

Seasonal Variation of Low Clouds in Track 1 and Track 5 CAM

Minghua Zhang (Stony Brook University)

Cecile Hannay (NCAR) and the CAM Development Team

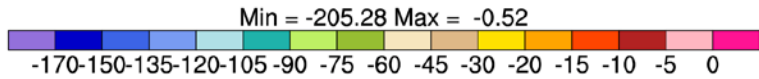
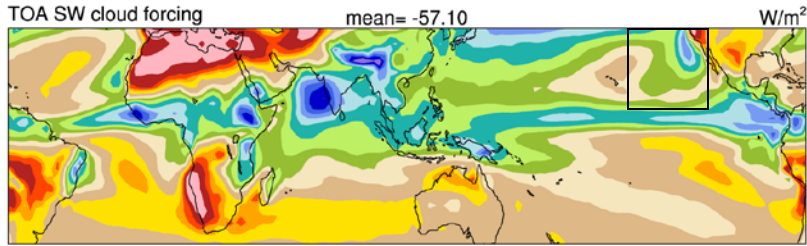
Wuyin Lin (Brookhaven National Laboratory)

SW CRF

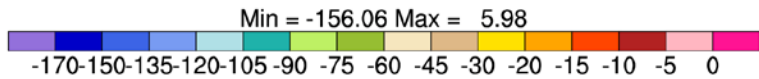
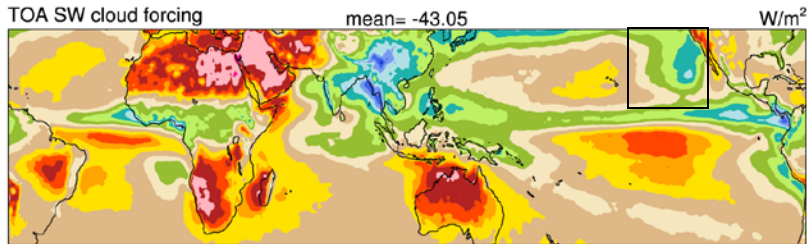
Track 1

JJA

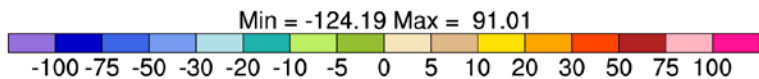
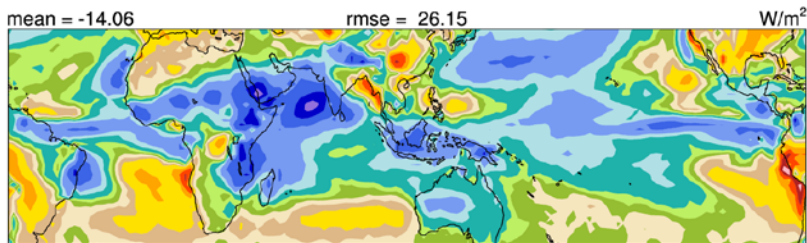
f40_amp_t1_01 (yrs 1978-2002)



CERES2



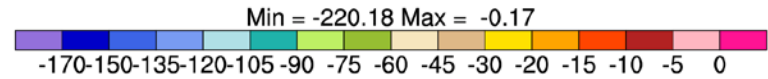
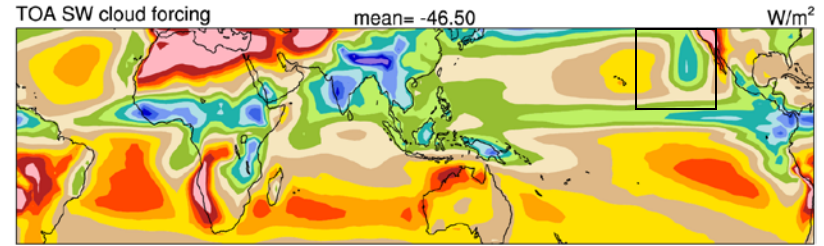
f40_amp_t1_01 - CERES2



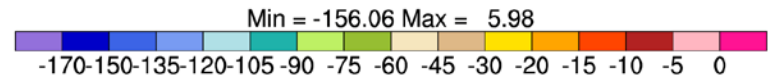
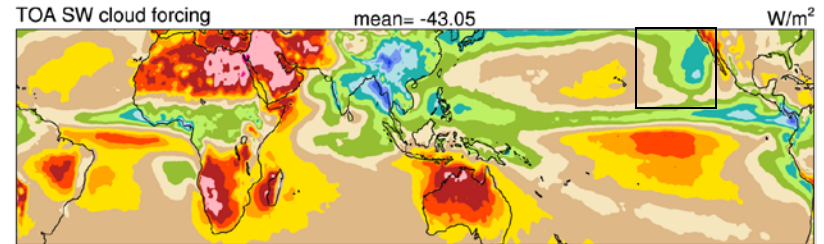
Track 5

JJA

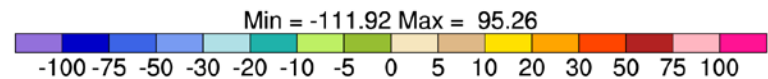
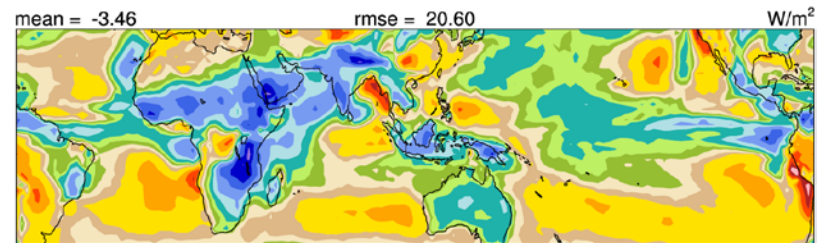
f40_amp_t5_02b (yrs 1978-2002)



CERES2



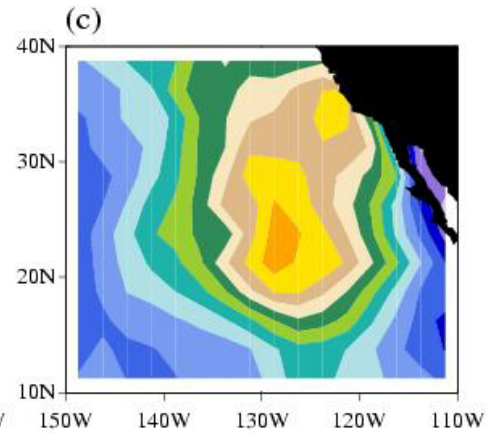
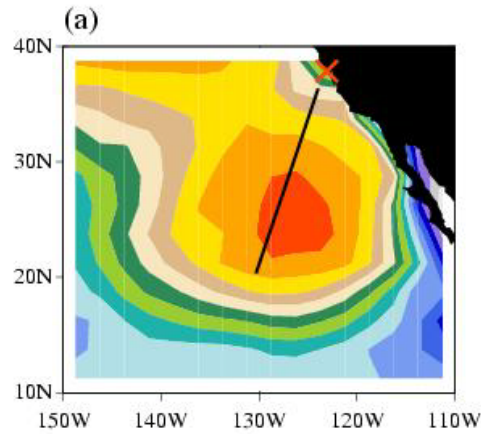
f40_amp_t5_02b - CERES2



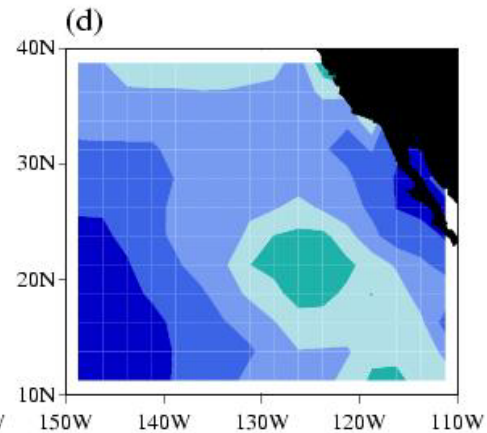
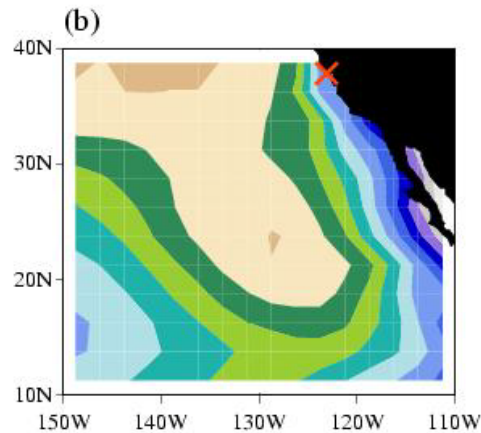
Cloud Amount

