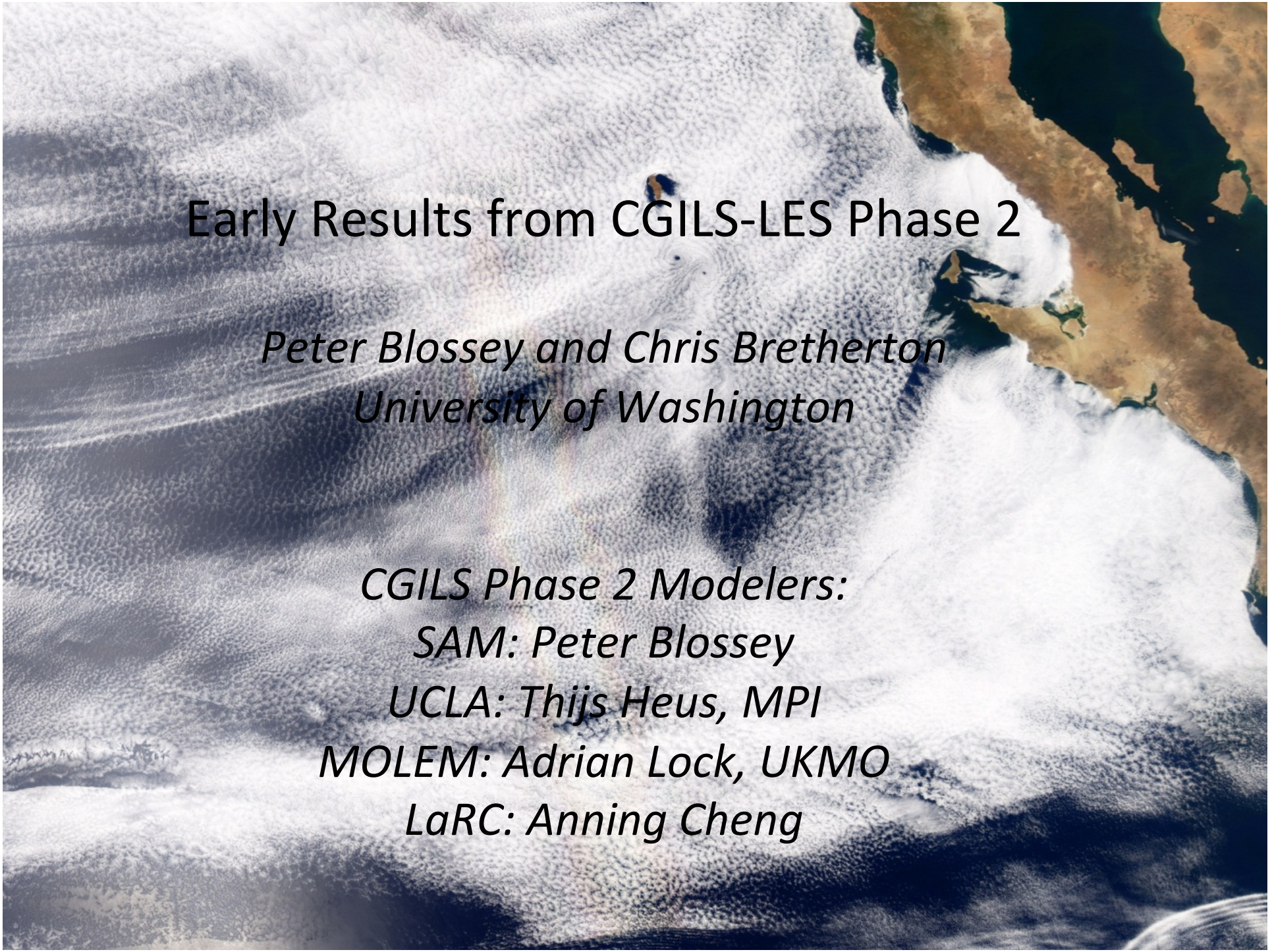


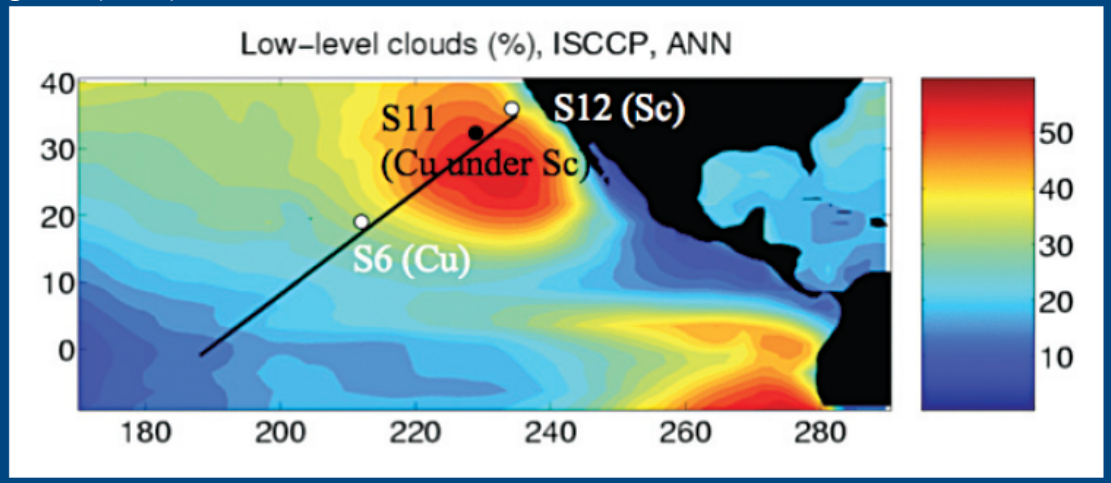
# Early Results from CGILS-LES Phase 2

*Peter Blossey and Chris Bretherton*
*University of Washington*

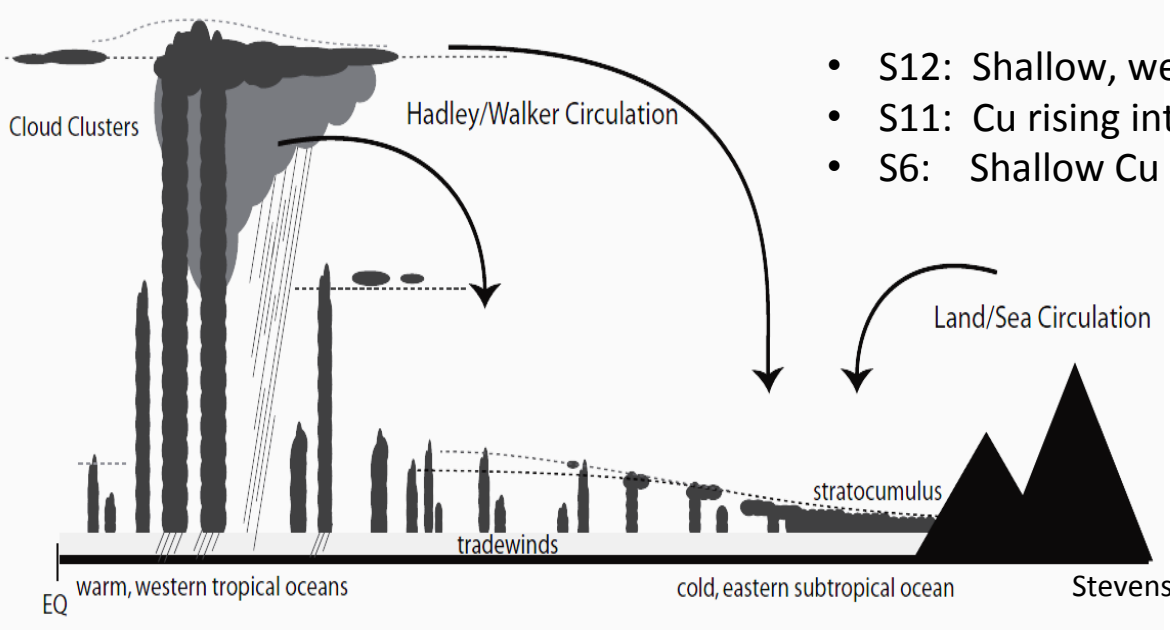
*CGILS Phase 2 Modelers:*
*SAM: Peter Blossey*
*UCLA: Thijs Heus, MPI*
*MOLEM: Adrian Lock, UKMO*
*LaRC: Anning Cheng*

# CGILS: CFMIP/GASS Intercomparison of Large-eddy and Single-column models

Zhang et al (2010)




**The CGILS intercomparison transect overlaid on the Northeast Pacific annual-mean low cloud amount. Initially, CGILS focused on location S11 (32°N, 129°W) near the northern end of the GCSS Pacific Cross-Section Intercomparison study region. The other two locations are S6 and S12. S11 is near the climatological summertime maximum of low-level cloud cover. S6 is characterized by shallow cumuli, and S12 by shallow coastal stratocumulus.**




Stevens 2006

