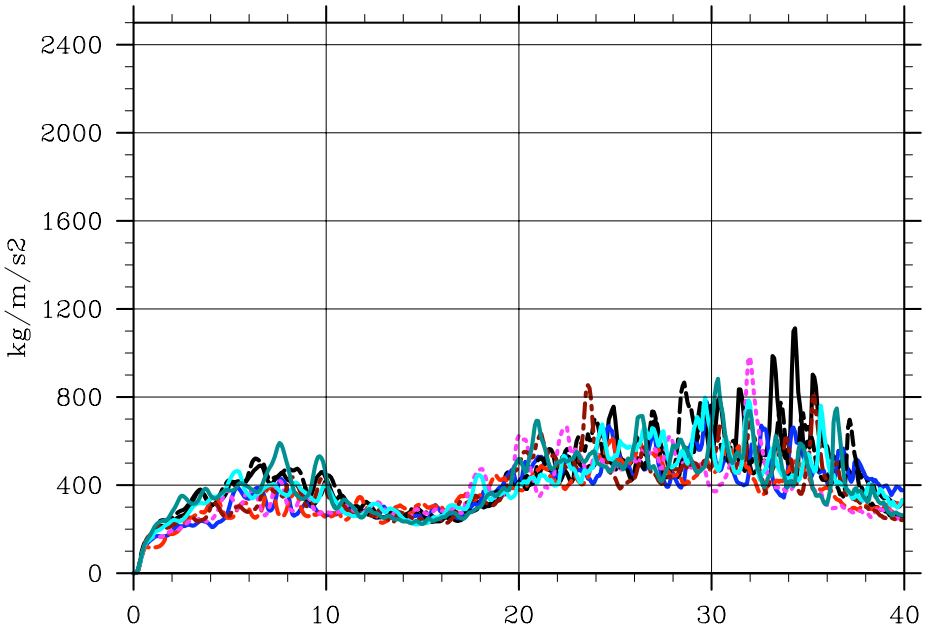


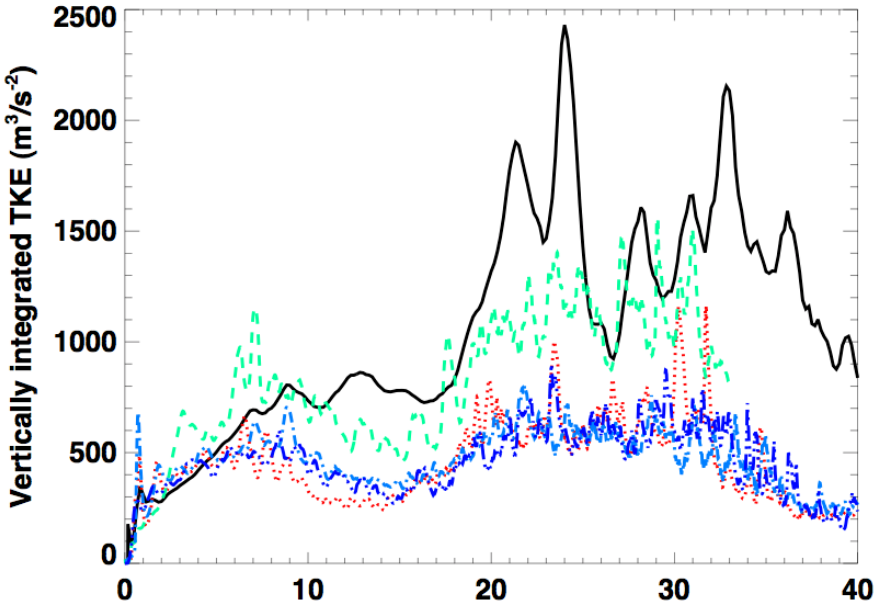


Cloud Cover


1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
SAM
SAM M NC100
SAM UM5
SAM M C100
SAM M C200
SAM M C400
SAM RE8
SAM DBLEZ
DHARMA
UKMO
SAM
UCLA
DALES