In-cloud liquid path

JJA

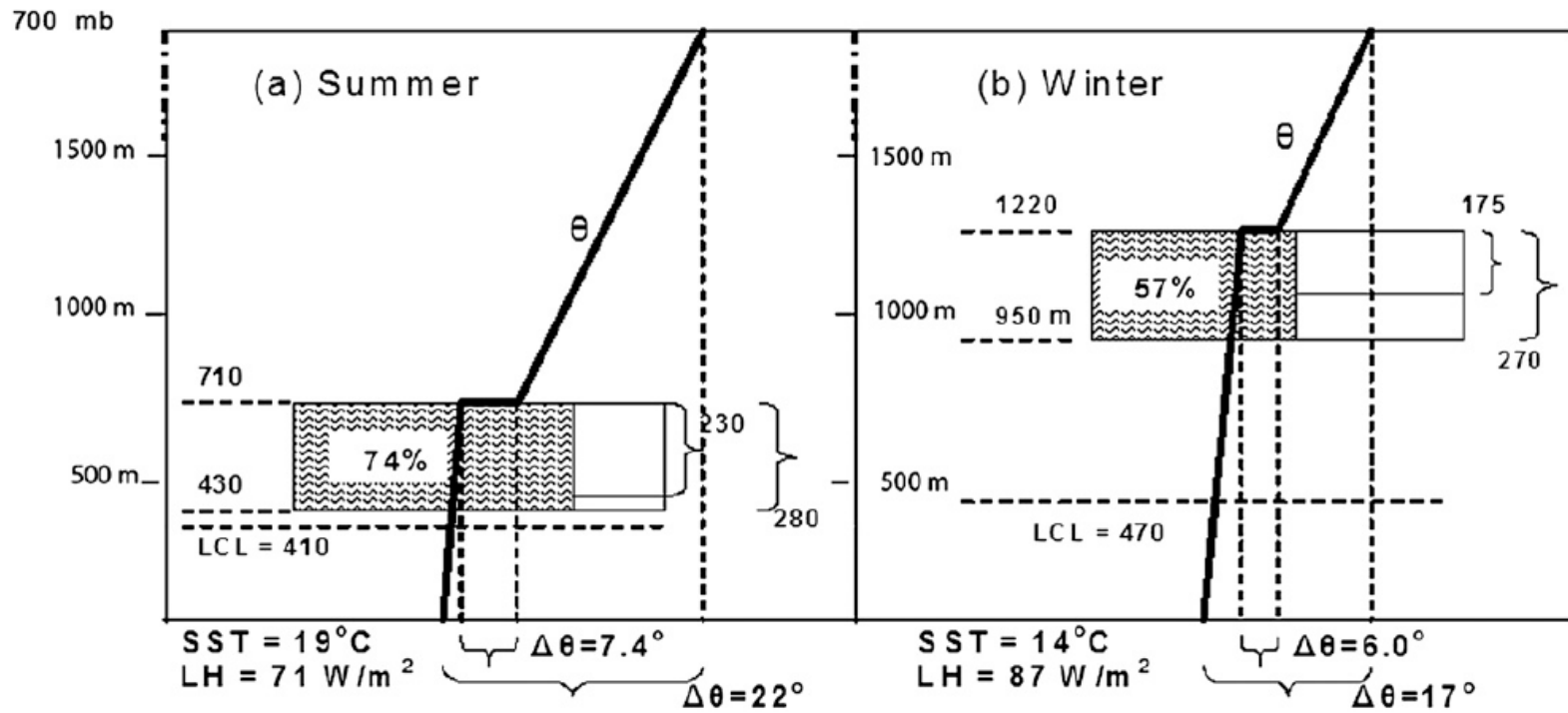


DJF



JJA

DJF



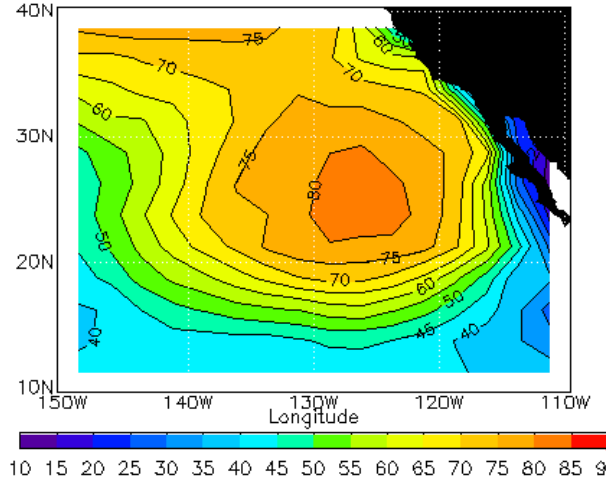
Lin, Zhang, Loeb (2009, JCL)

