

Southeast Pacific stratocumulus in CAM4 and CAM5

Falling down and breaking up

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CAPT forecasts & averaging

2006 October

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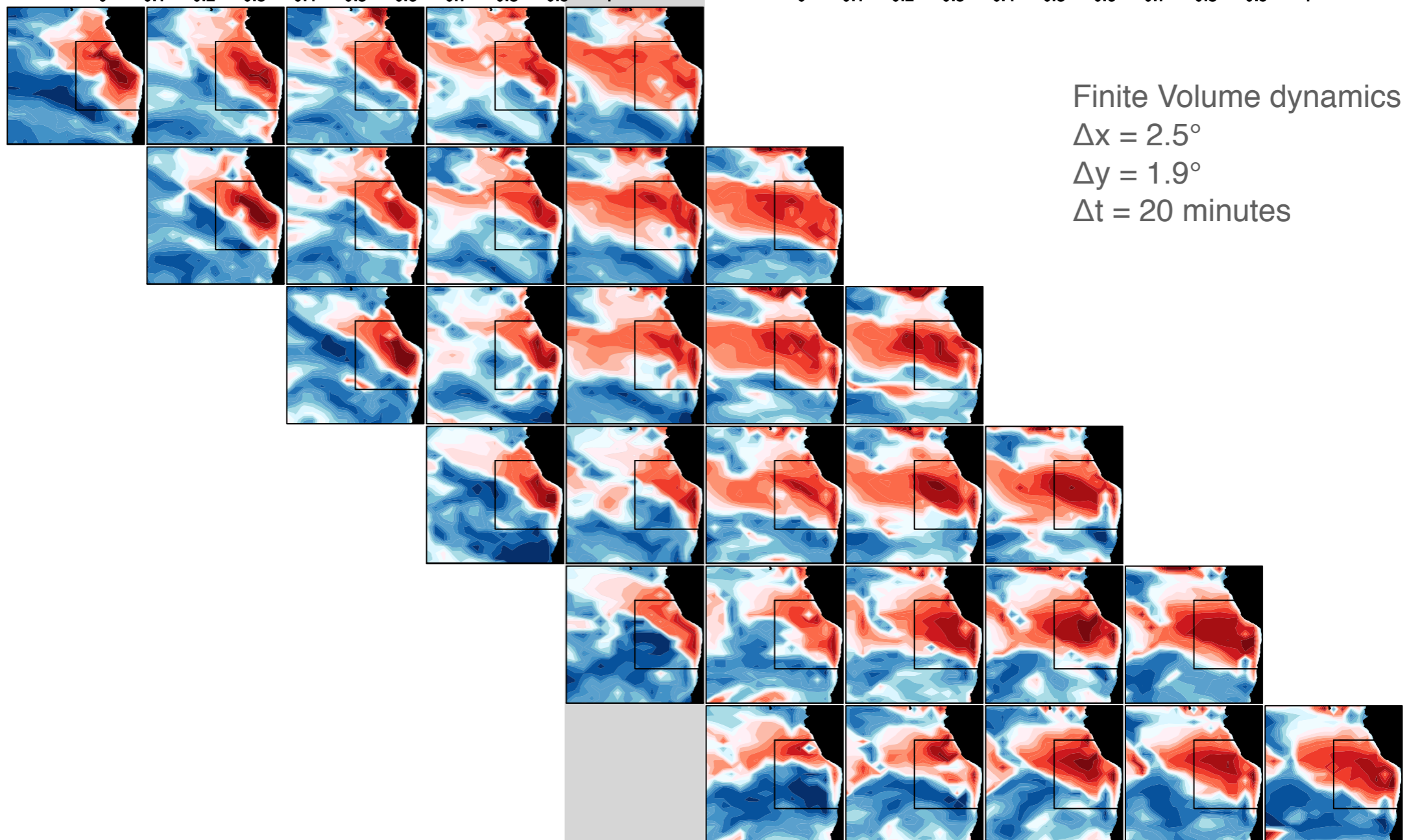
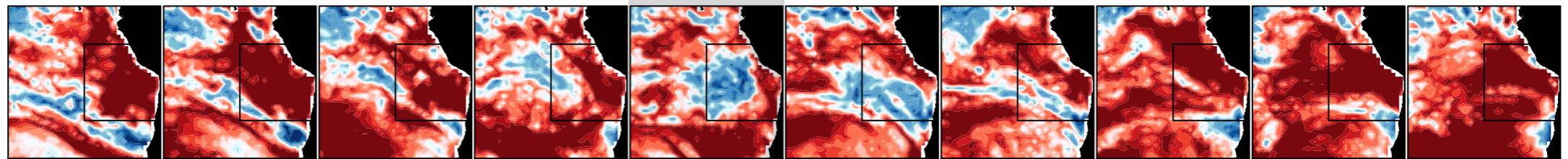
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MODIS
CLOUD
FRACTION

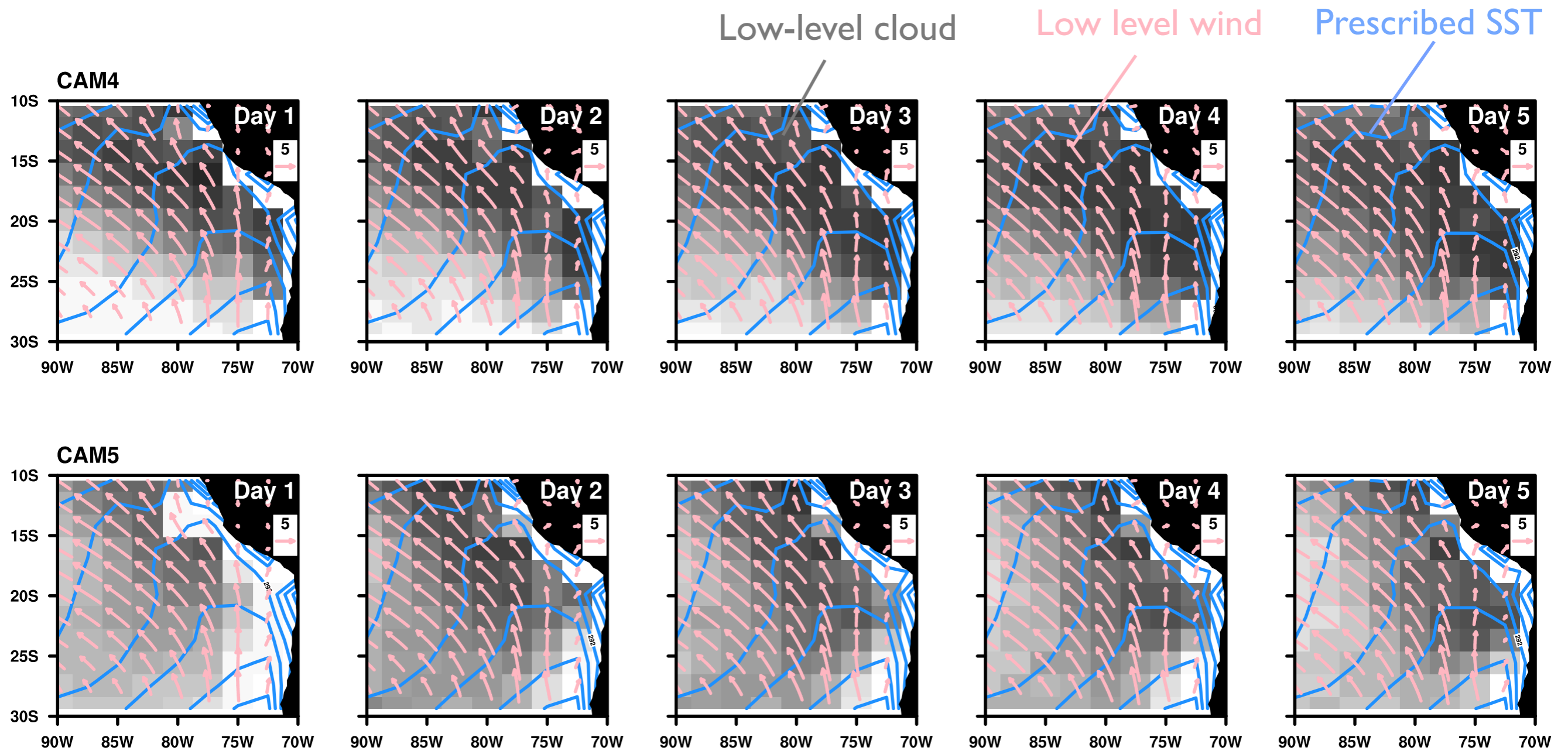


Finite Volume dynamics
 $\Delta x = 2.5^\circ$
 $\Delta y = 1.9^\circ$
 $\Delta t = 20$ minutes