Vertically Integrated TKE

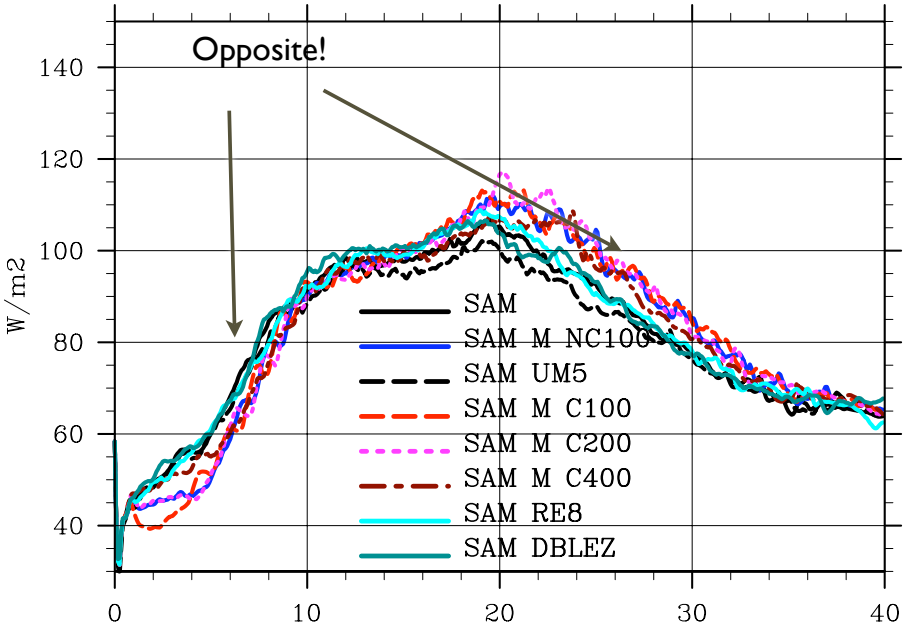


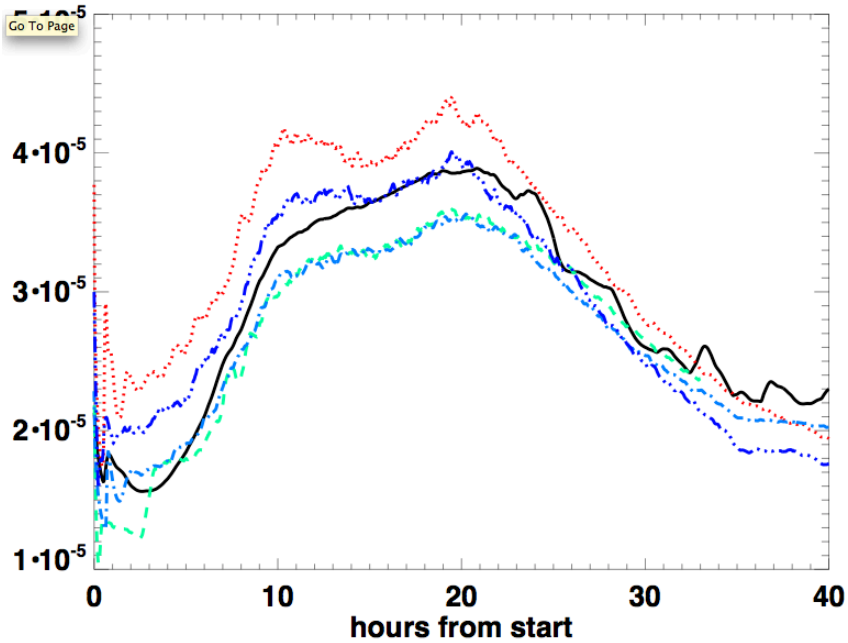


SAM
SAM M NC100
SAM UM5
SAM M C100
SAM M C200
SAM M C400
SAM RE8
SAM DBLEZ