Cloud Amount and Liquid Water Path

CLDLLOW

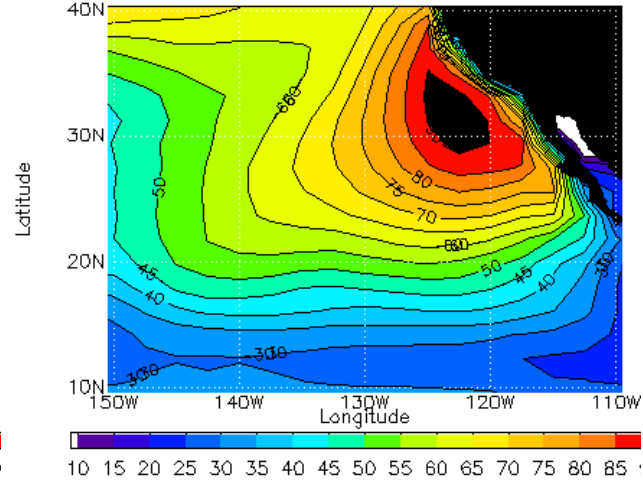
OBS

CLDLLOW ISCCP JJA



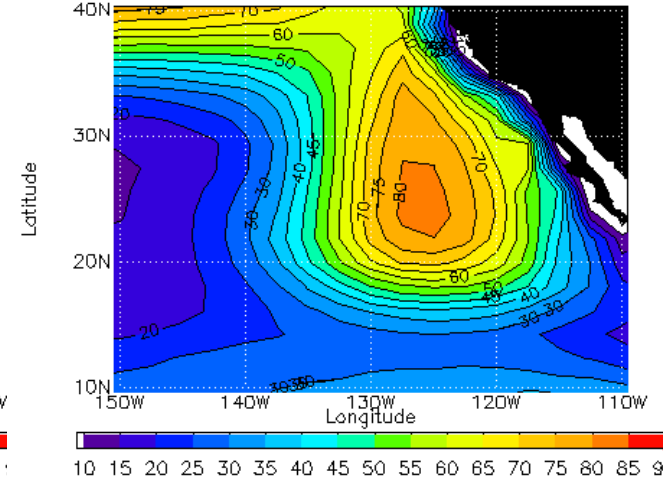
Track 1

Track1_CLDLLOW_JJA

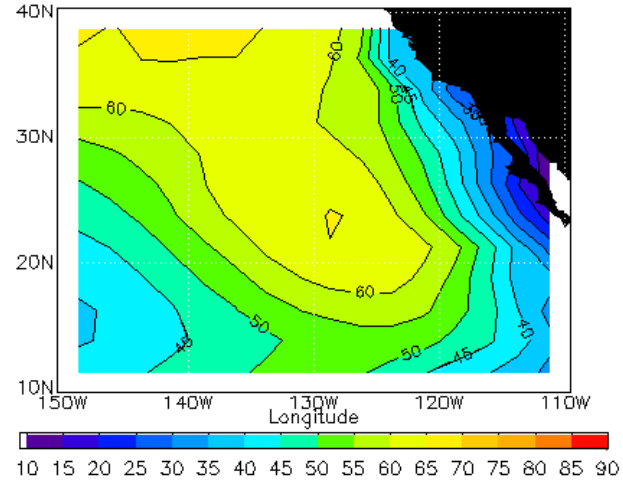


Track 5

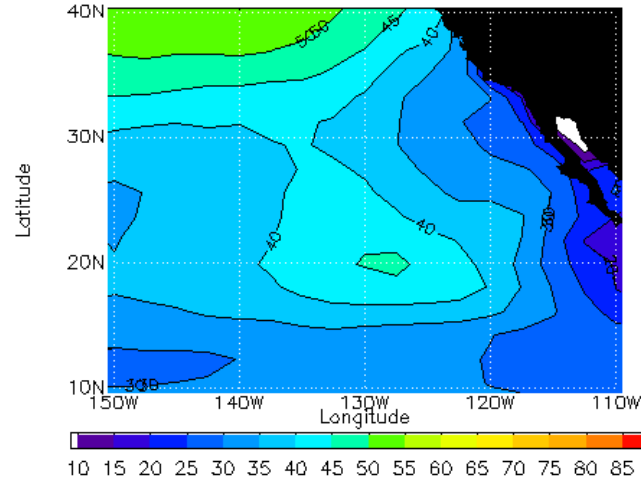
Track5_CLDLLOW_JJA



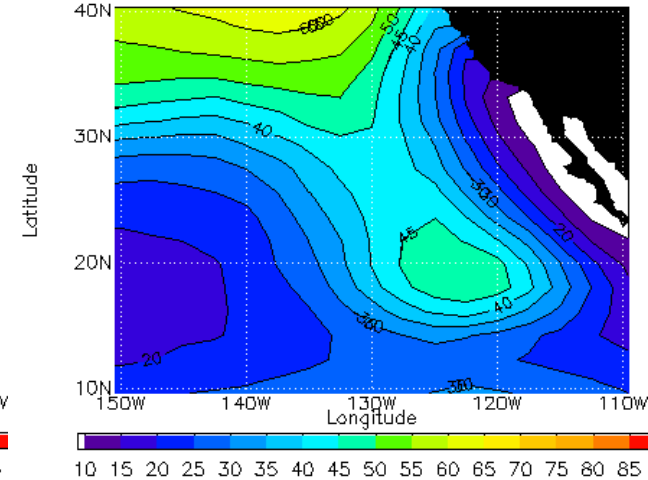
CLDLLOW ISCCP DJF



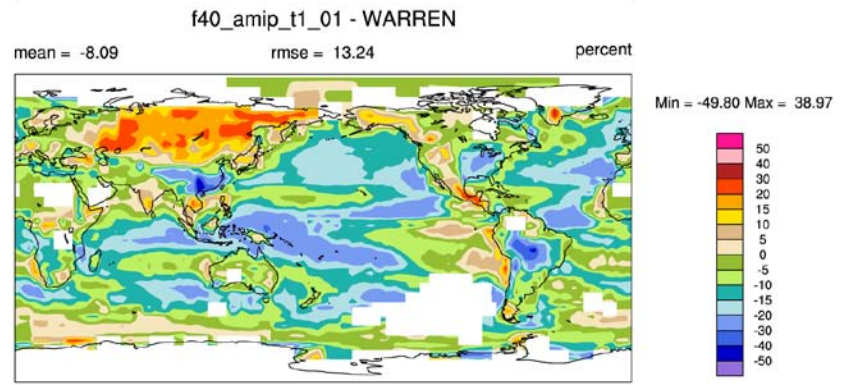
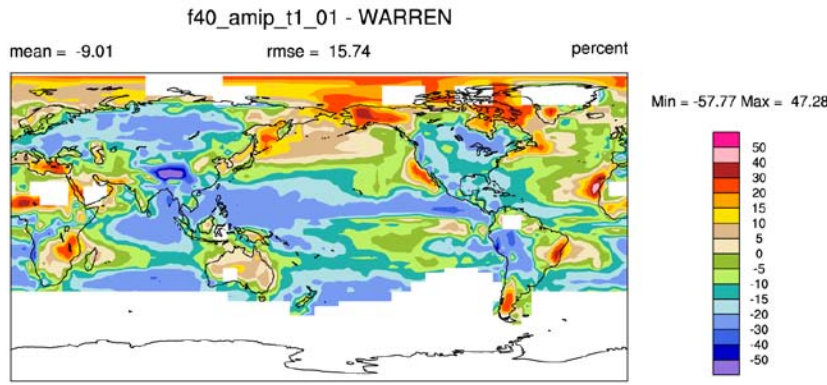
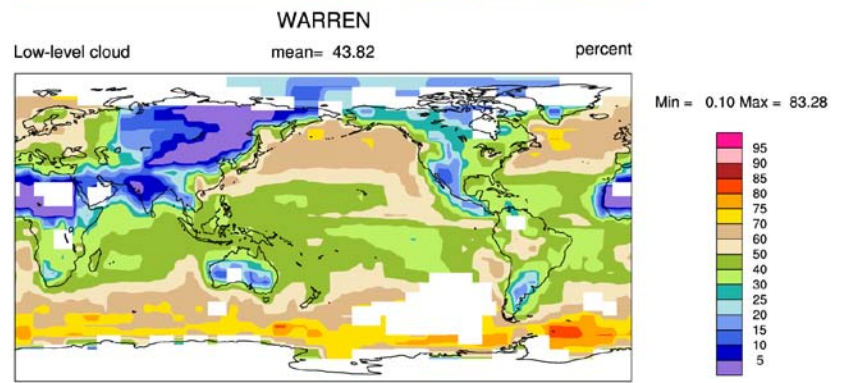
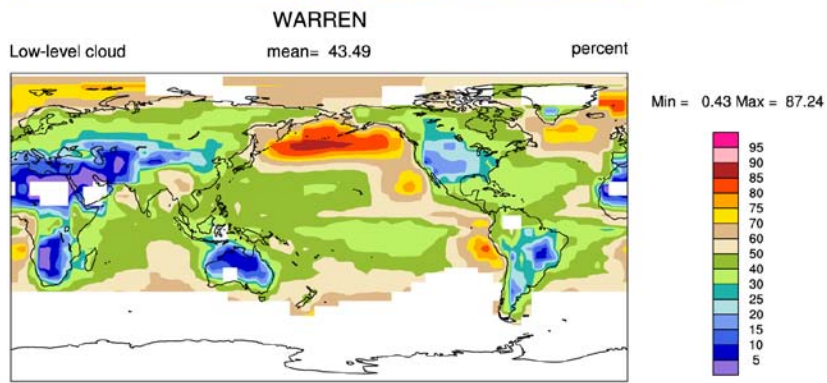
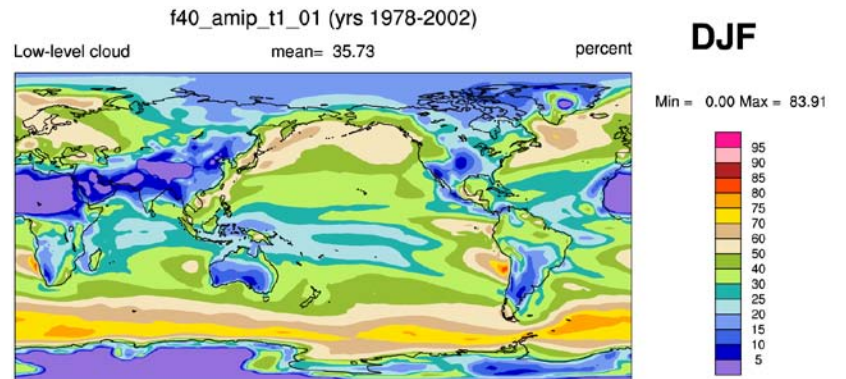
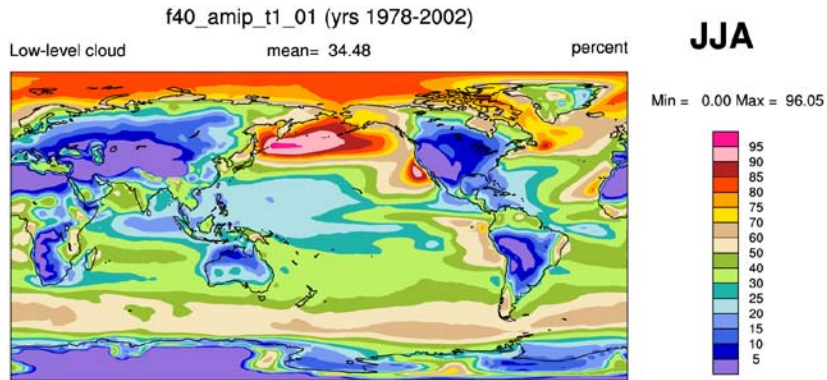
Track1_CLDLLOW_DJF