CAM4 FORECASTS



Large-scale circulation

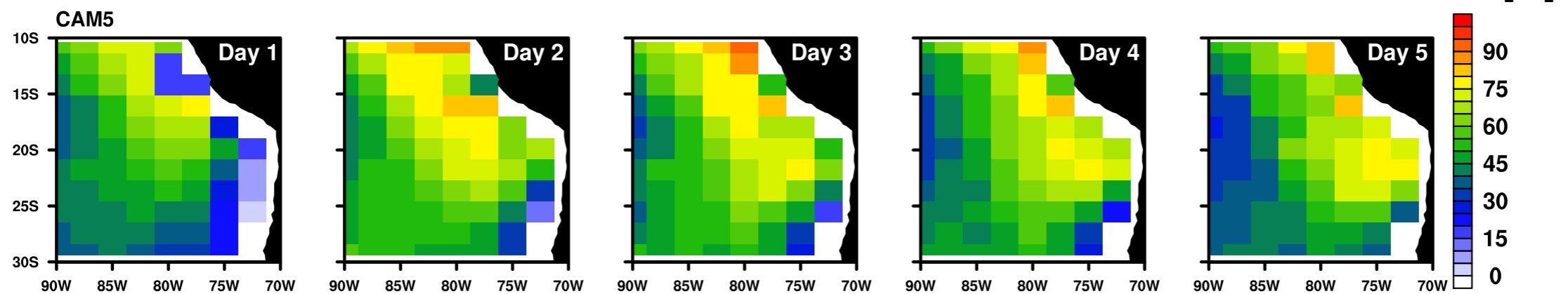
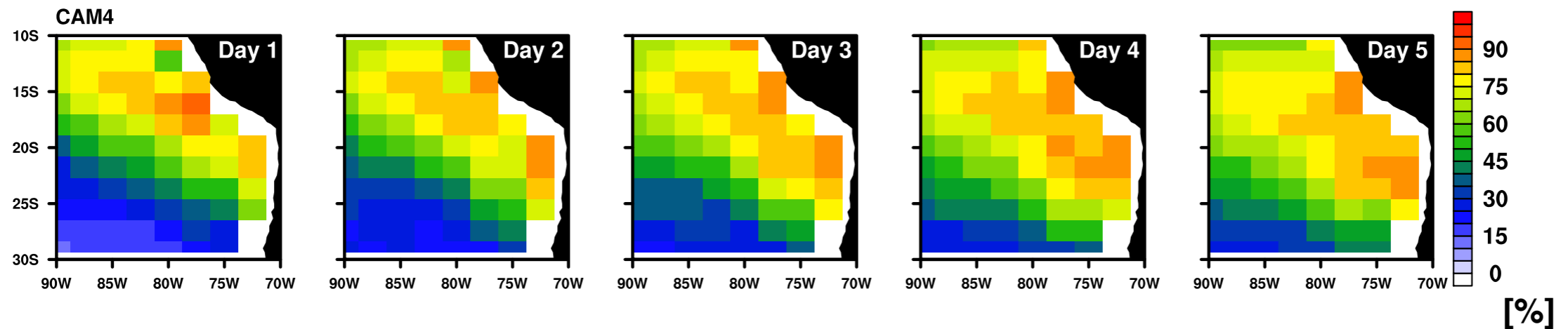
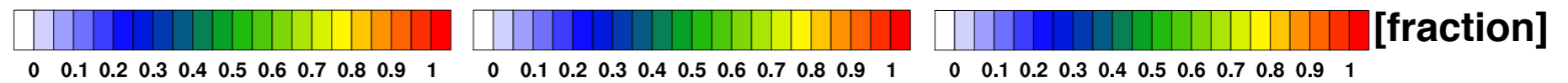
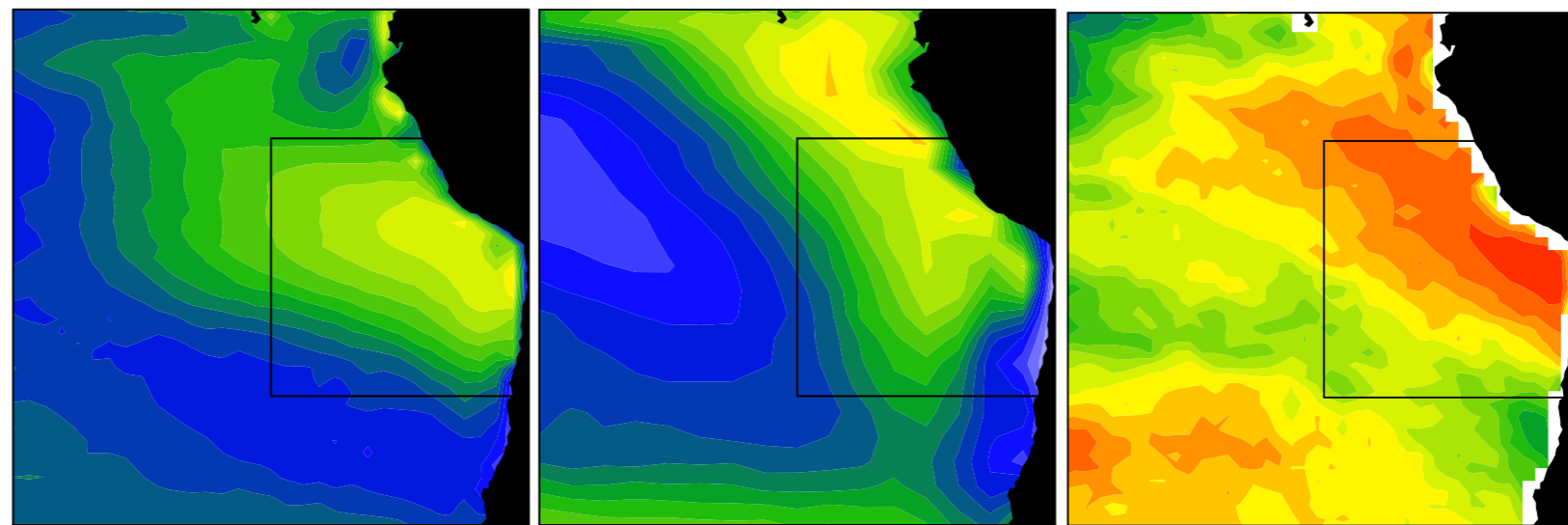