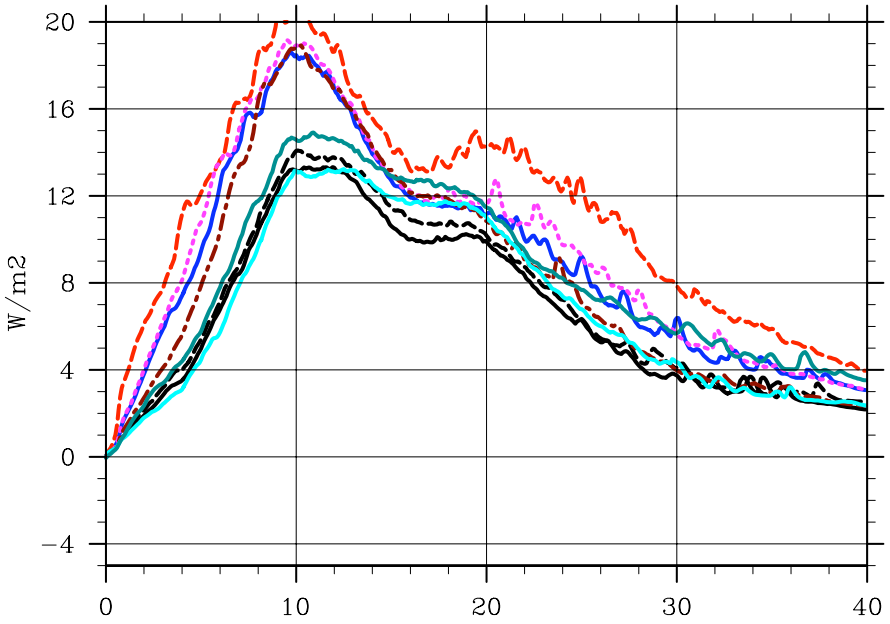
DHARMA
UKMO
SAM
UCLA
DALES

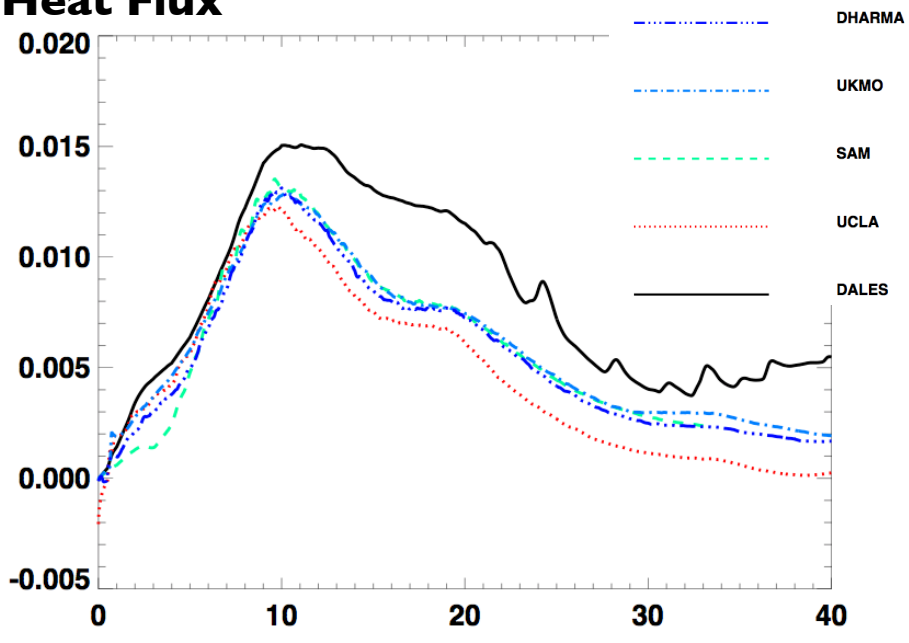
Latent Heat Flux



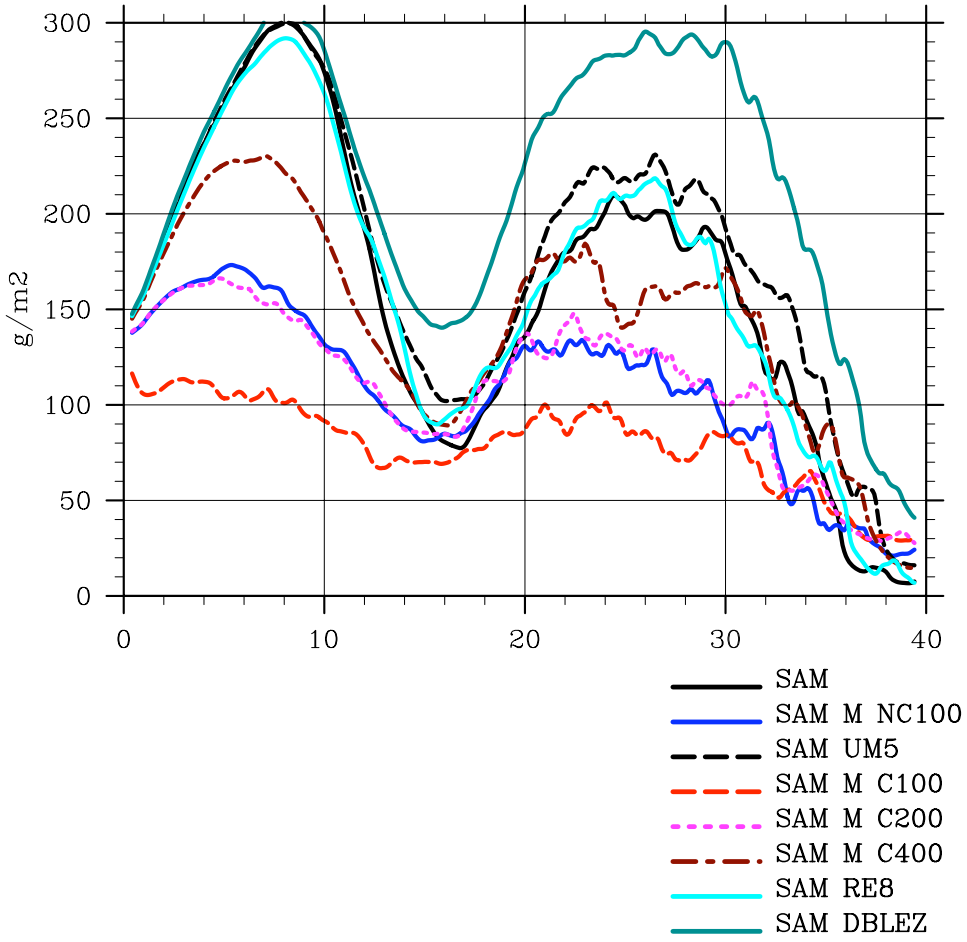


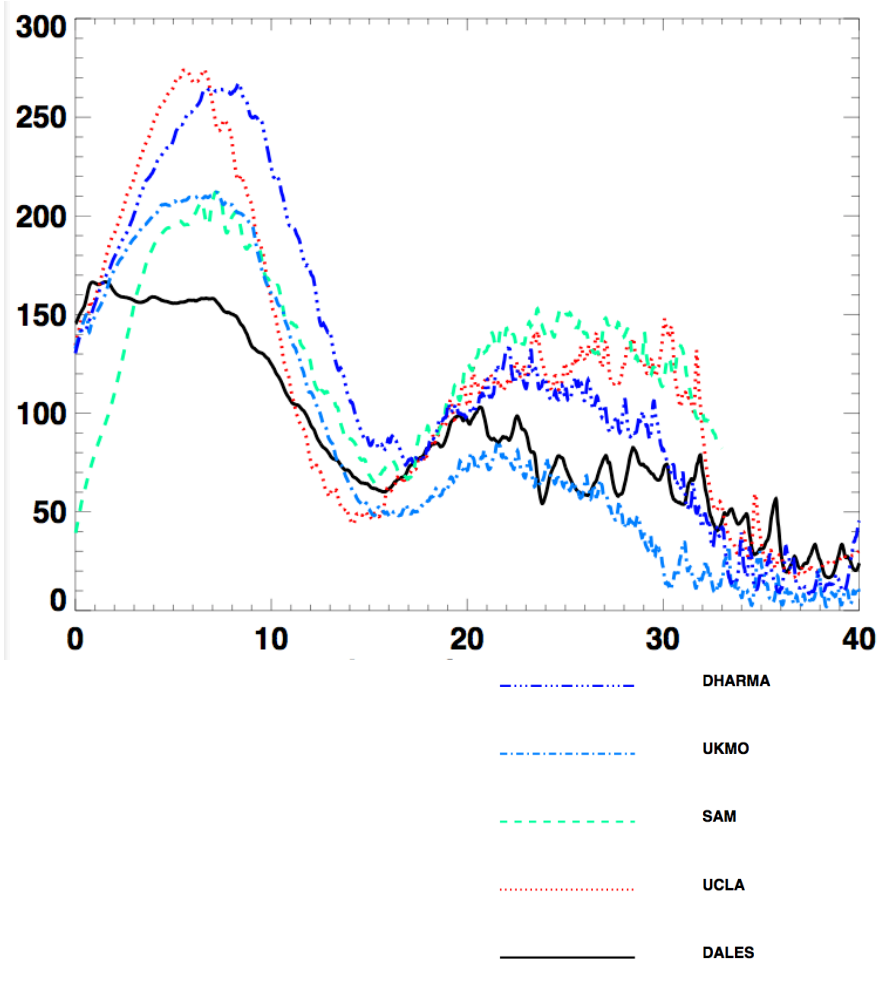