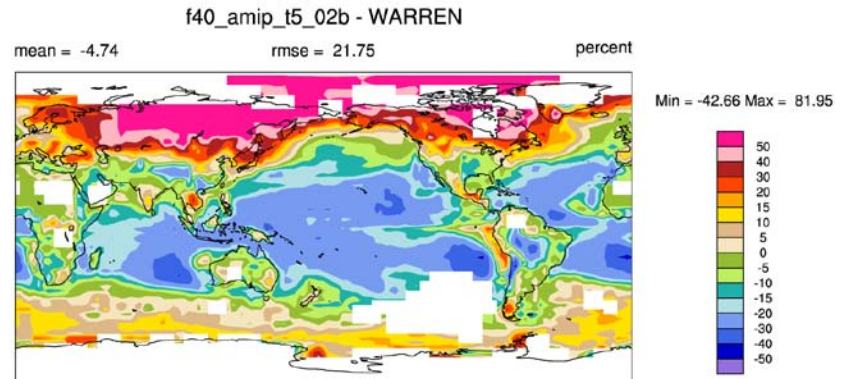
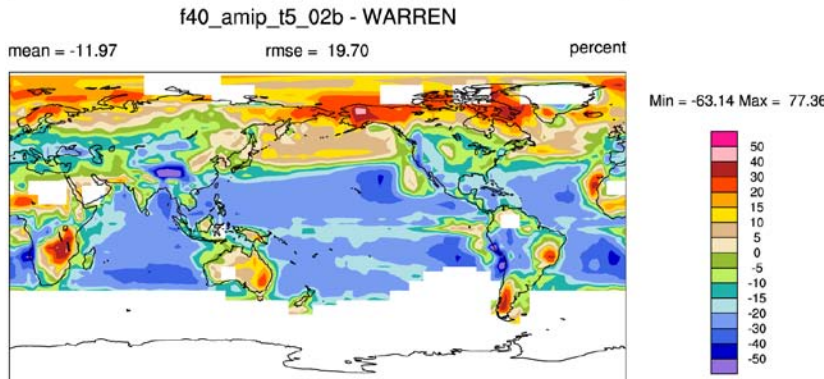
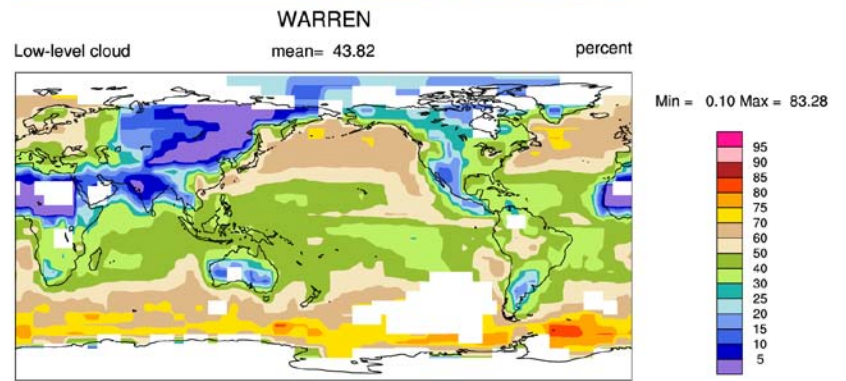
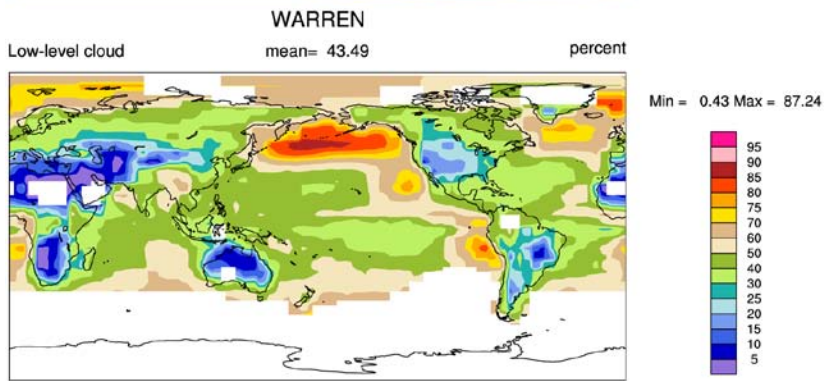
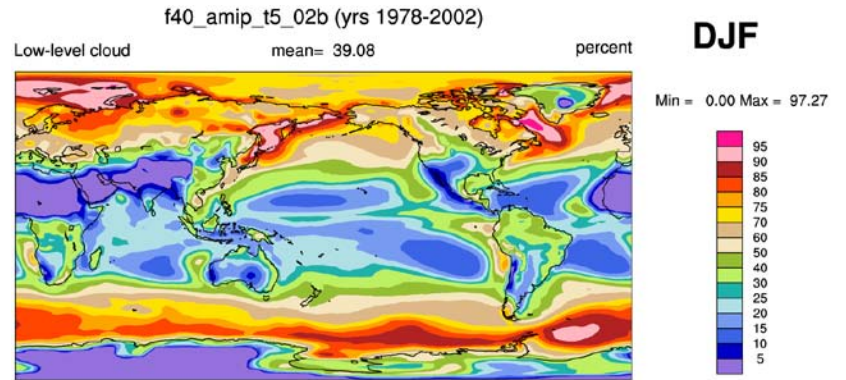
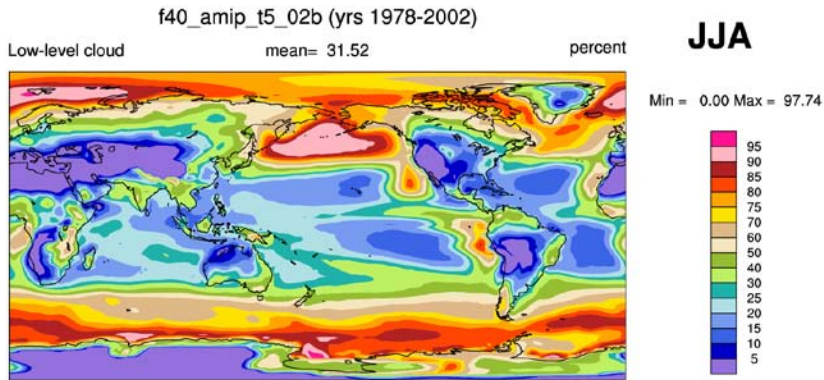
Track5_CLDLLOW_DJF



Track 1 Low Clouds

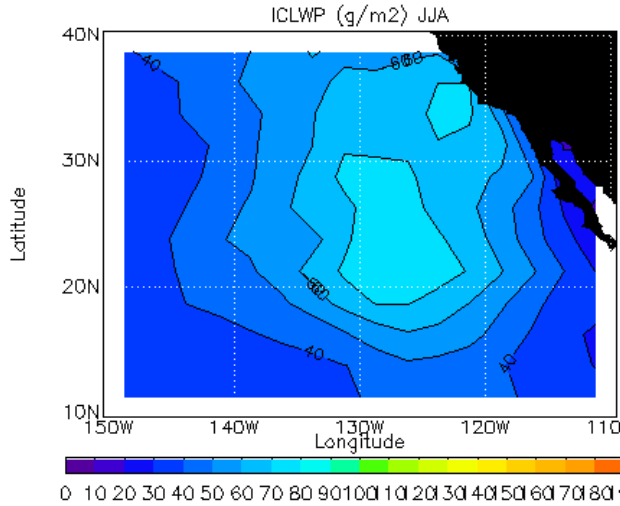


Track 5 Low Clouds

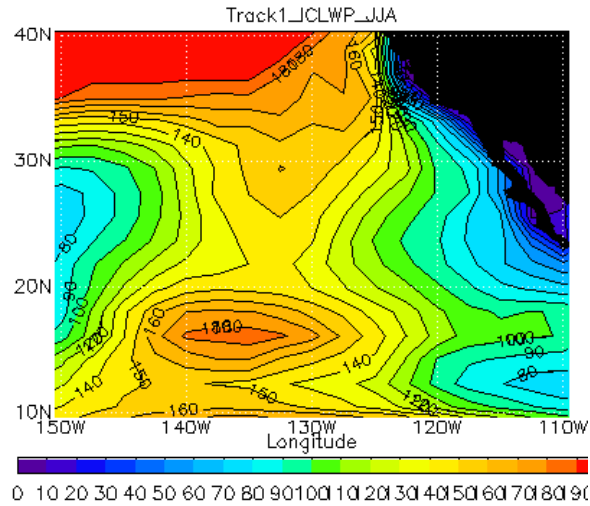


In-Cloud Liquid Path

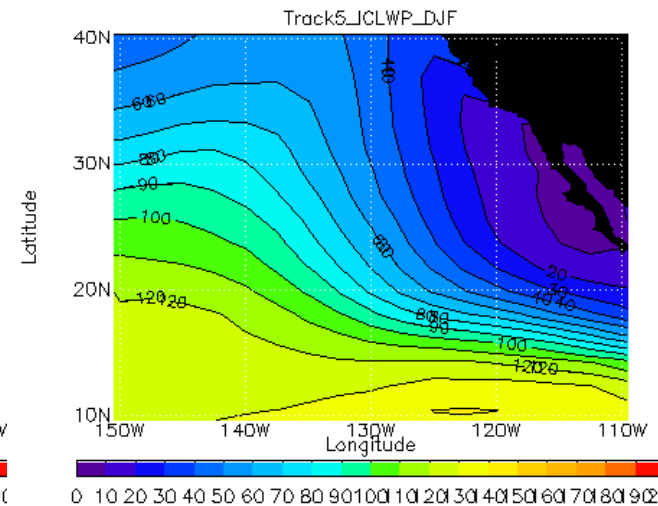
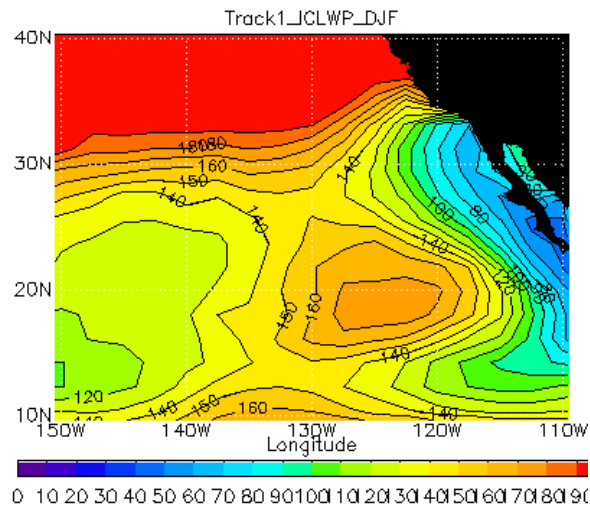
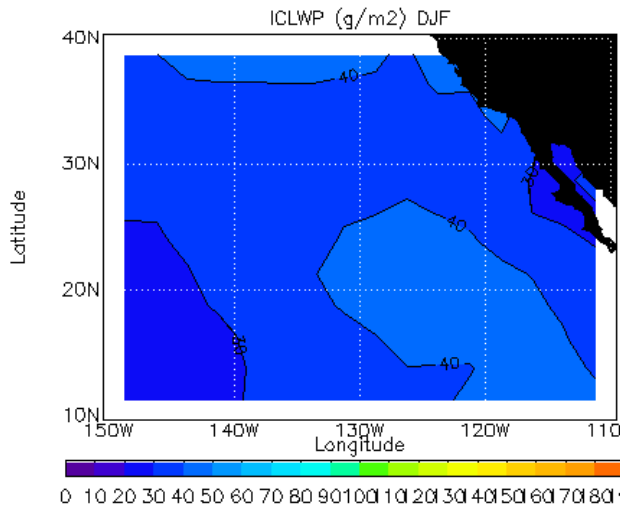
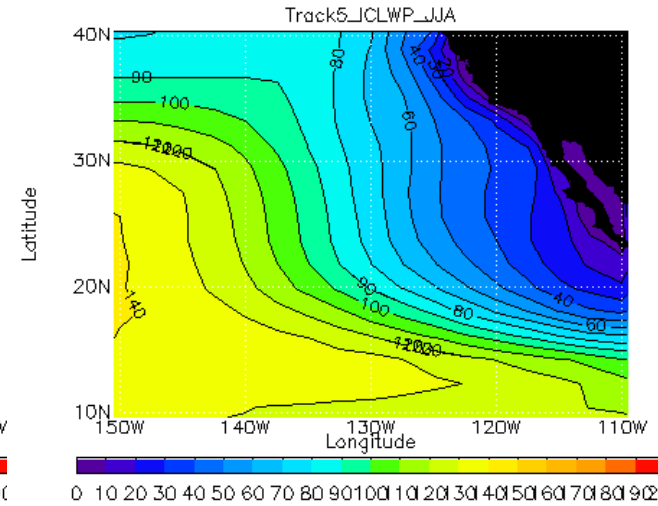
OBS