Cloud fraction monthly mean

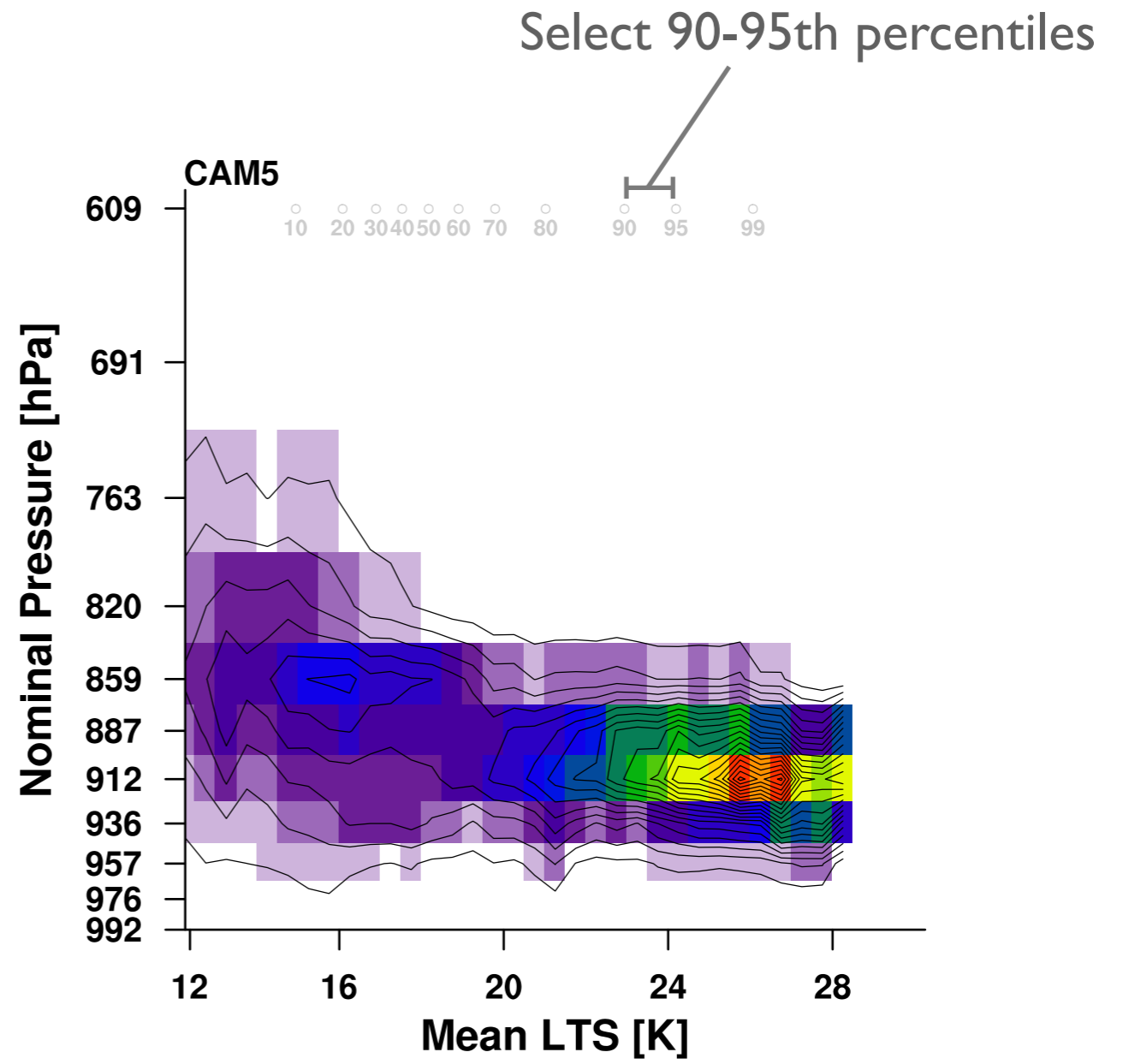
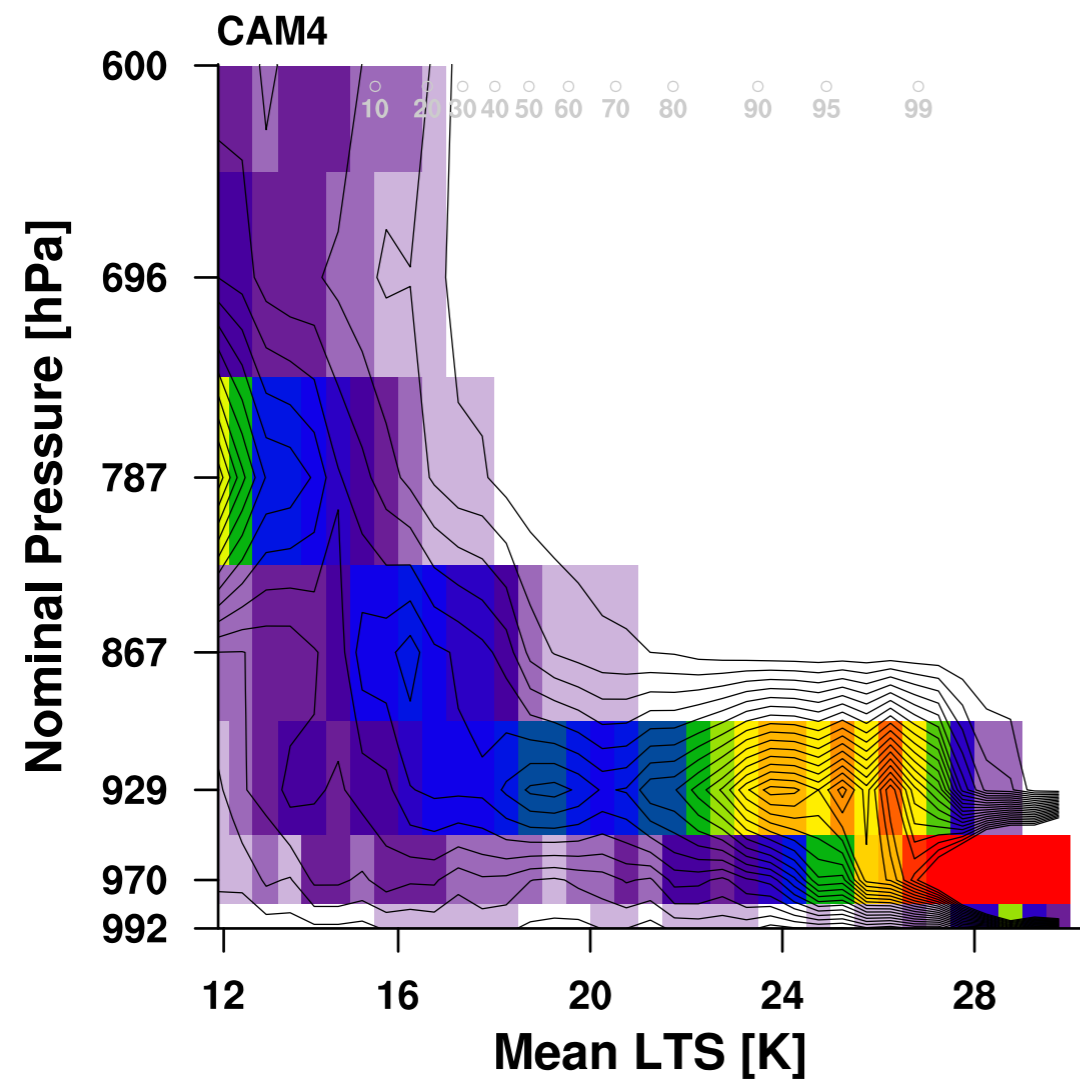
CAM4 1°, 10yrs, SOM