- S12: Shallow, well-mixed stratocumulus (Sc)
- S11: Cu rising into Sc
- S6: Shallow Cu

CGILS Goal: Compare LES and SCM CTBL simulations of these locations under large-scale forcings representative of present and perturbed climates

# CGILS papers

Zhang et al. 2012 JAMES (CGILS case setup) doi: 10.1029/2012MS000182.

Zhang et al. 2013 JAMES (CGILS SCM results), submitted

Blossey et al. 2013 JAMES (LES results) doi:10.1002/jame.20025

Bretherton et al. 2013 JAMES (UW LES sensitivities) doi: 10.1002/jame.20019

# CGILS LES cases

Phase 2

- **4x$CO_2$ fixed SST**
- **dCMIP3** (CMIP3 multimodel-mean forcing change, ΔEIS raised at S12 to 0.8K from 0.5K in Bretherton et al. 2013)

Small technical issues with some outputs or setup of most LESs; probably unimportant.

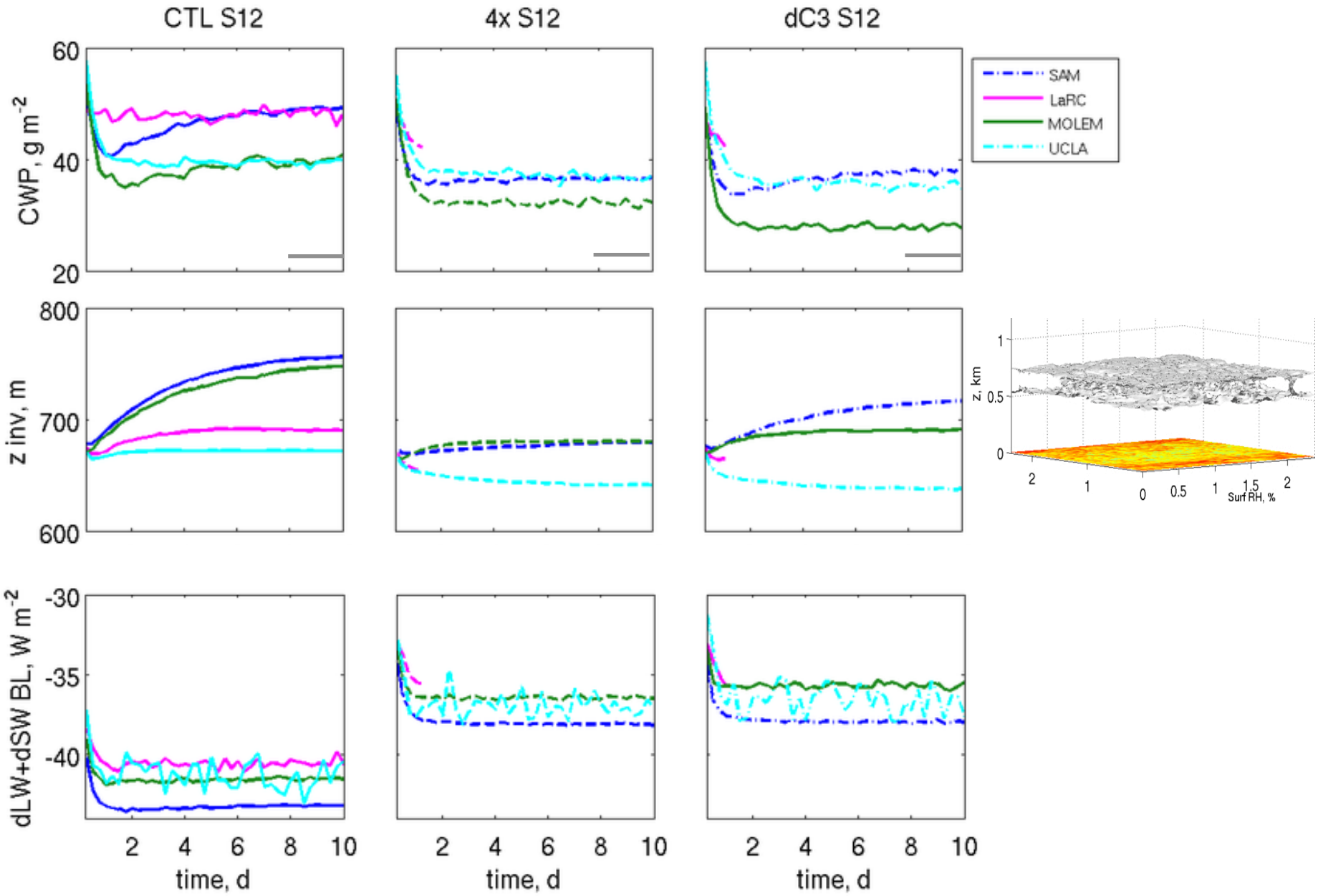
- **S6 transient forcing (SAM pilot study)**