Track 1



Track 5



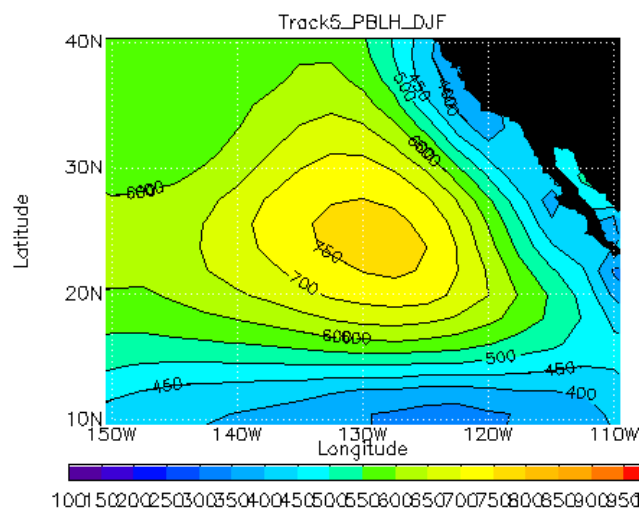
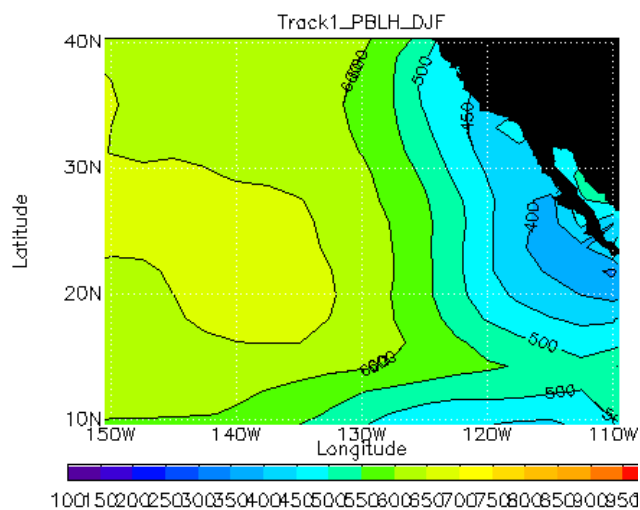
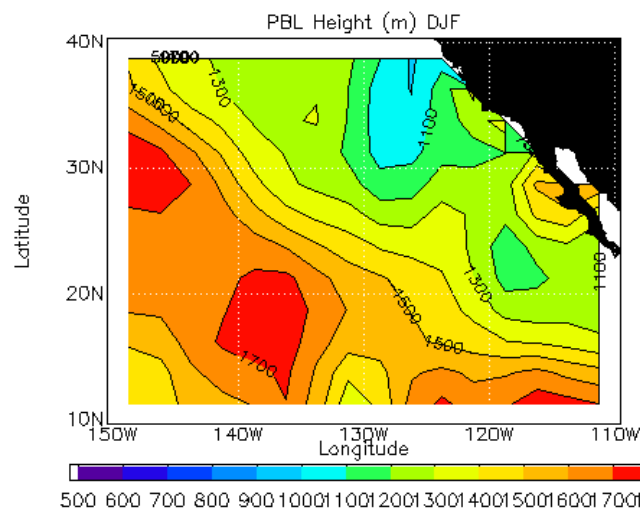
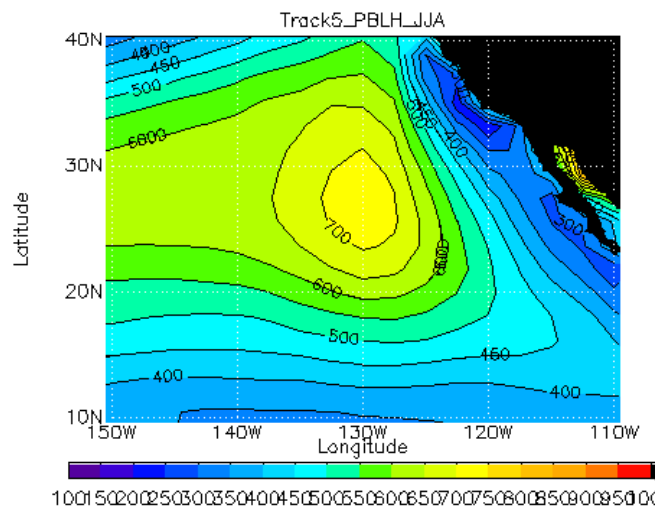
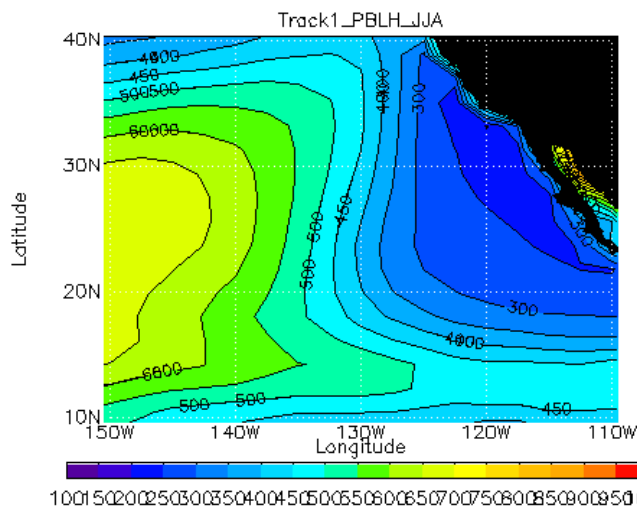
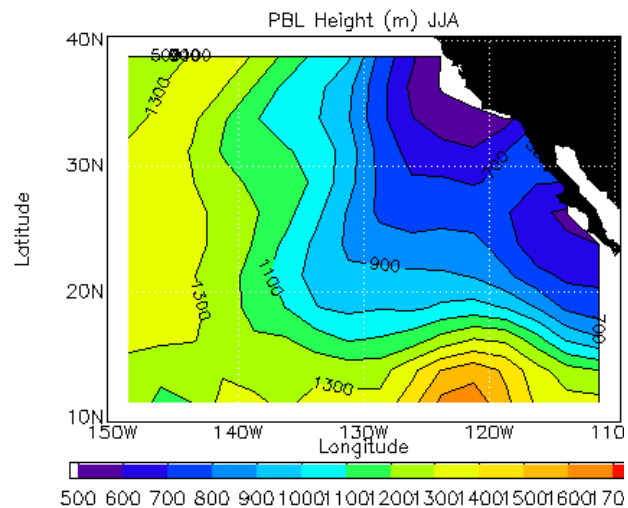
Other features