Sensible Heat Flux



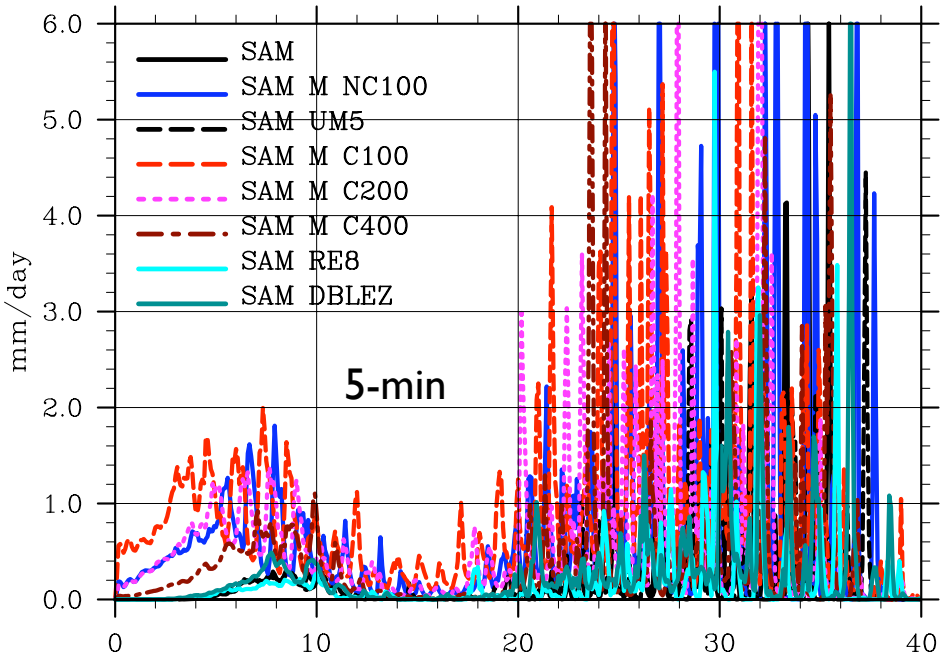


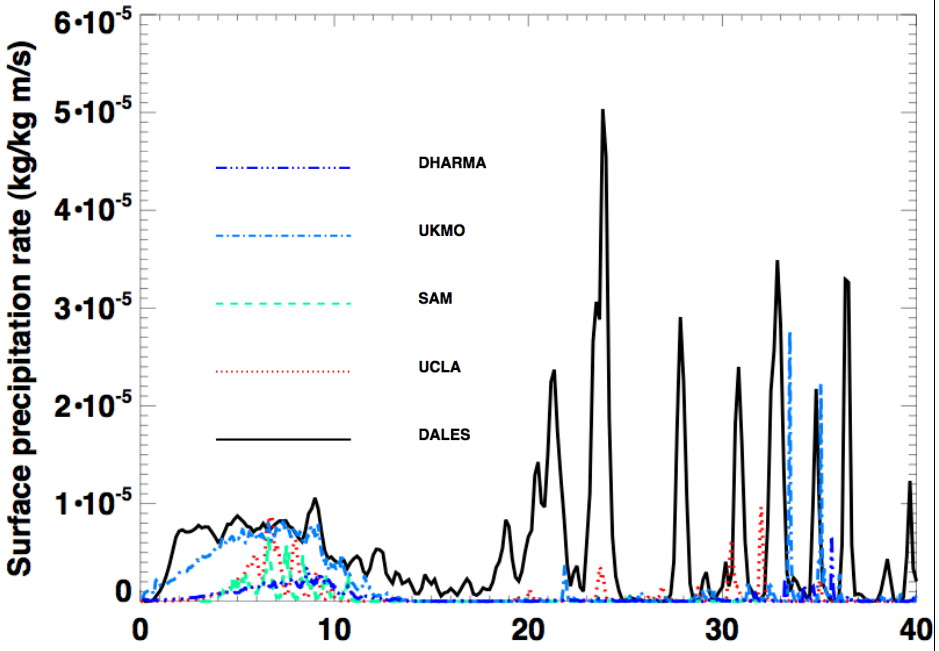
Liquid Water Path

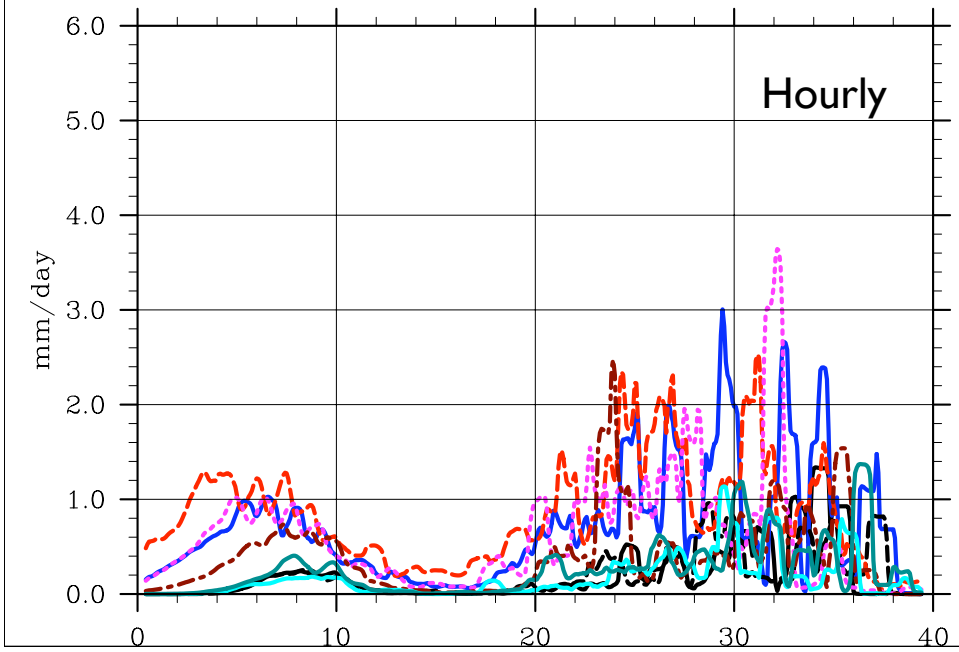


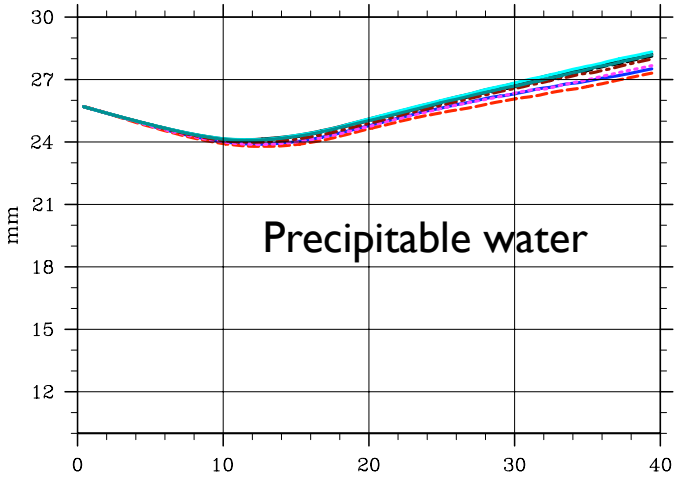