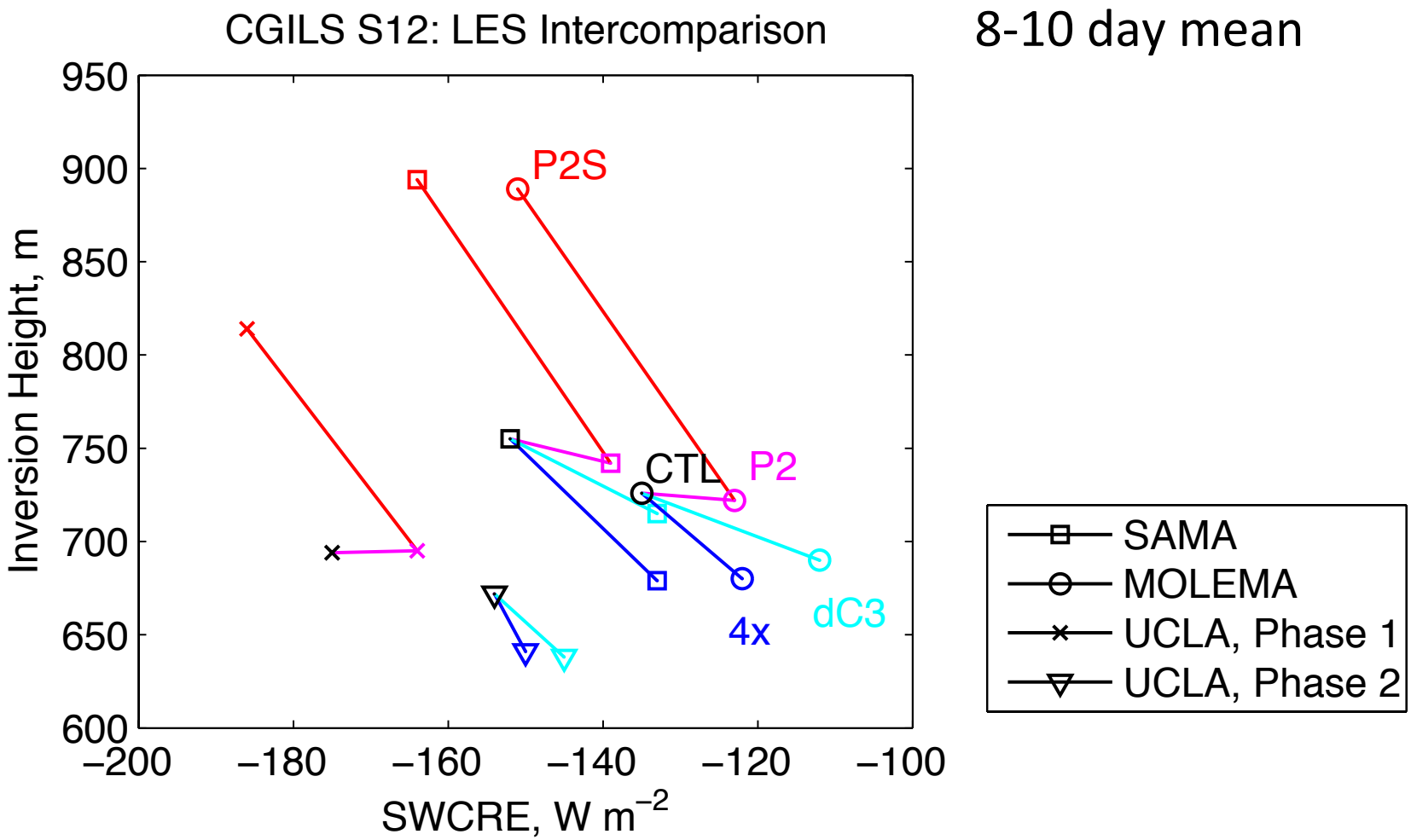
Old cases

- **P2S**
- **P2** (S12 only)
- **CTL**

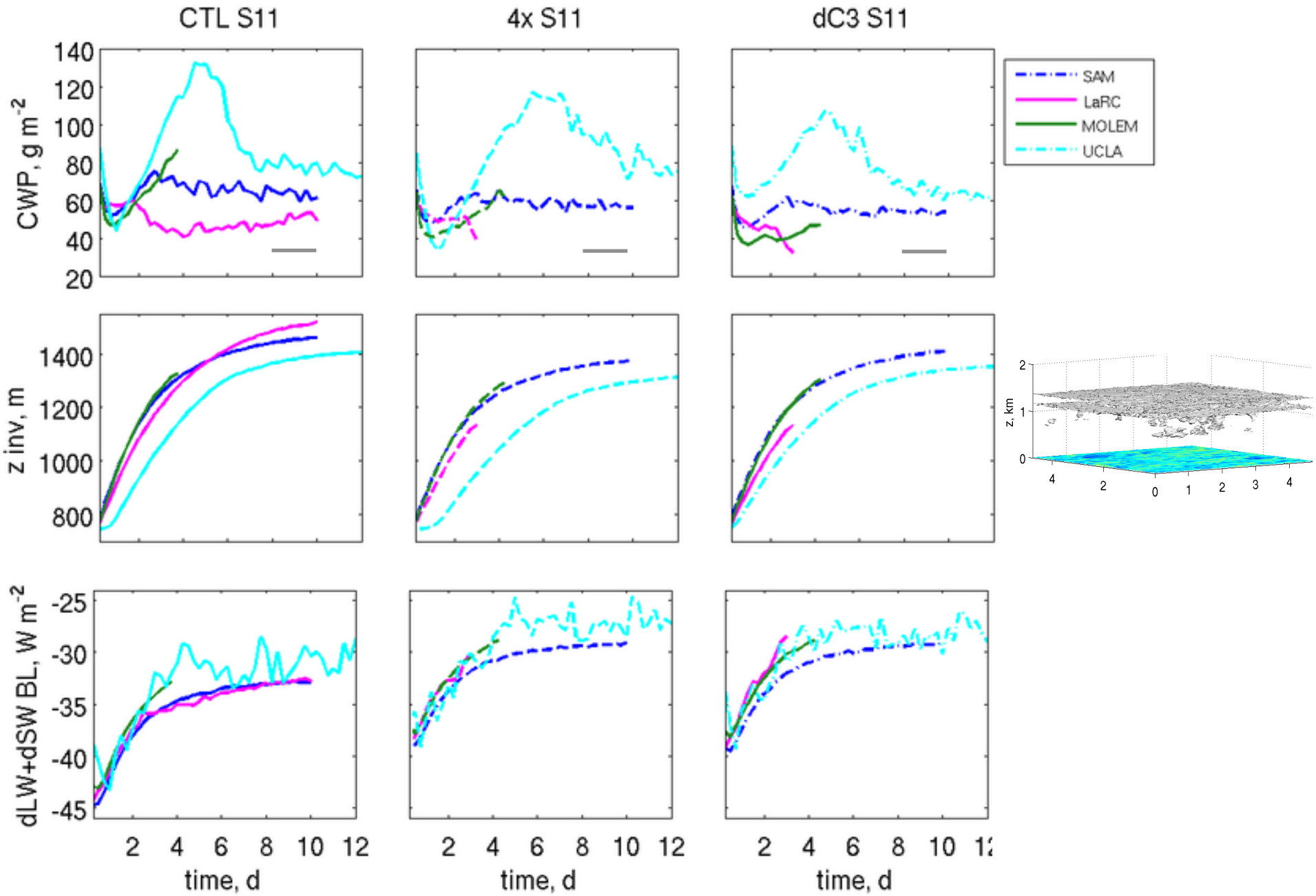
| Perturbation | dCMIP3 |
|---|---|
| δ$CO_2$ | 2x |
| δSST | 2.2–2.5K, S12→S6 |
| δω(500 hPa) | -5 % |
| δEIS | 0.8-0.6K, S12→S6 |
| δRH | -1.5% |
| δ(wind speed) | -1.5% |