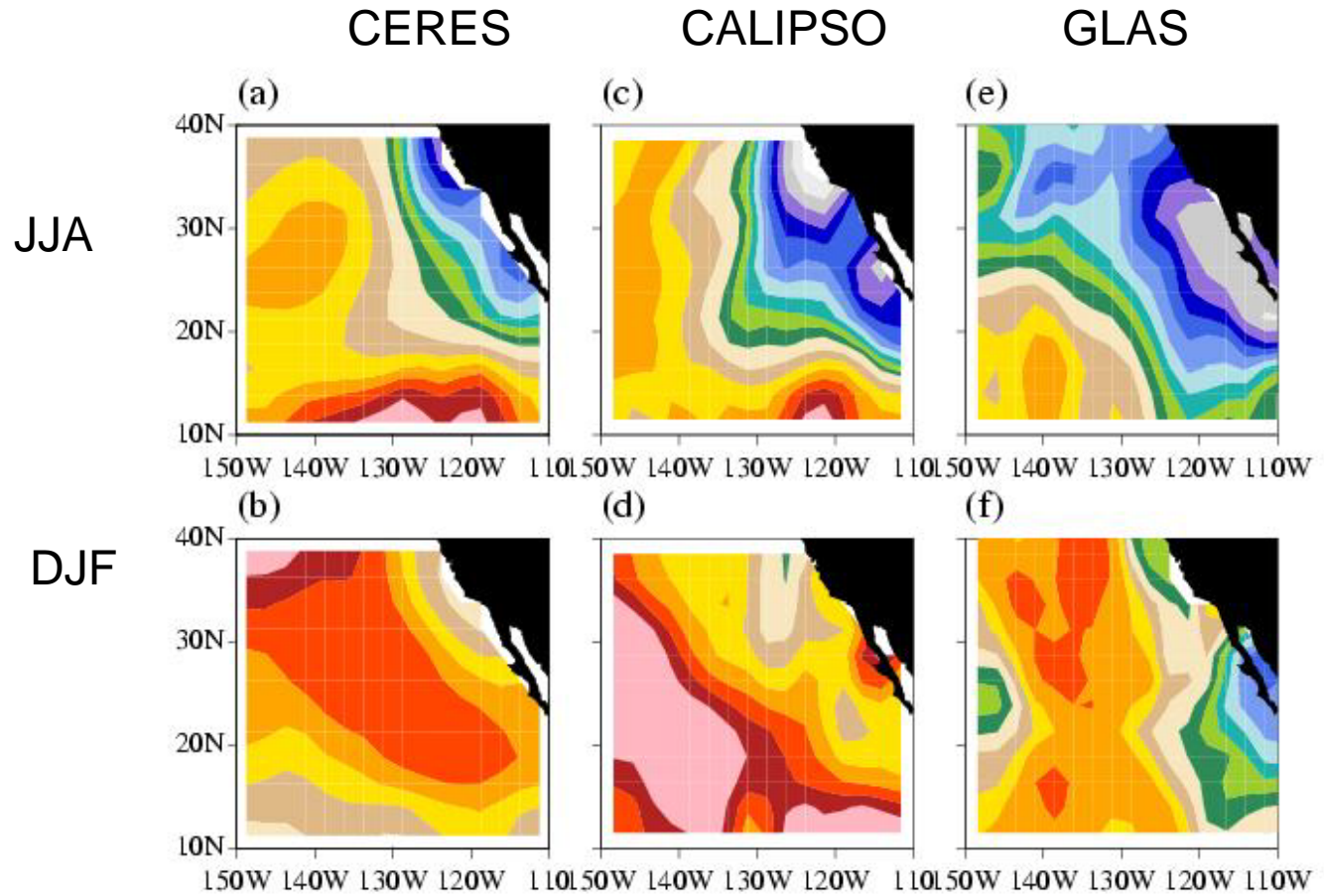
PBL Height

OBS

Track 1

Track 5





Cloud Top Height
(Inversion Height)

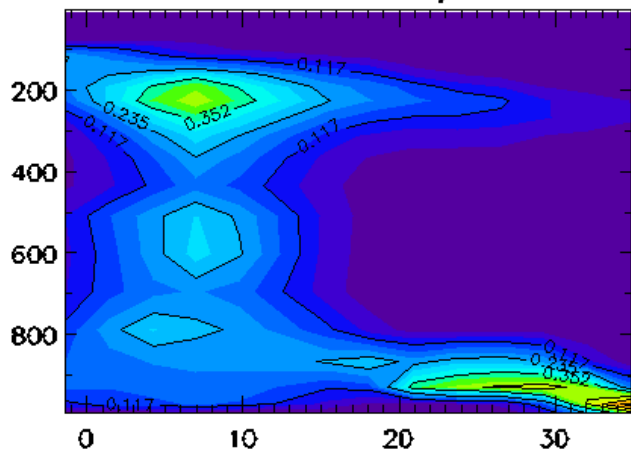
Cloud Amount

Track 1

Track 5

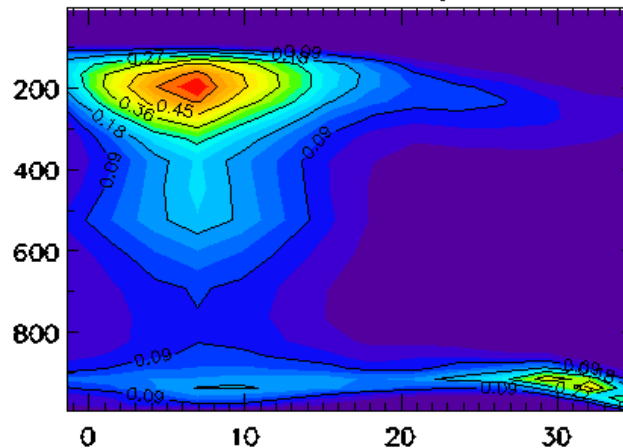
JJA

CLOUD_T1_JJA min=0.00000, max=0.78177



0.00 0.03 0.06 0.09 0.12 0.15 0.18 0.21 0.24 0.27 0.30 0.33 0.36 0.39 0.42 0.45 0.48 0.51 0.54 0.57 0.60 0.63 0.66 0.69 0.72 0.75 0.78

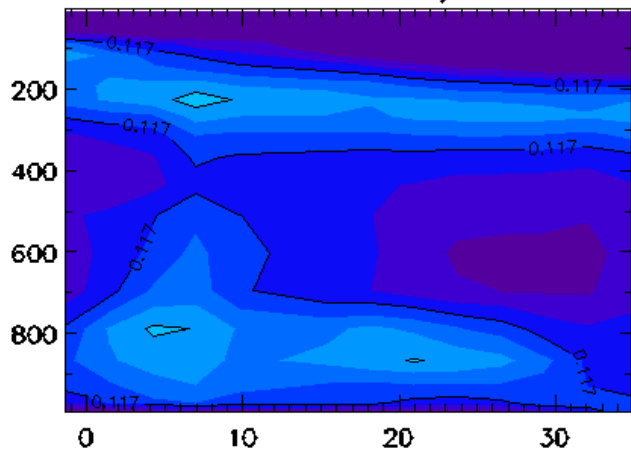
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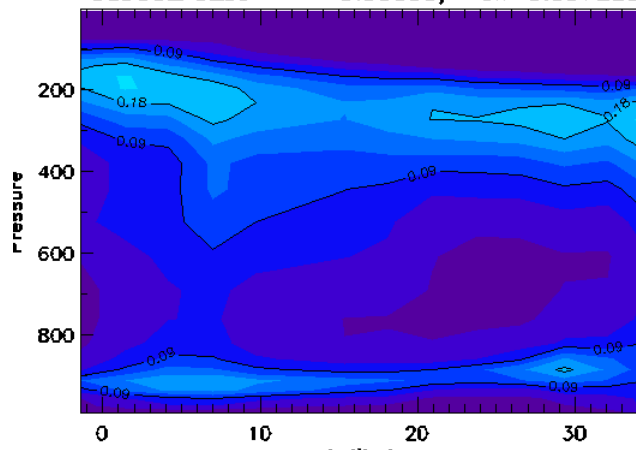
DJF

CLOUD_T1_DJF min=0.00000, max=0.78177



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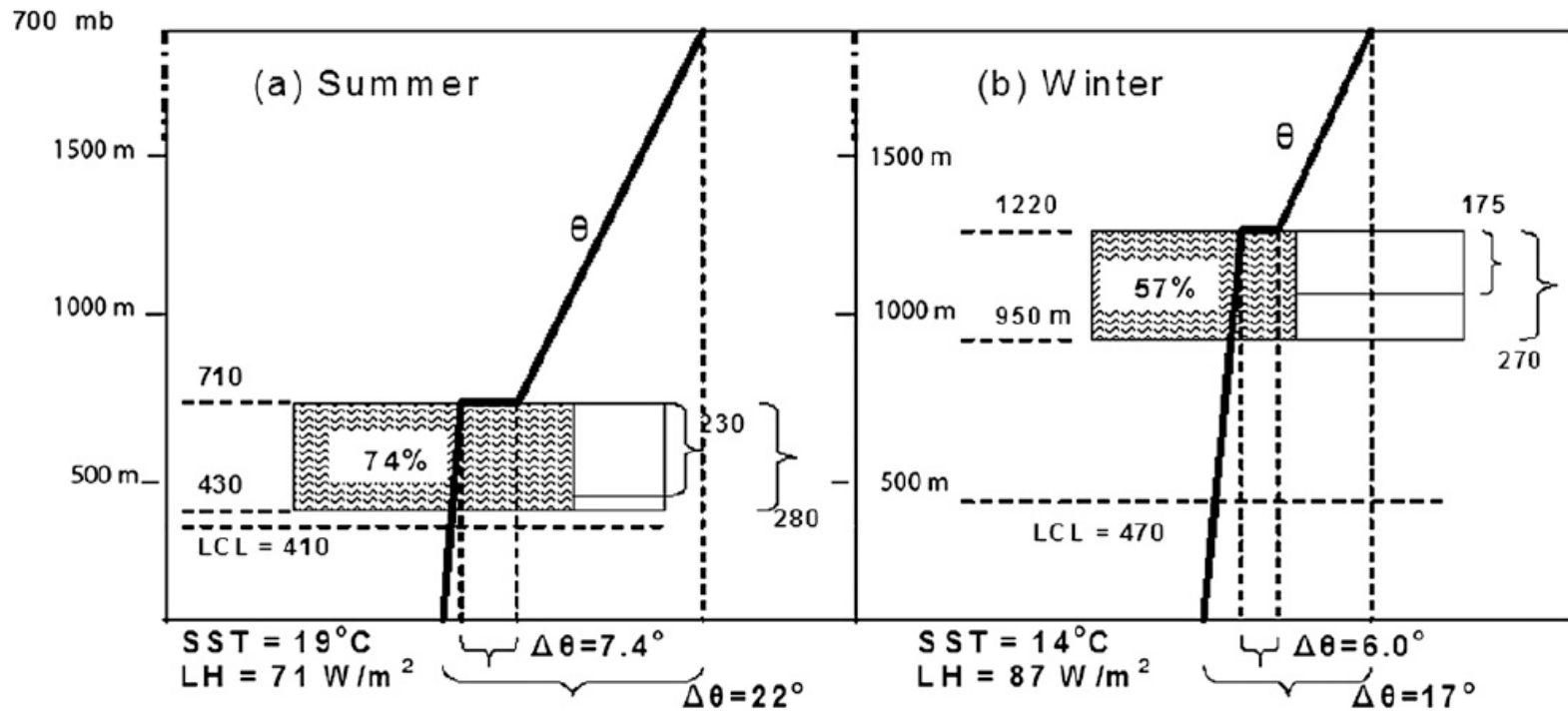
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JJA