CAM5 2°, 10yrs, SOM

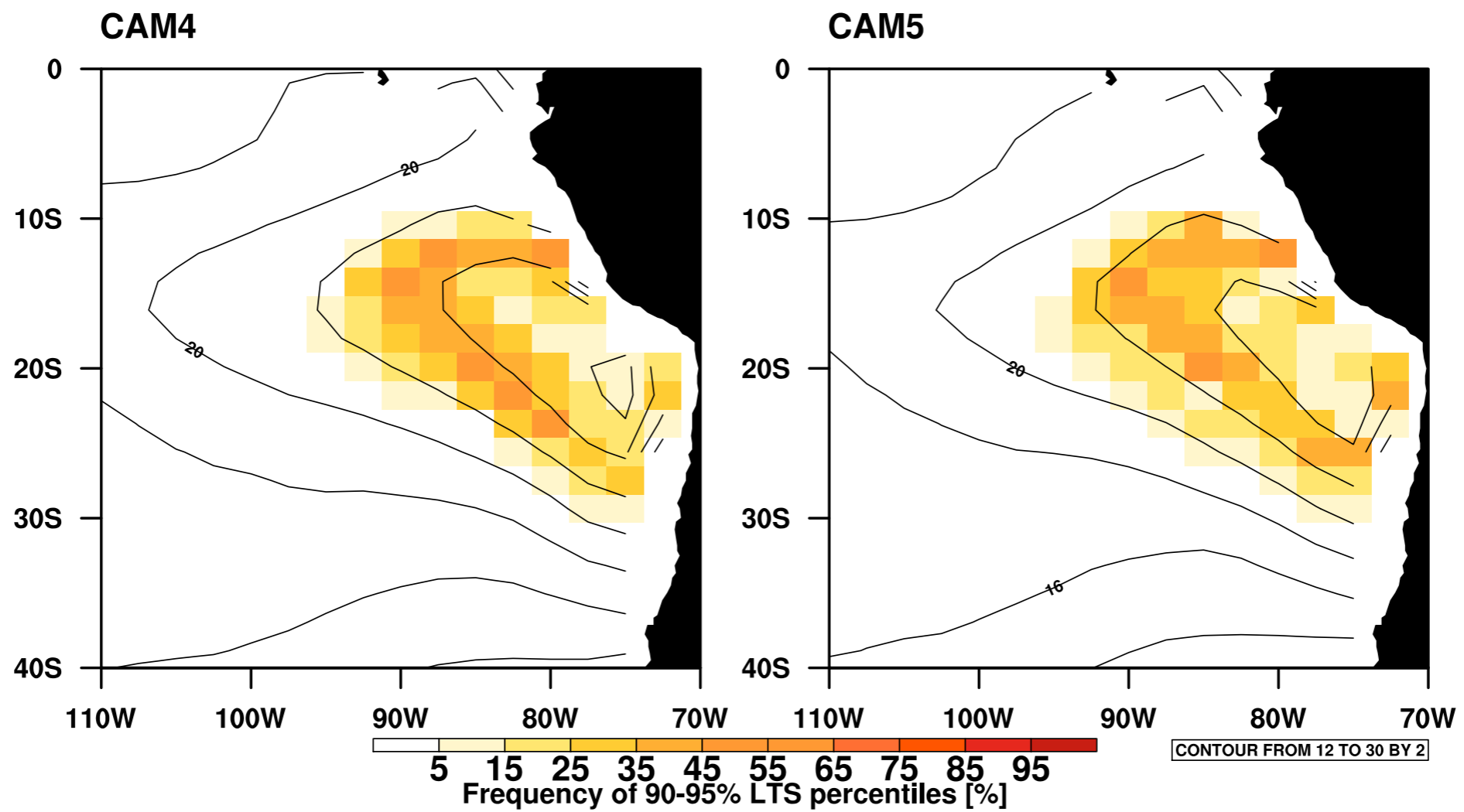
MODIS 1°, Oct. 2006



Cloud sorted by LTS

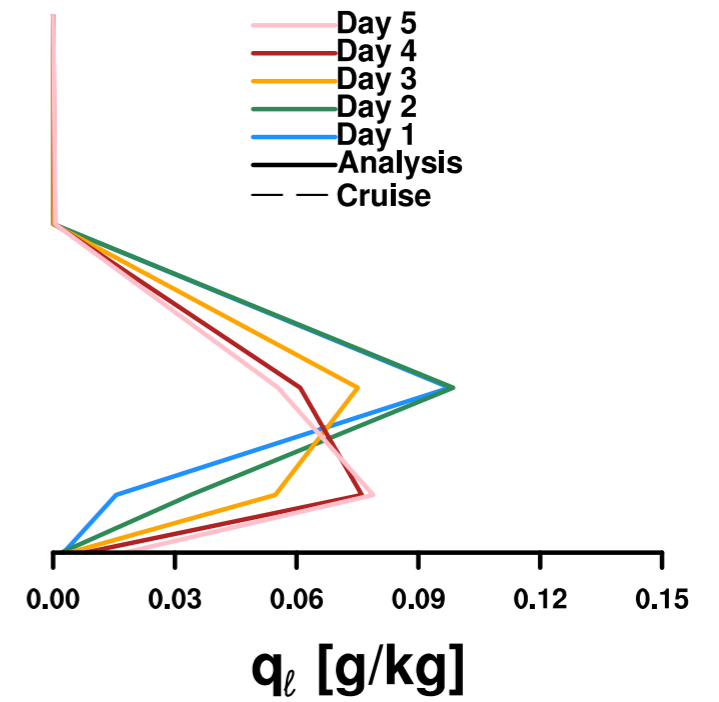
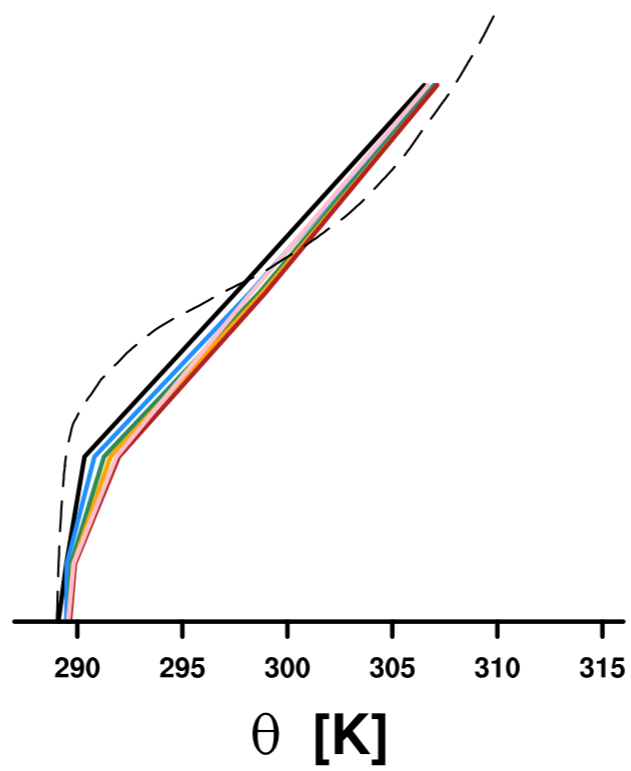
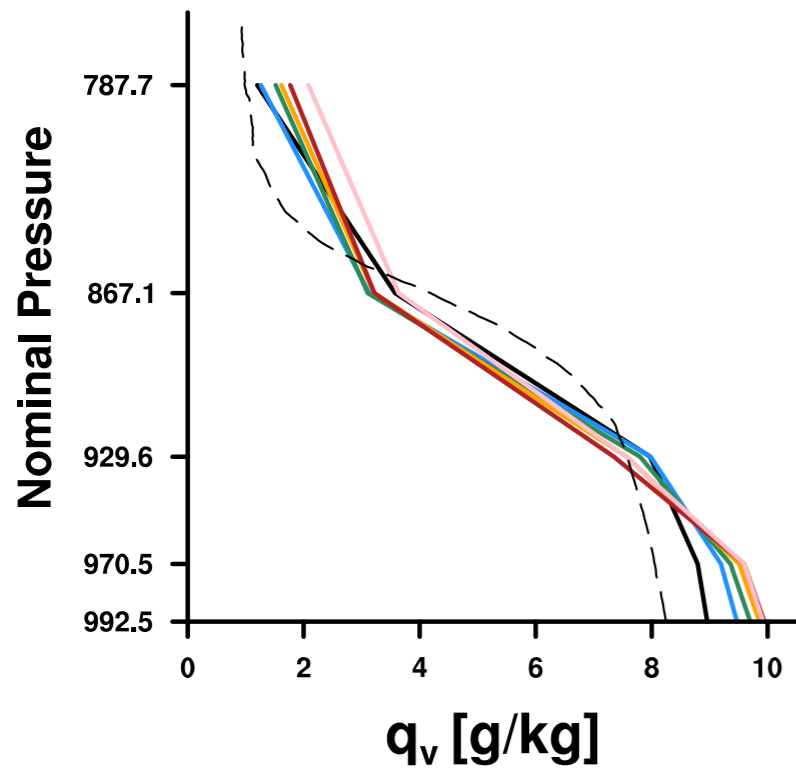