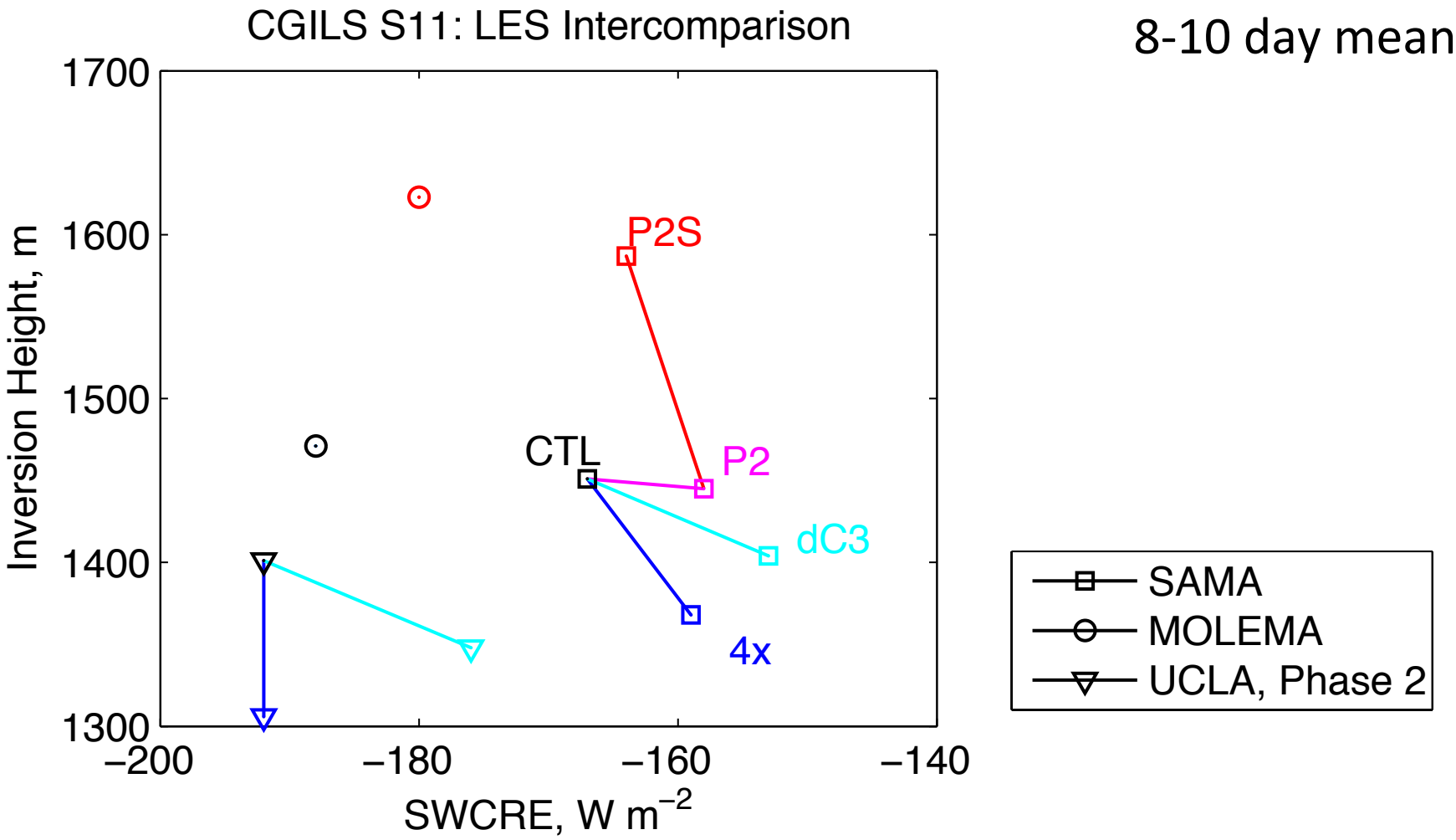
# S12 Phase 2 time series



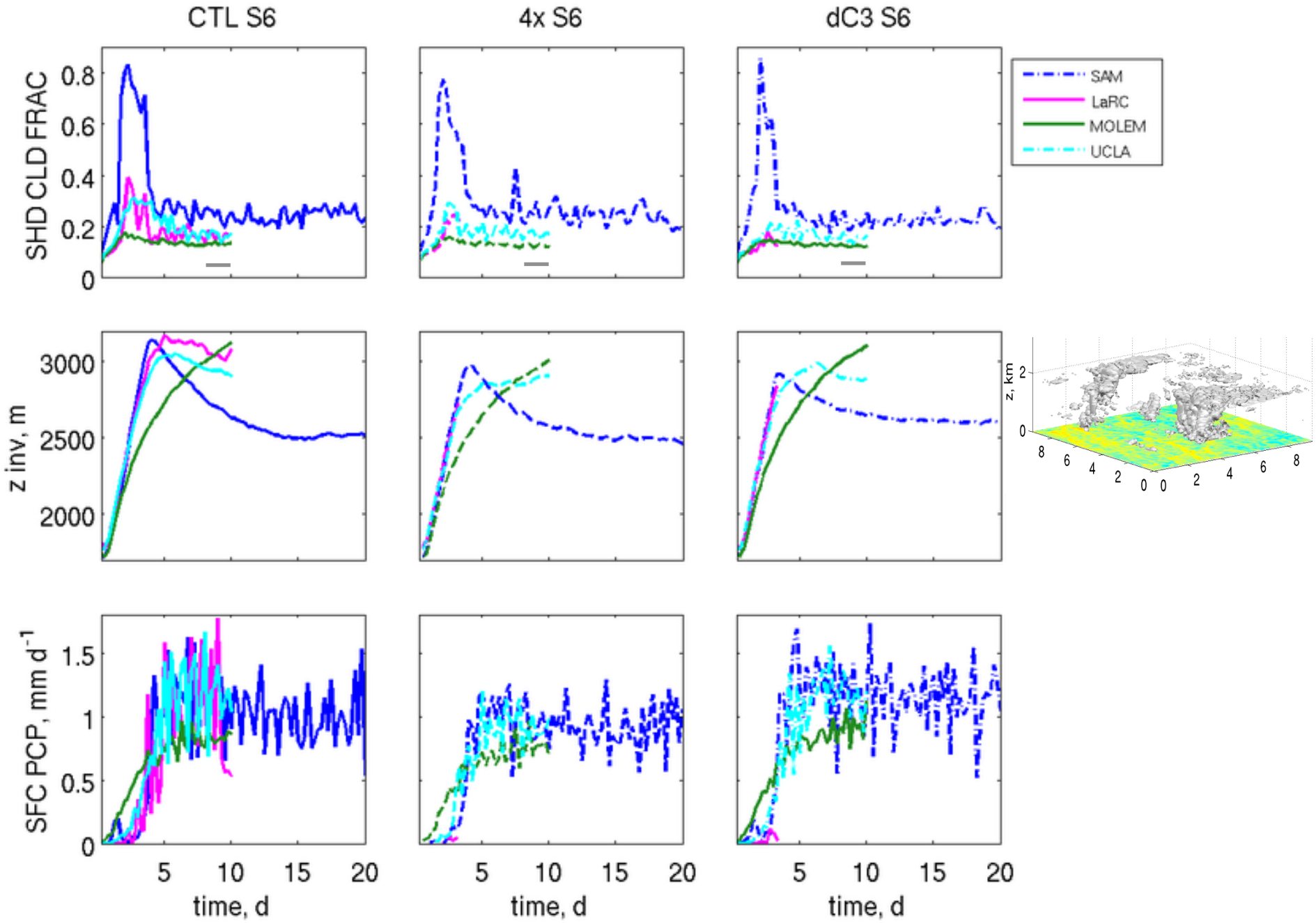


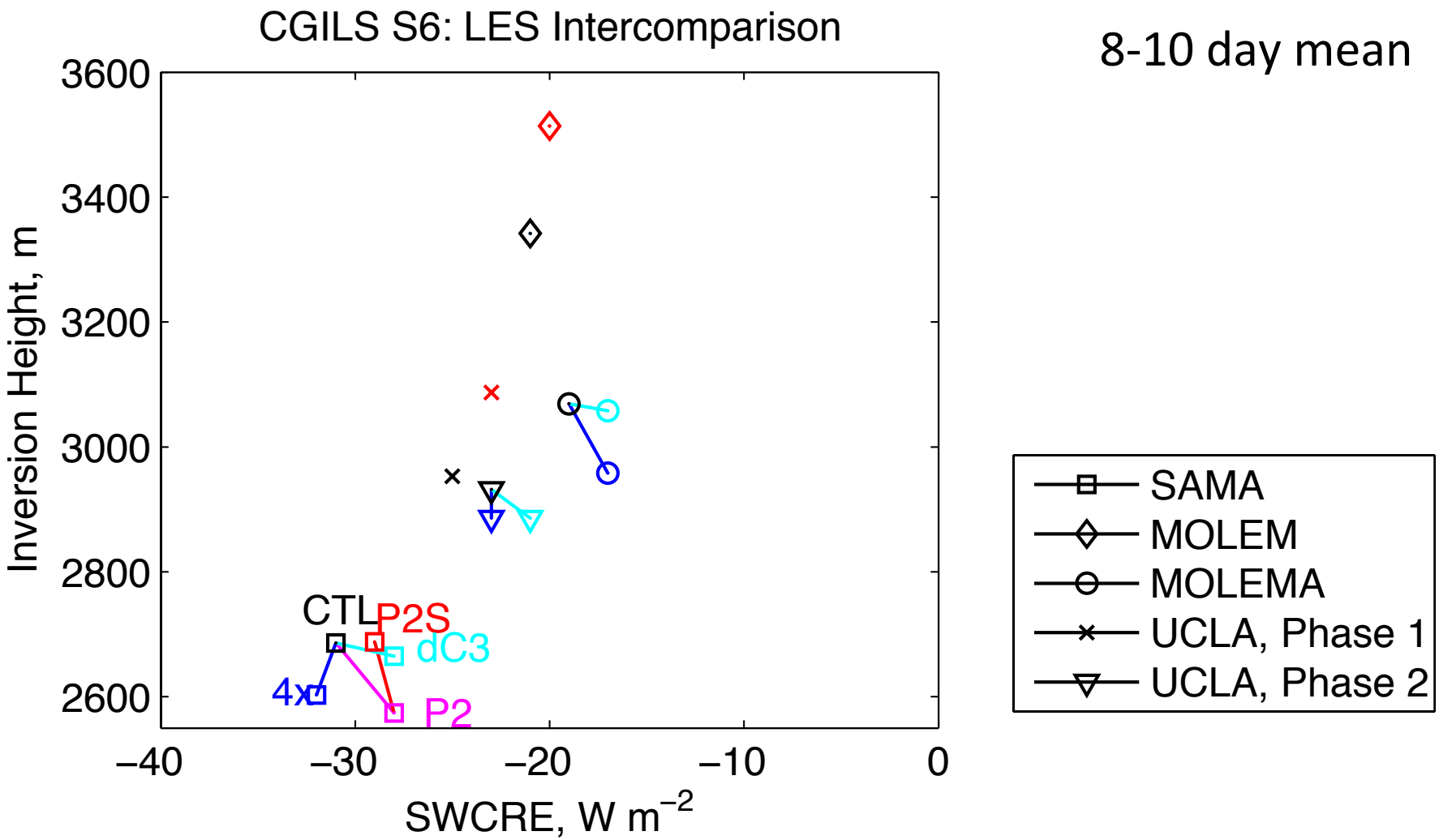

- LES all show cloud thinning and inversion shallowing for 4x, dC3