DJF

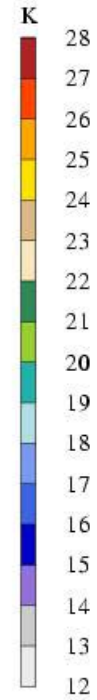
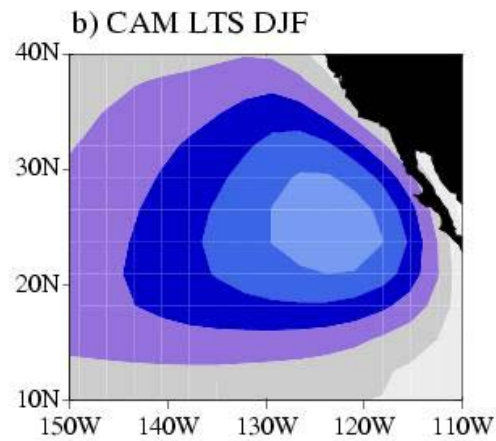
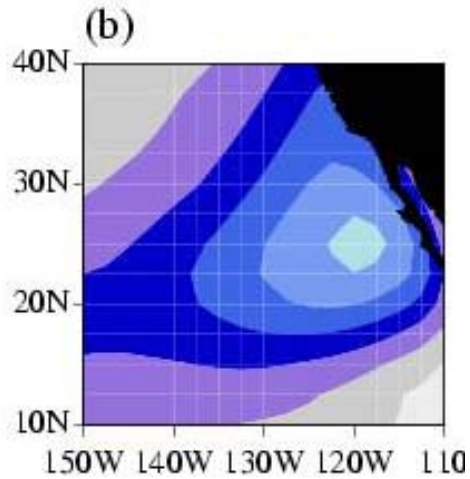
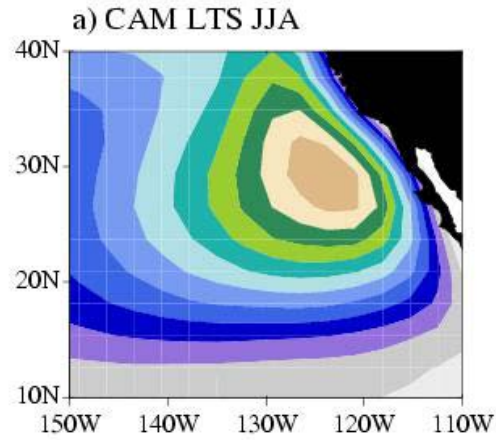
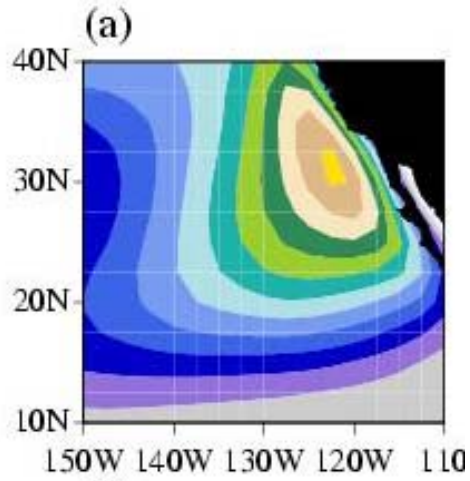


(Lin, Zhang, Loeb 2010, JCL)

Low Tropospheric Stability

OBS

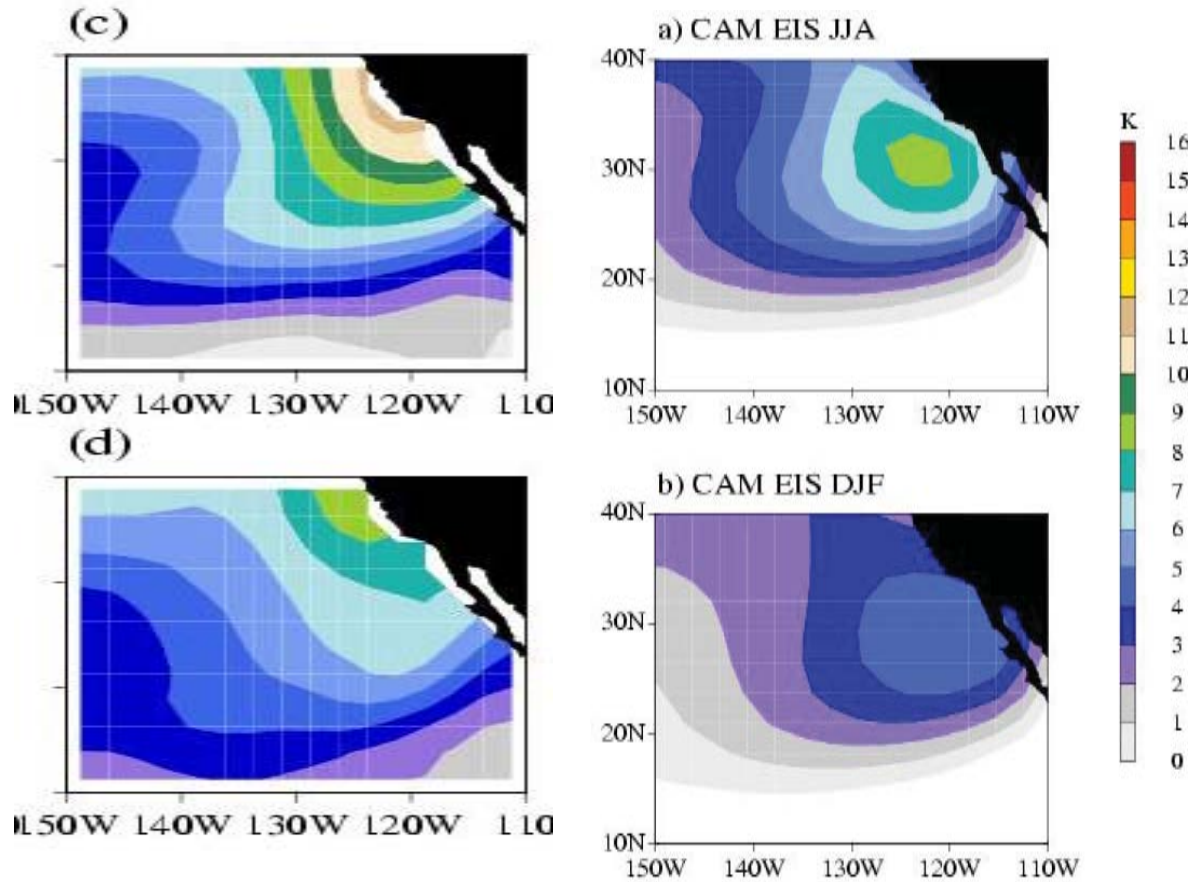
CAM3.35 (Track1)



Inversion Strength

OBS

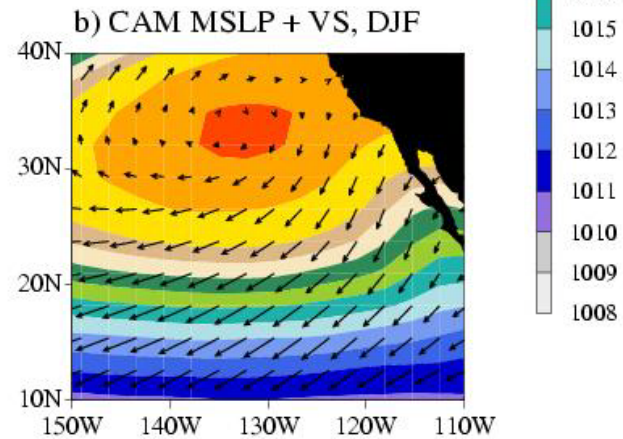
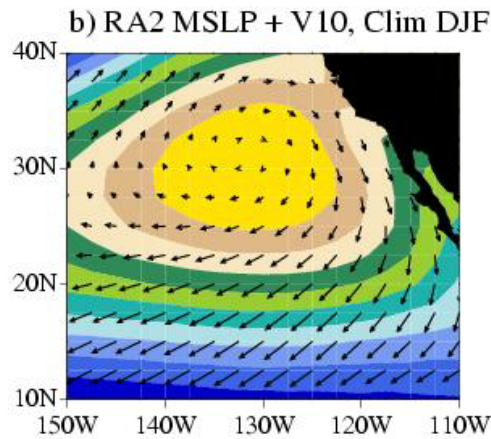
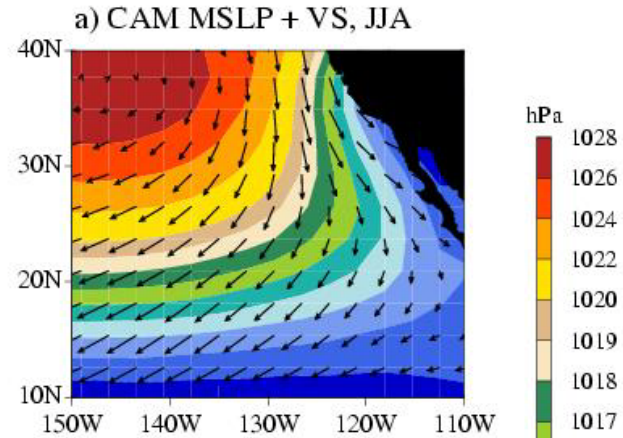
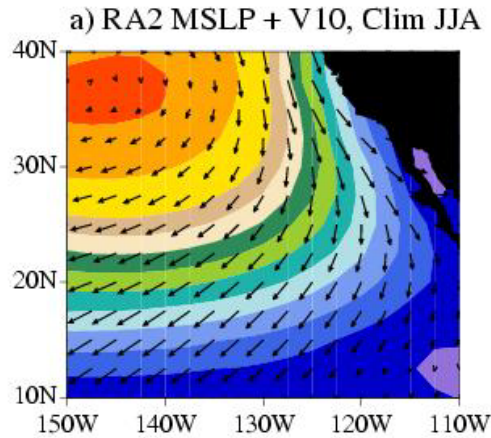
CAM3.35 (Track1)