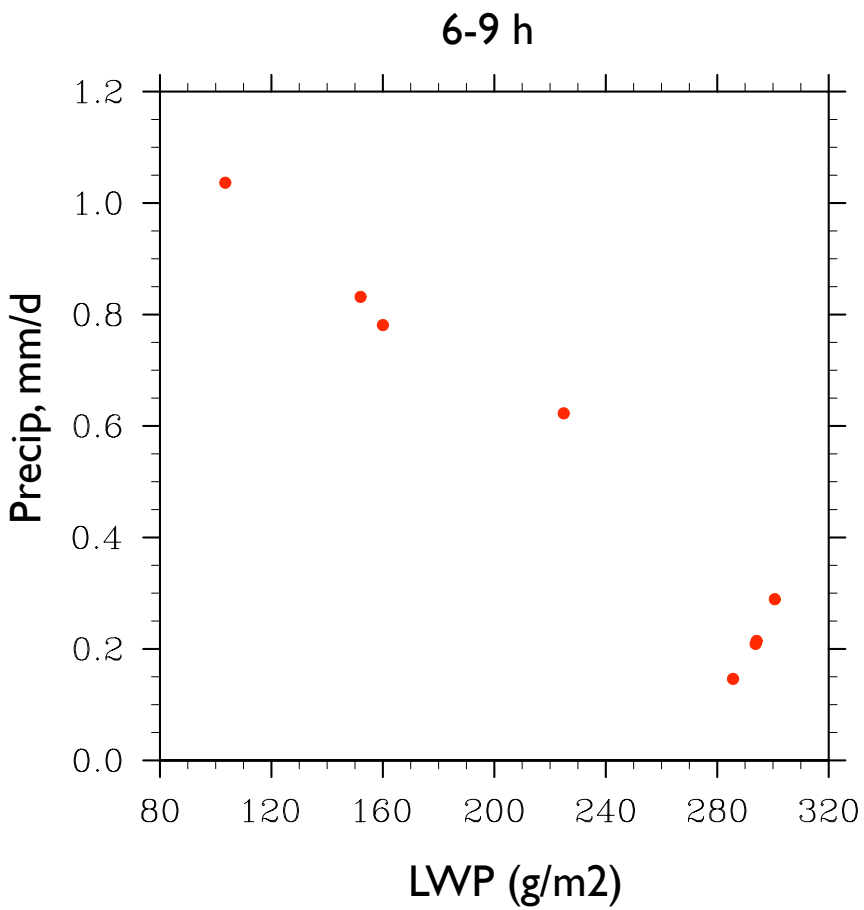
Surface Precipitation



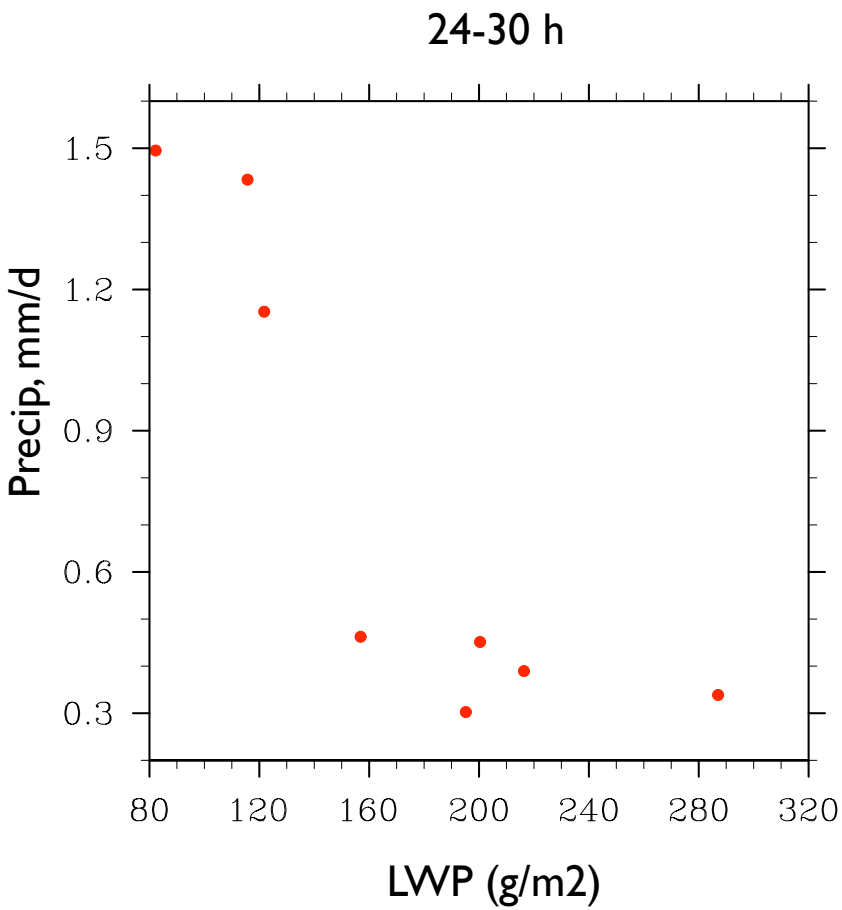






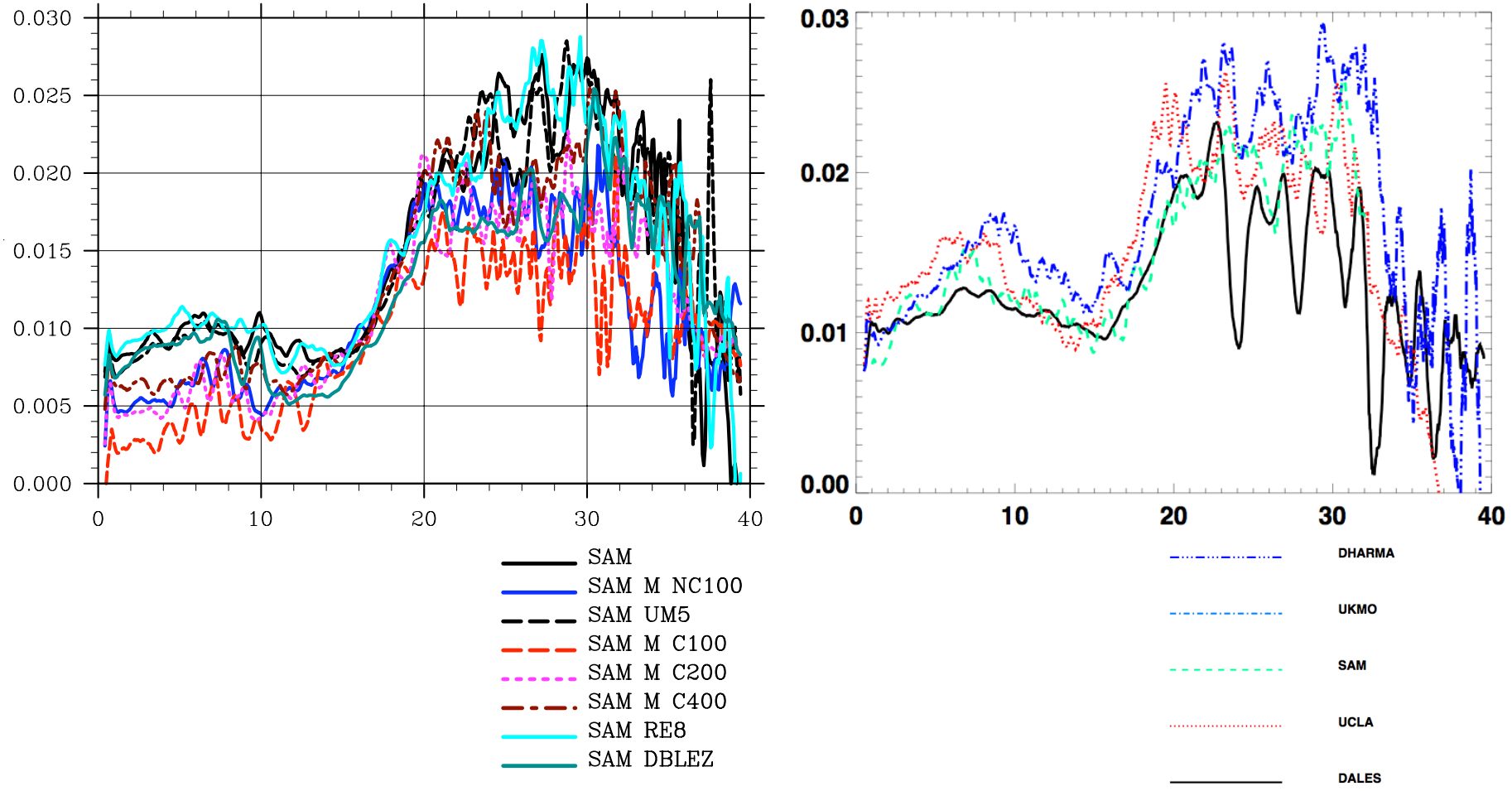


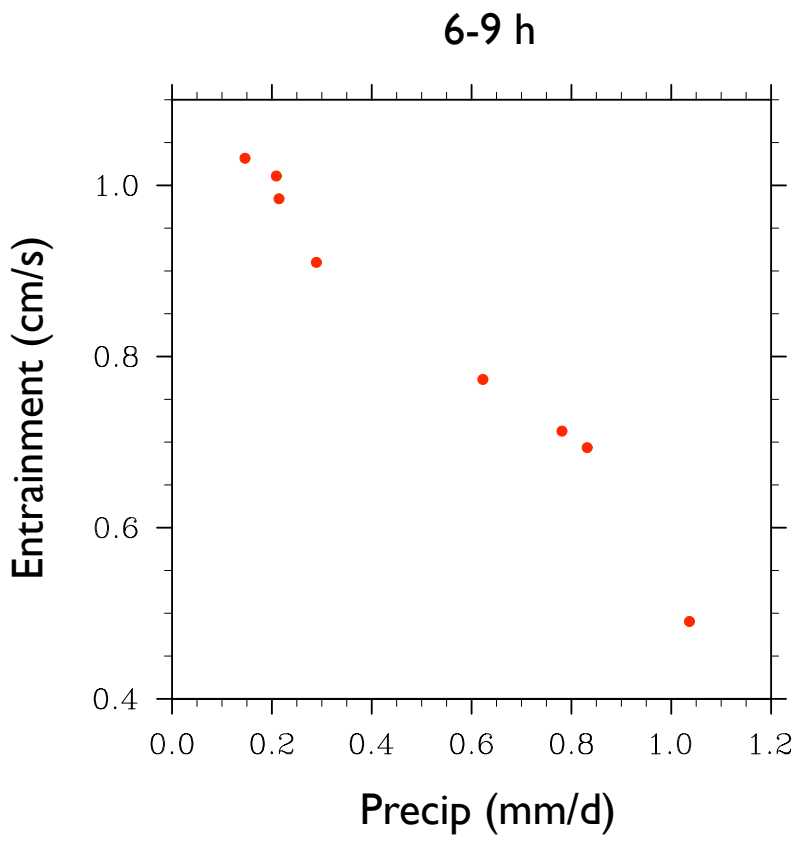