- UCLA: Weaker 4x, dC3 response


CTL S11
4x S11
dC3 S11
CWP, g m-2
z inv, m
dLW+dSW BL, W m-2
time, d
SAM
LaRC
MOLEM
UCLA
z, km



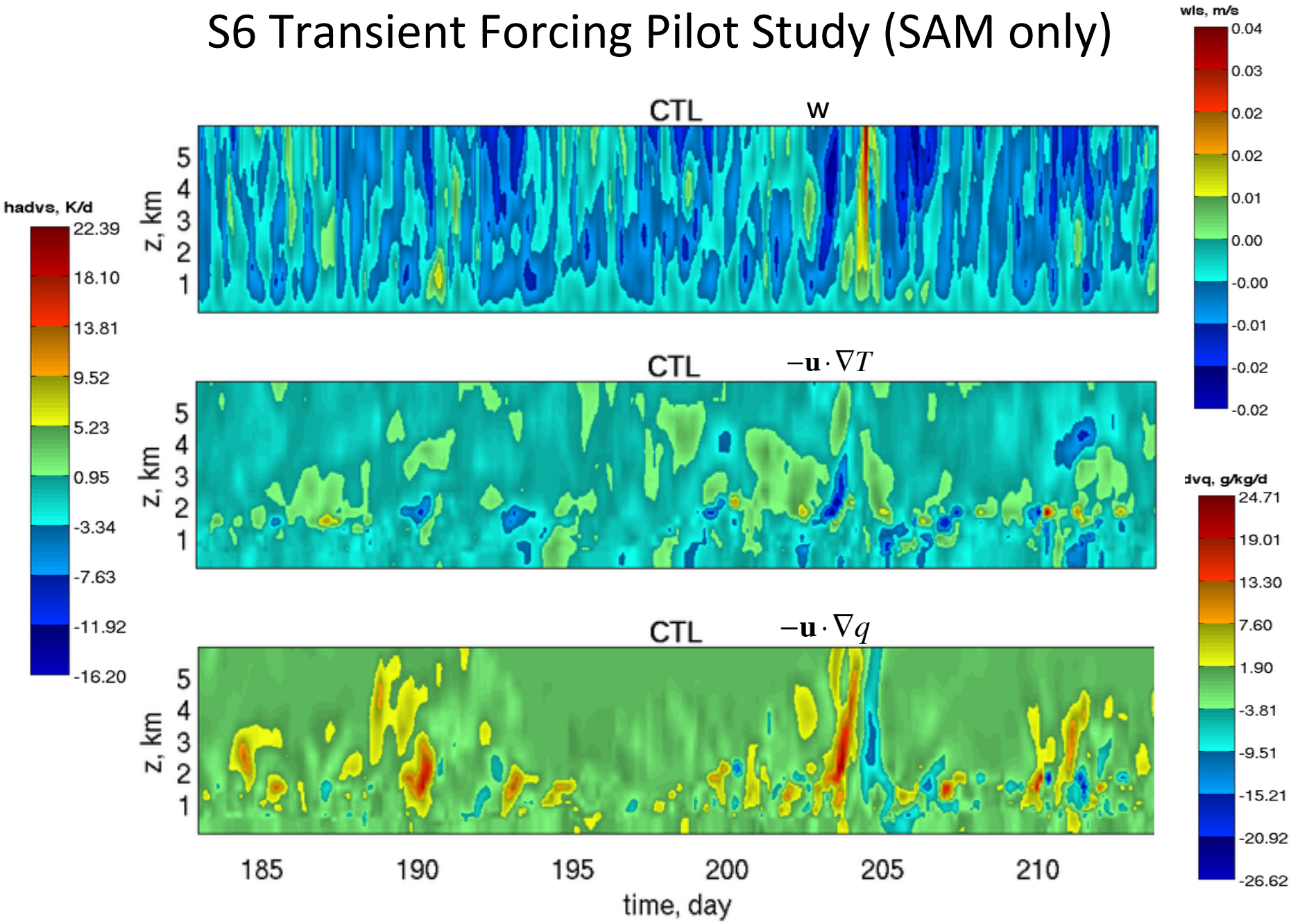

- SAM, UCLA both show cloud thinning (dC3) and inversion shallowing (4x, dC3)
- UCLA: Much thicker capping stratocumulus


CTL S6
4x S6
dC3 S6
SHD CLD FRAC
0
0.2
0.4
0.6
0.8
SAM
LaRC
MOLEM
UCLA
z inv, m
2000
2500
3000
z, km
0
2
0
2
4
6
8
0
2
4
6
8
SFC PCP, mm d-1
0
0.5
1
1.5
5
10
15
20
time, d
time, d
time, d