The 90-95th percentiles

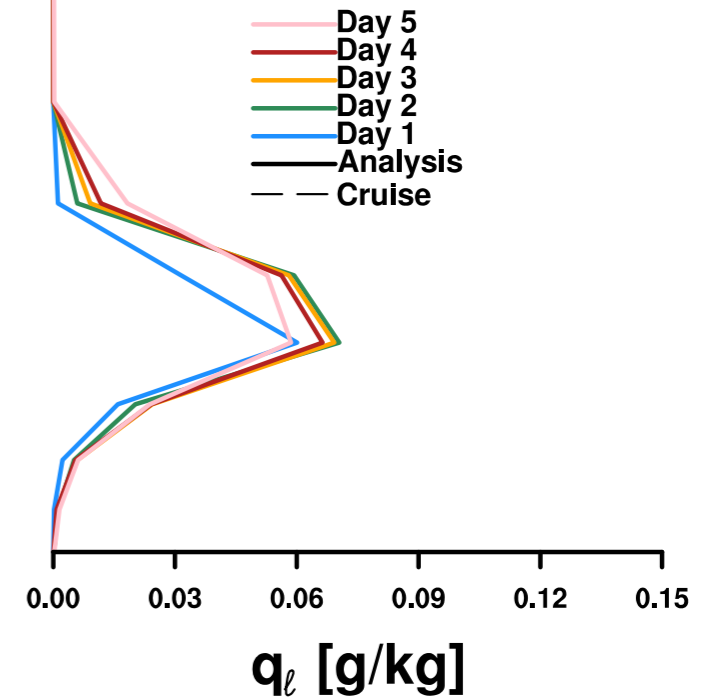
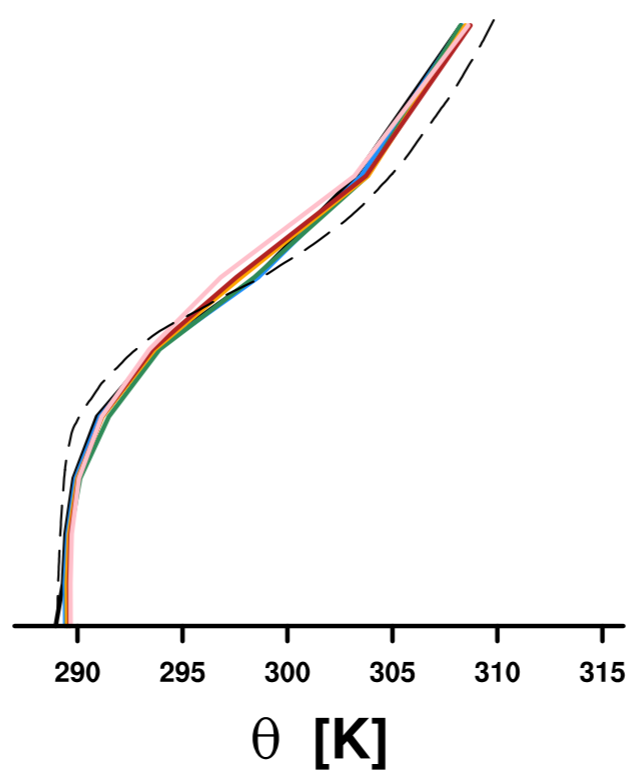
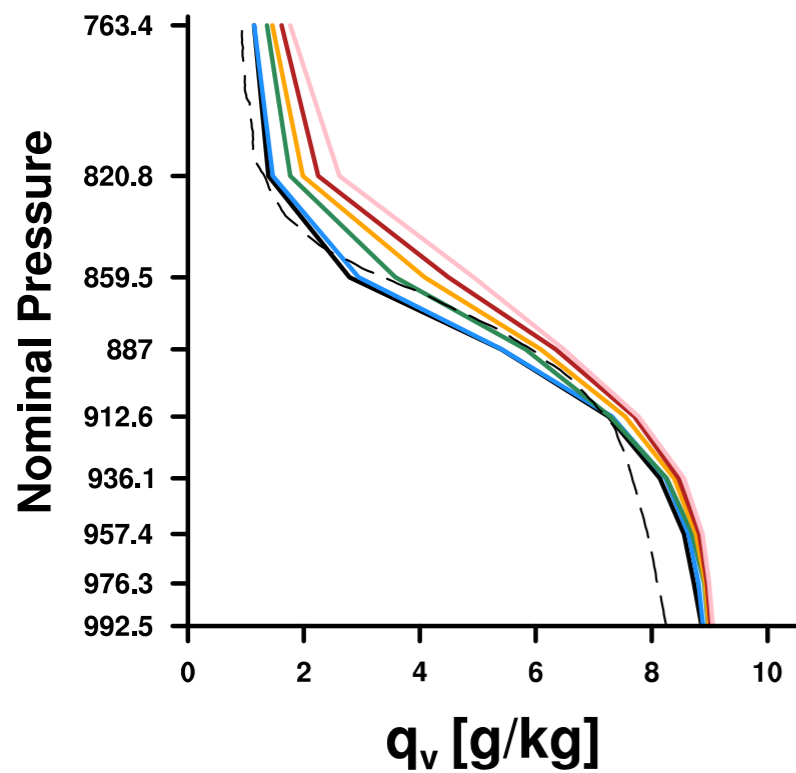