Sc regime



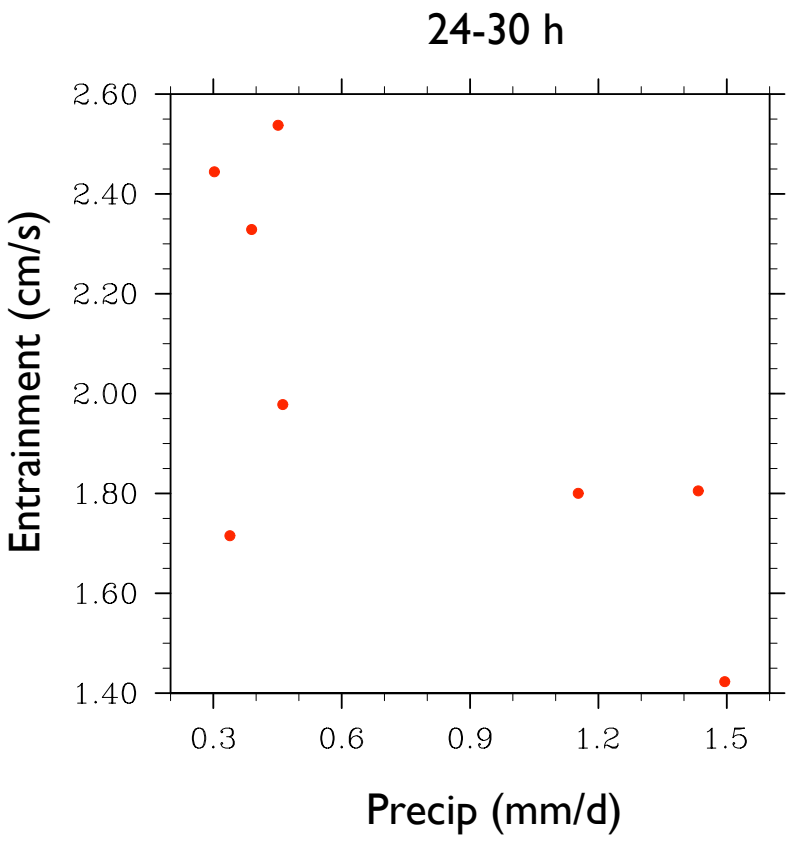
Cu regime

Entrainment Rate (hourly)





Sc regime



Cu regime

Preliminary Results

- Strong sensitivity to microphysics *drizzle);
- Increase/decrease of N_c by factor of 2 results in increase/decrease of final Z_{inv} by 300 m;
- No sensitivity to advection scheme used for scalars;
- The higher vert. resolution, the slower the transition, final Z_{inv} is lower by 300 m;
- Found no sensitivity to r_{eff}
- The smaller LWP, the higher drizzle rate;
- The higher drizzle rate, the slower entrainment and transition to Cu;