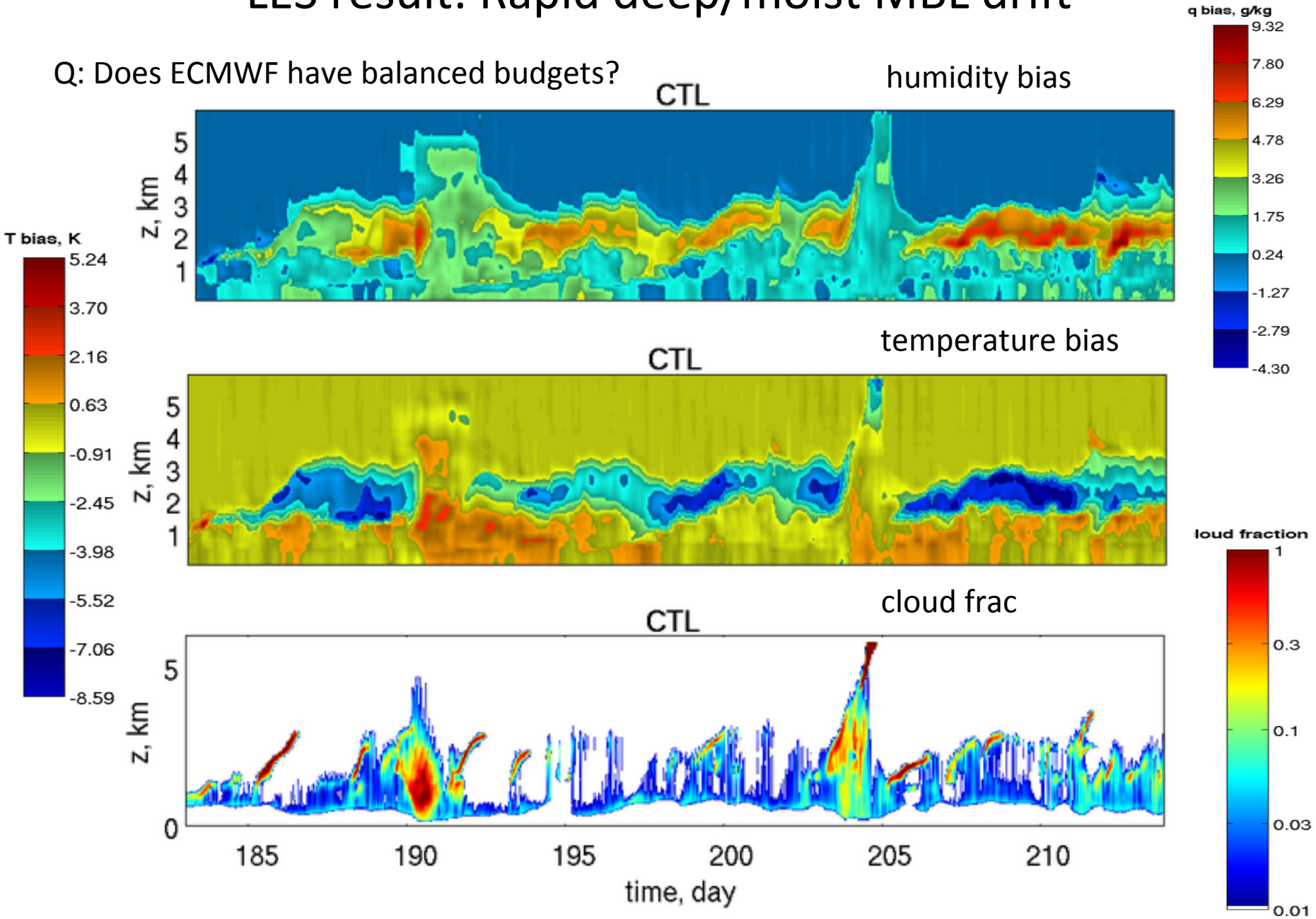

- LES all show slightly less cloud (dC3) and inversion shallowing (4x, dC3)
- Diversity in inversion heights