Mean profiles

CAM4

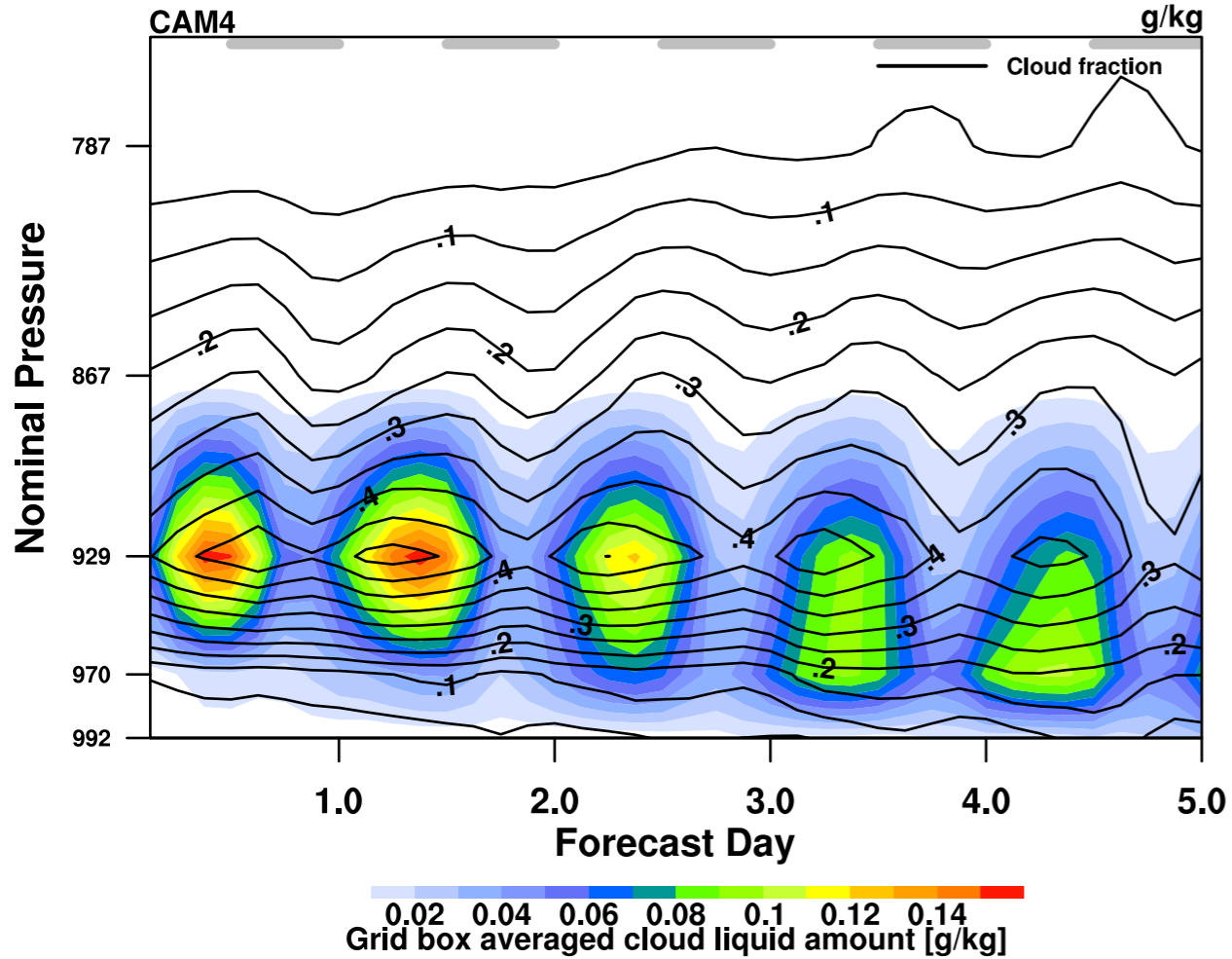


CAM5

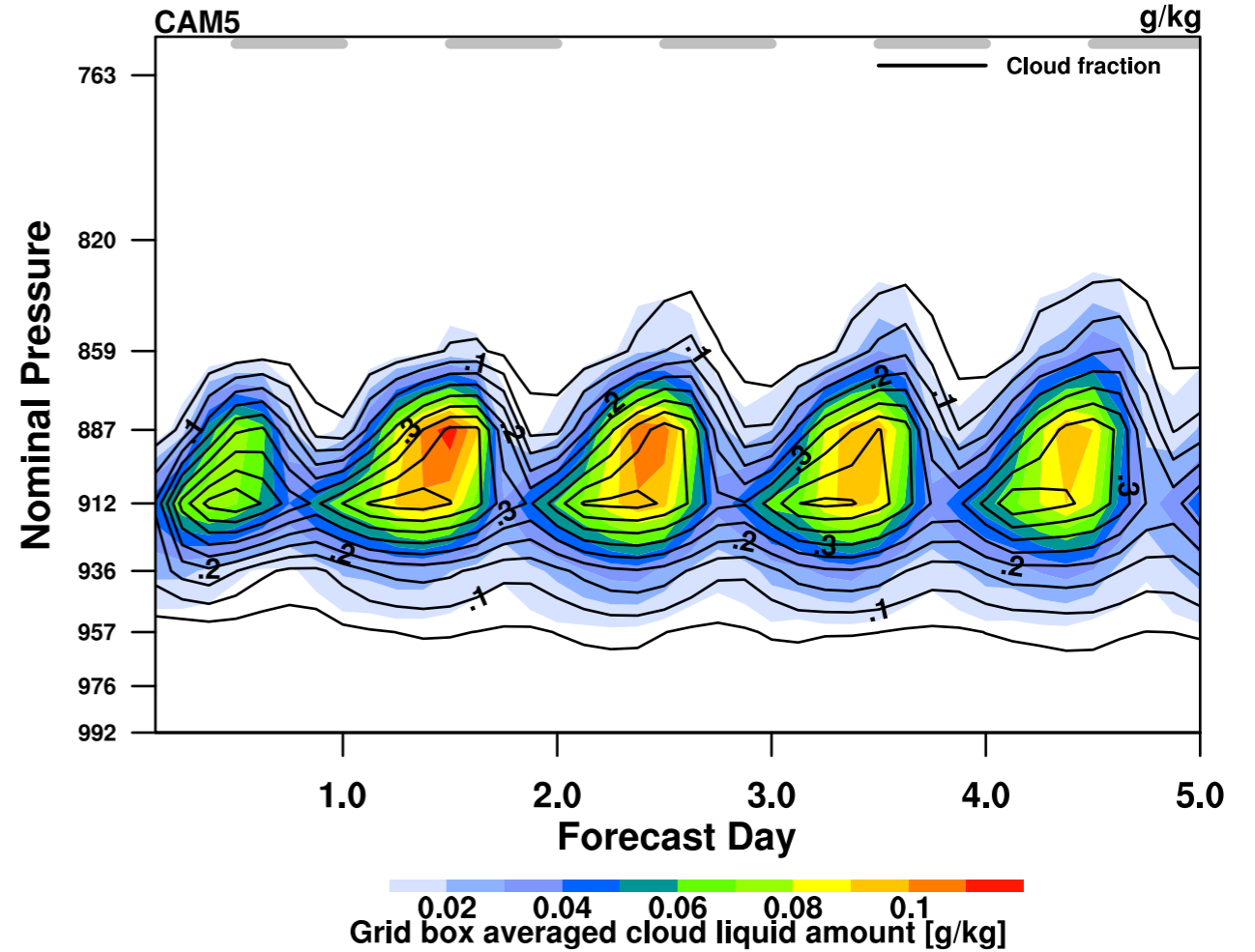


Mean cloud structure

Falling down

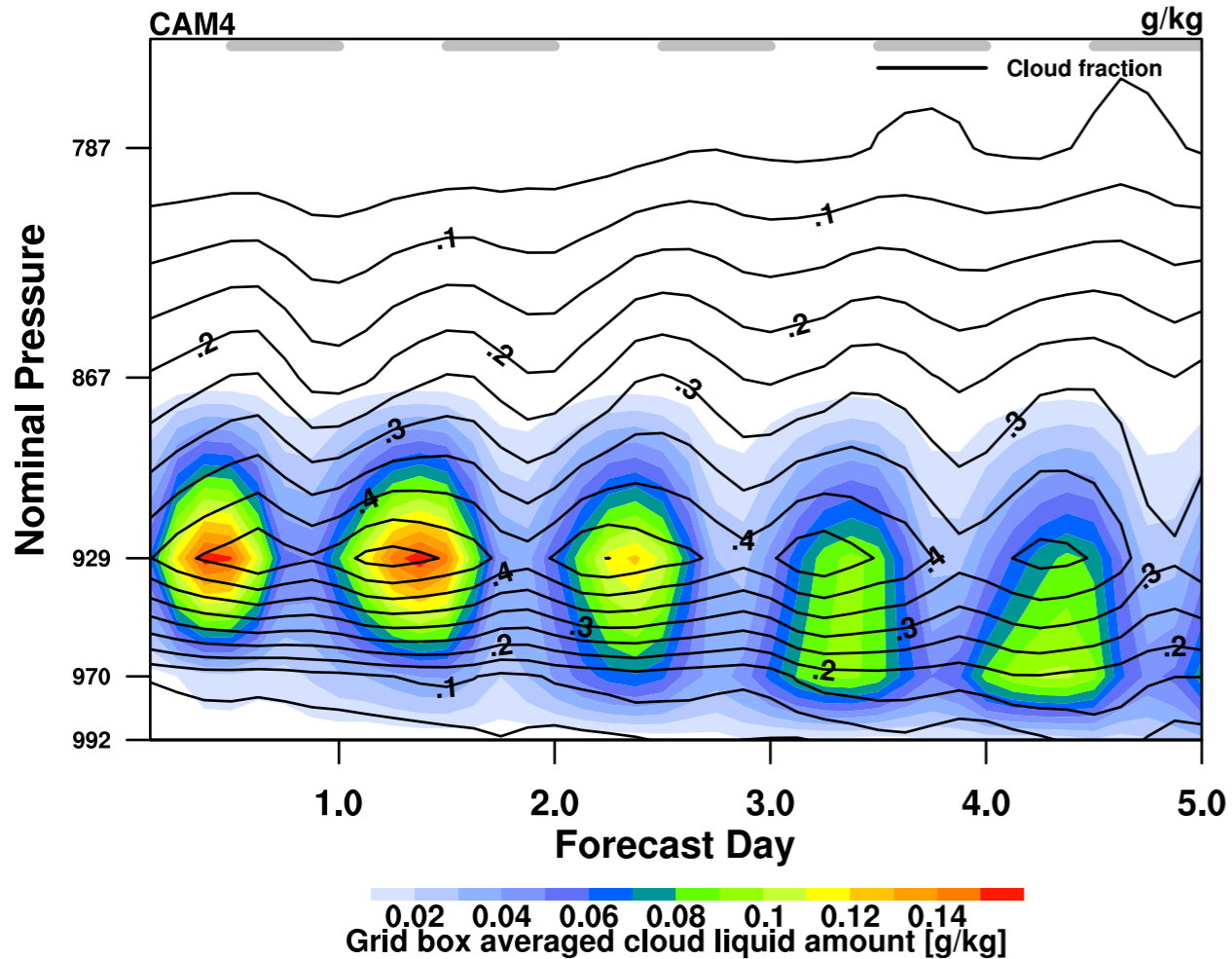


Breaking up

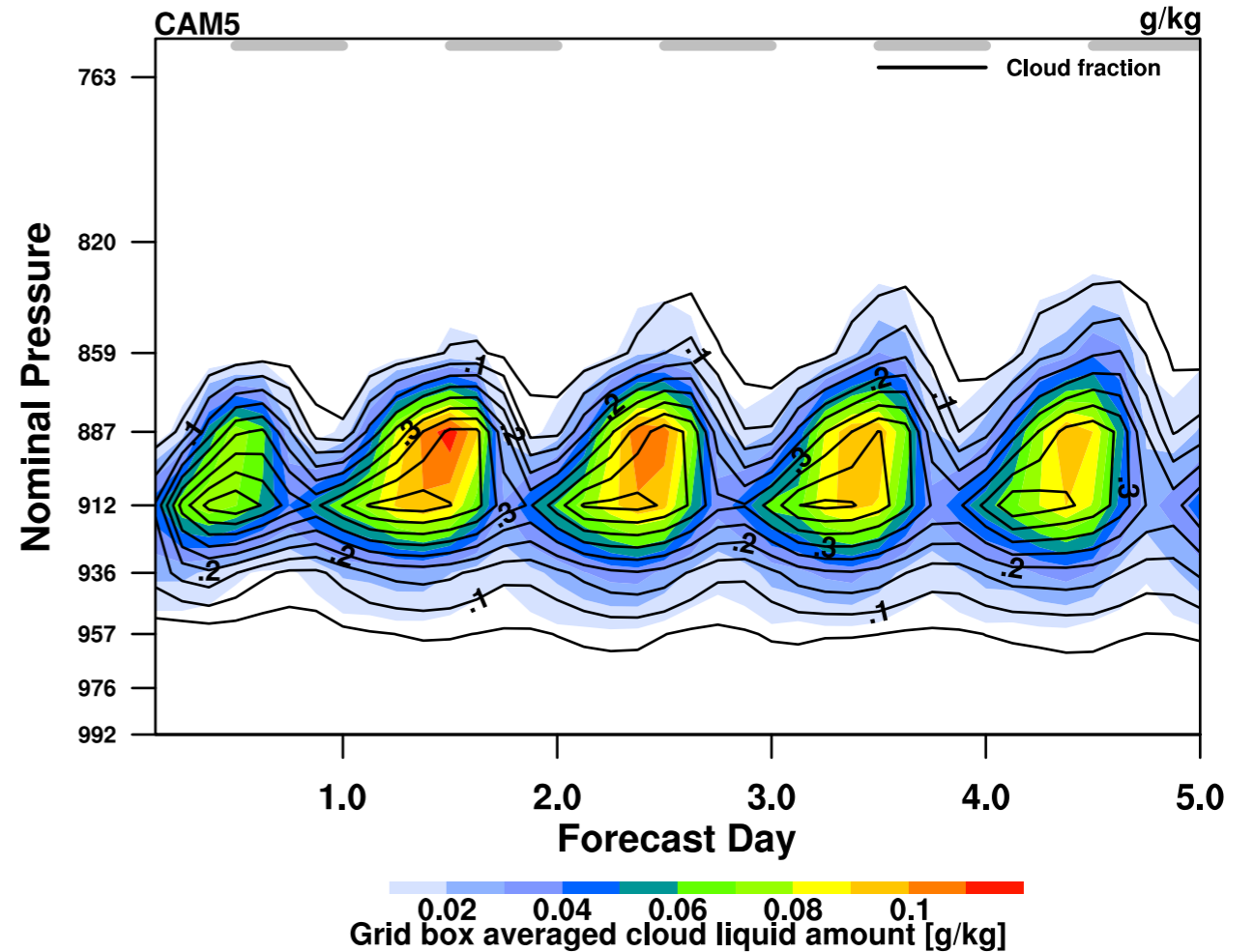


Mean cloud structure

Falling down



Breaking up

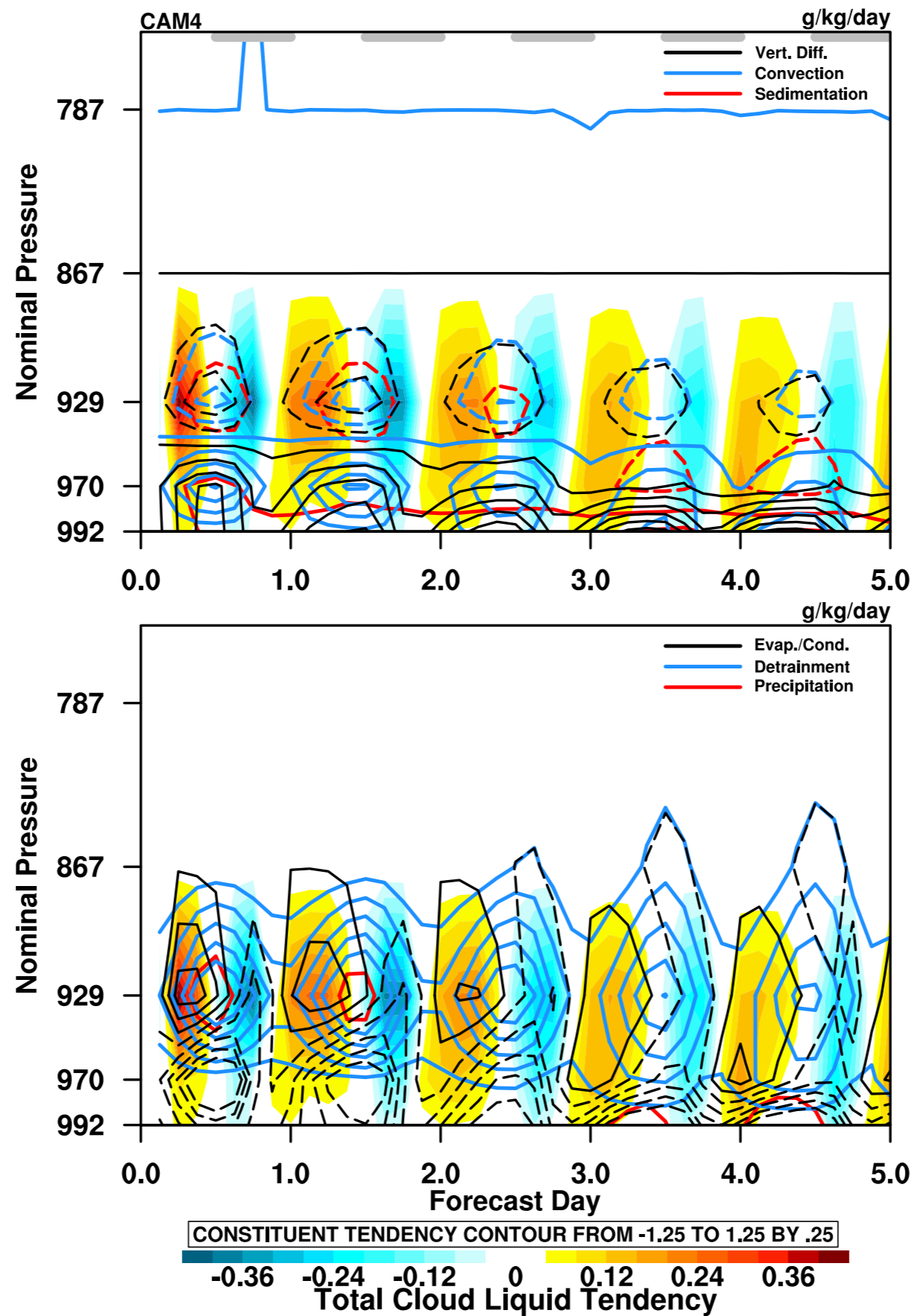


What controls the cloud water come from?

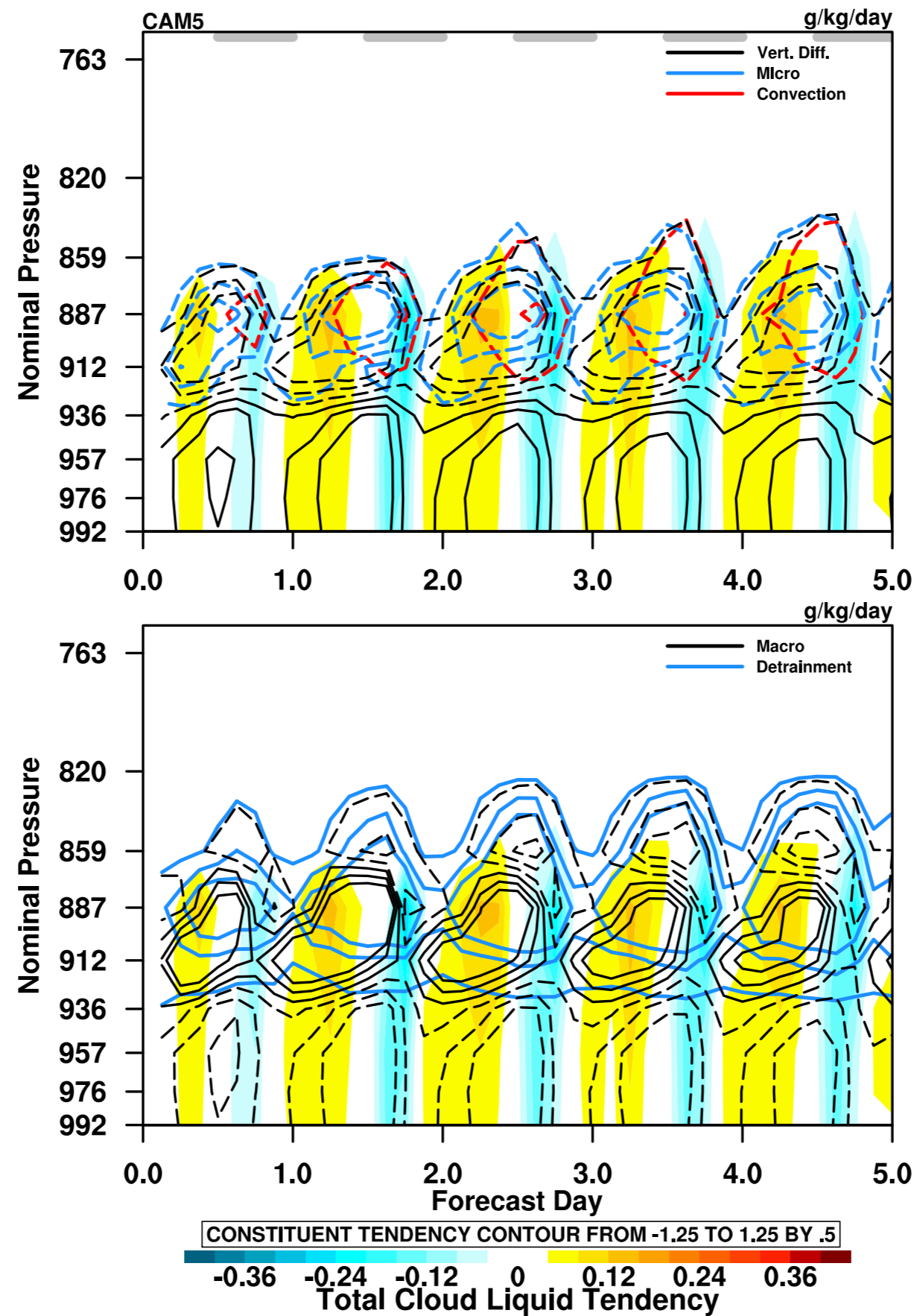
$$\frac{\partial q_e}{\partial t} = -\mathbf{V} \cdot \nabla q_e + P(q_e)$$