# S6 Transient Forcing Pilot Study (SAM only)

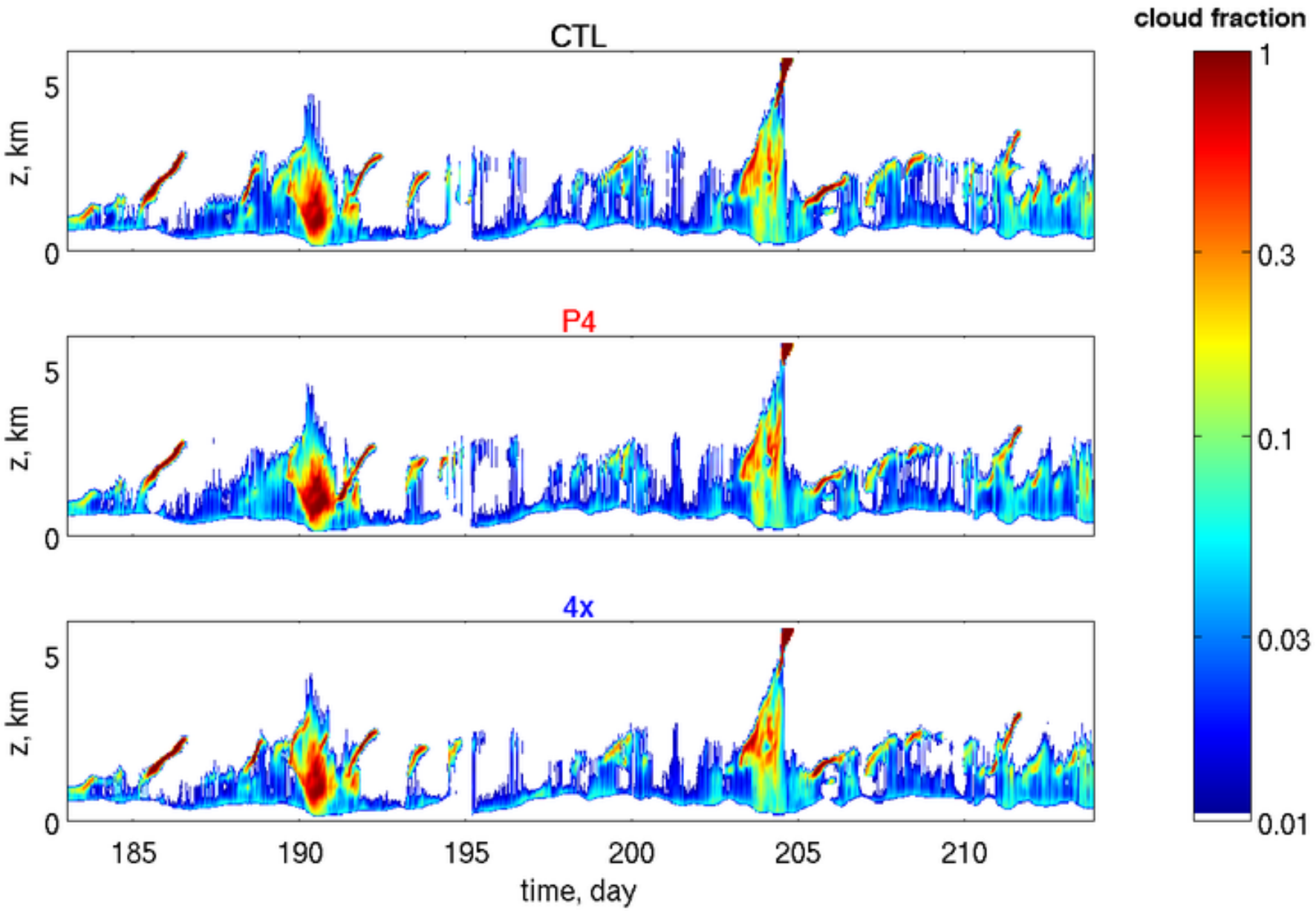


# LES result: Rapid deep/moist MBL drift

Q: Does ECMWF have balanced budgets?

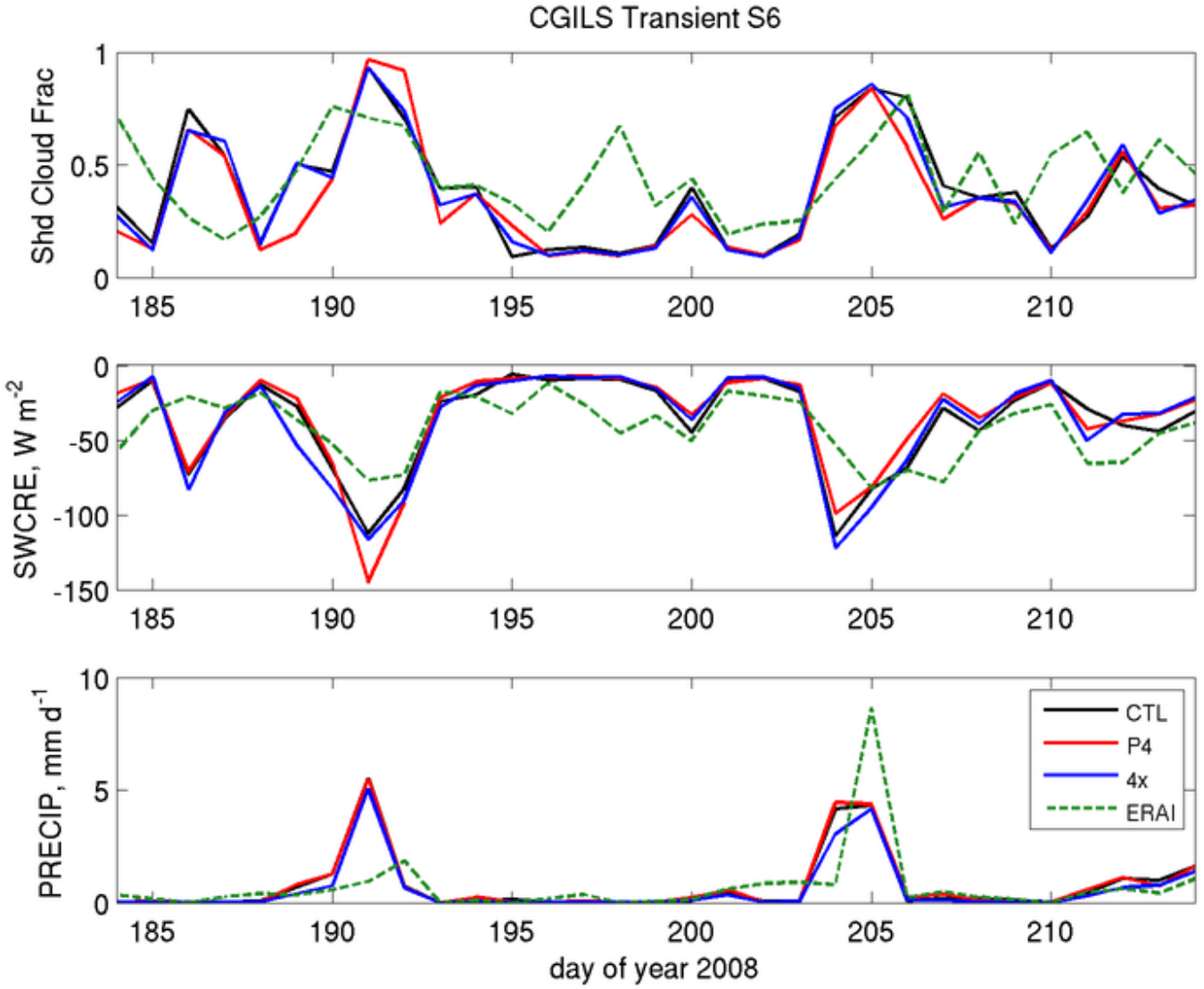


# Sensitivity to climate perturbations



# Sensitivity to climate perturbations

Less rain, more SWCRE in 4xCO2?
Premature to draw robust conclusions



# Conclusions

- CGILS Phase 2 alive and well
- Several LES groups have submitted 4xCO2 and dCMIP3 results
- Will probably close to new submissions by mid-July, so let Peter know now if you want to run these cases.
- dCMIP3 shows cloud thinning at all locations by all LES; most also show some 4xCO2 cloud thinning.
- 4xCO2 and dCMIP3 show inversion shallowing at all locations by all LES.
- A first 30-day S6 transient-forcing case with SAM quickly develops a deep, moist bias, similar to S6 steady-forcing case.