$$P(q_e) = T_{\text{PBL}} + C_{\text{Trans}} + C_{\text{Det}} + M$$

Cloud water tendencies: CAM4



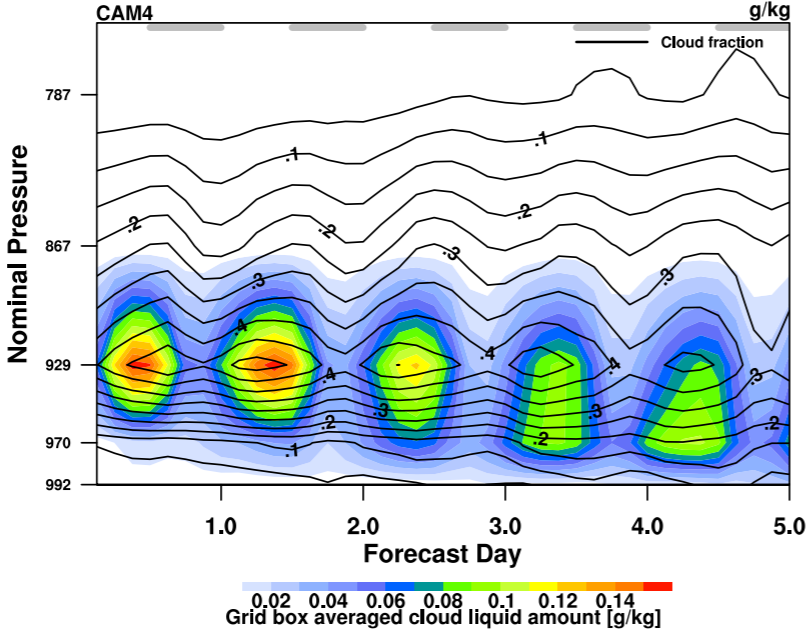
Cloud water tendencies: CAM5



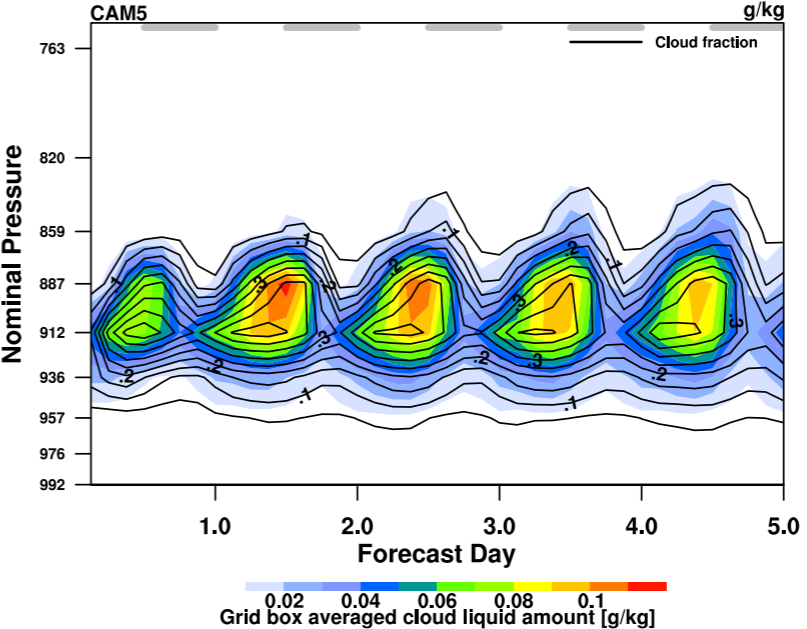
PreVoca v. VOCA

PreVoca

CAM4

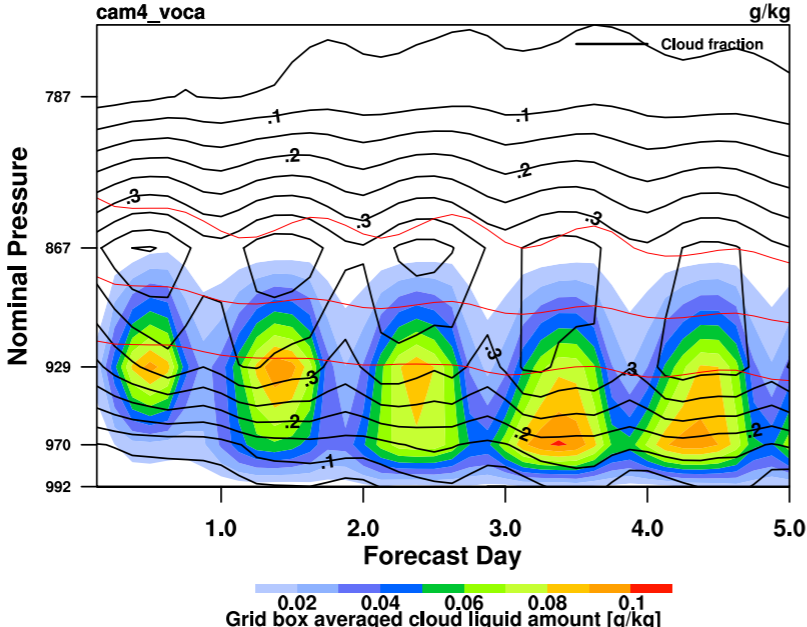


CAM5

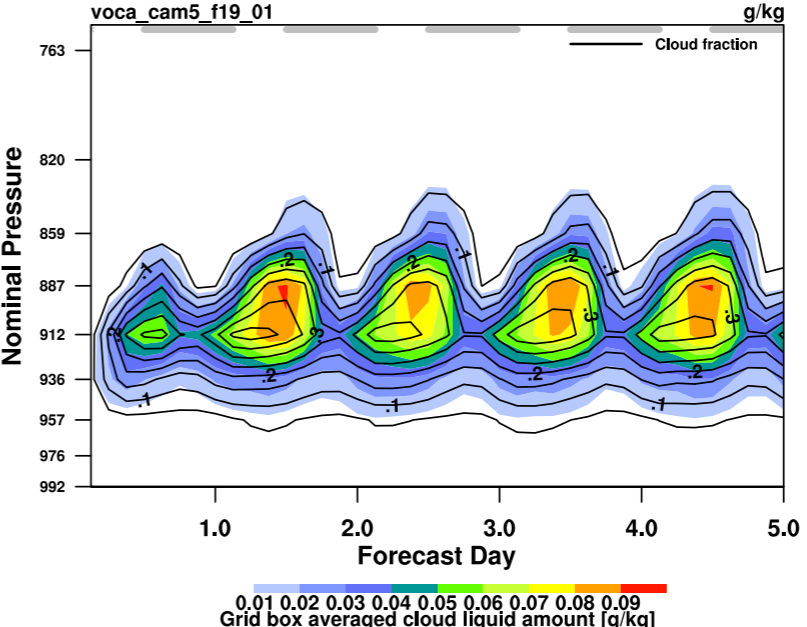


VOCA

cam4_voca



voca_cam5_f19_01



Conclusions

CAPT forecasts highlight fast physics processes

CAM4 does not support well-mixed stratocumulus layer

- PBL collapse: downward mixing of liquid without warming/drying effects

CAM5 more successfully represents stratocumulus

- deeper, well-mixed PBL on average

CAM5 might dissipates stratocumulus daily

- decoupling? (Yes, see details on Thursday.)
- projects onto climate through SWCF, transition to trade-wind cumulus