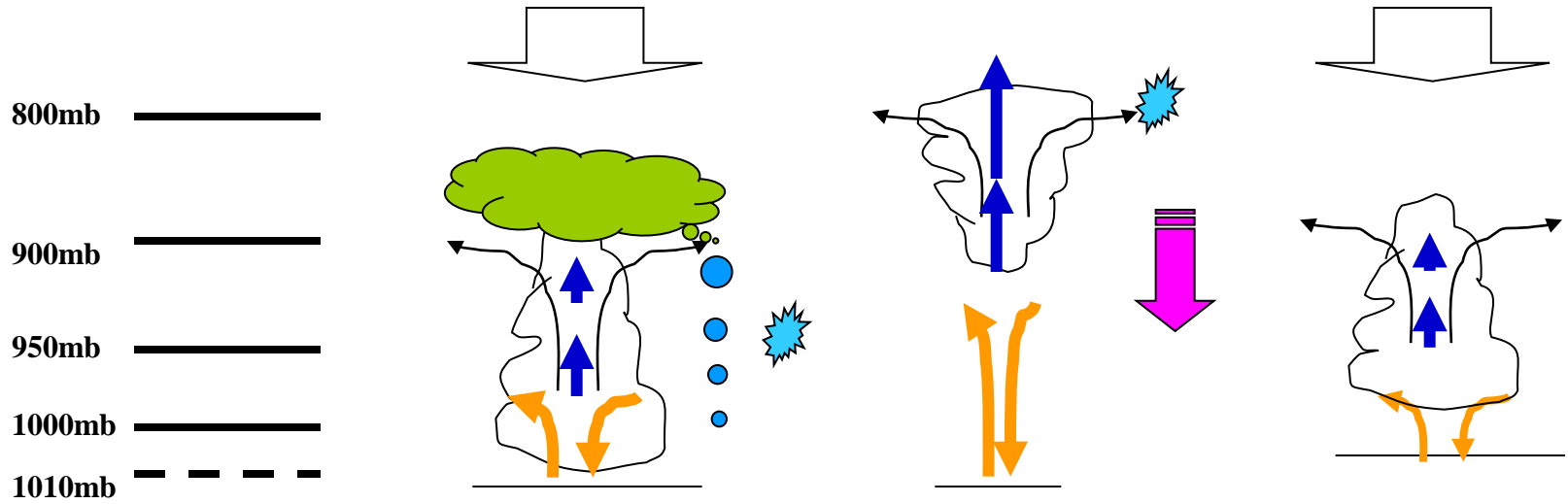
CAM PSL and Lowest Model Level Winds

OBS

CAM3.35 (Track1)



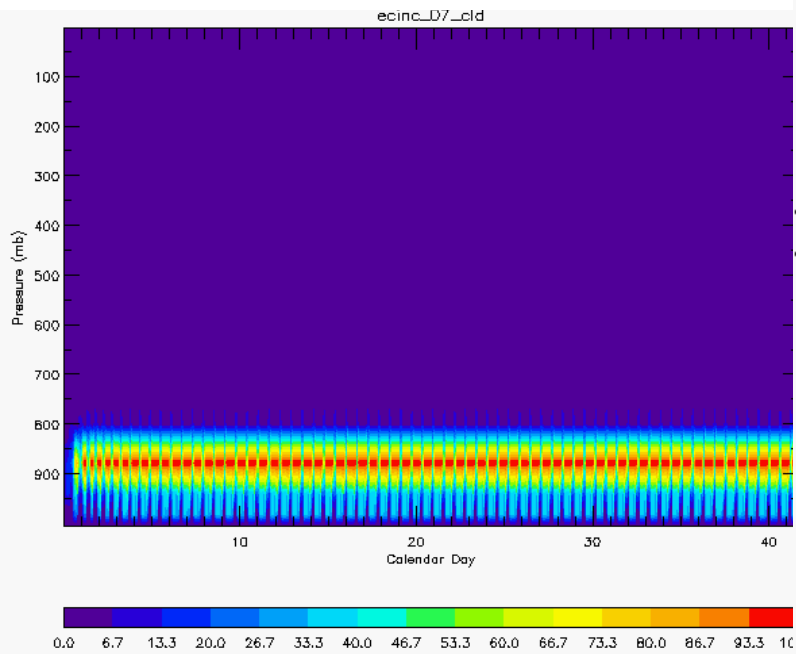
CAM3.1



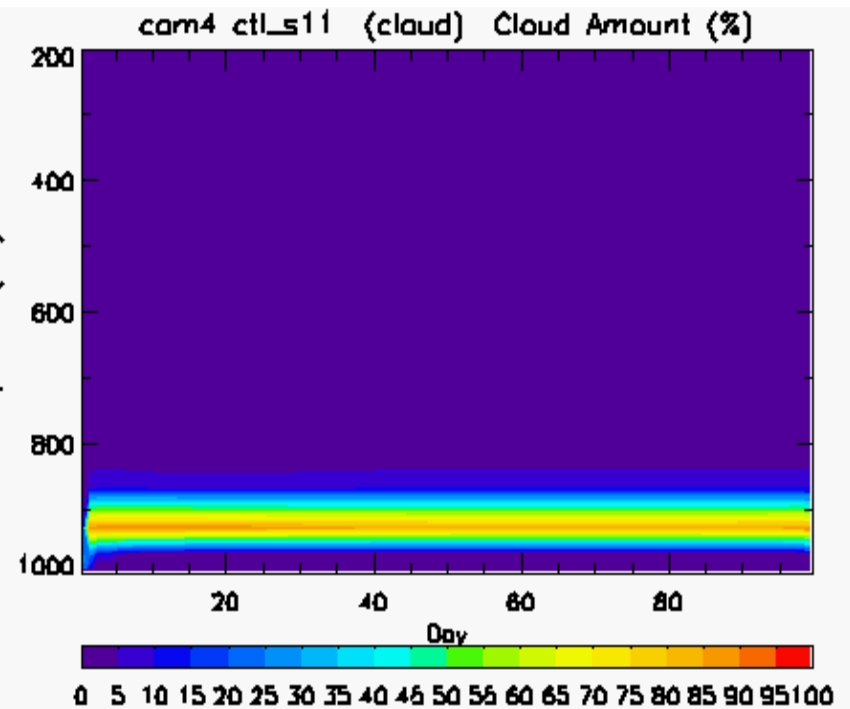
Zhang and Bretherton (2008, JCL)

Low Clouds Simulated in SCM Using Idealized Forcing

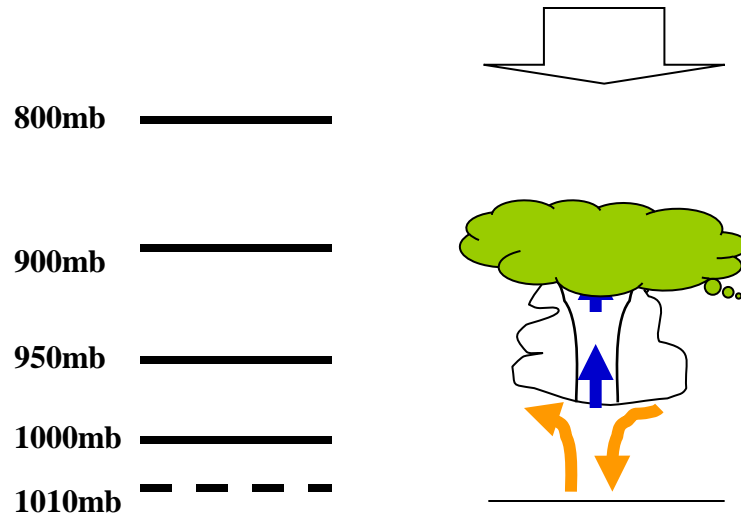
CAM3.1



Track 1 (CAM3.5.35)



Track 1



CFMIP-GCSS Intercomparison of LES and SCMs

CGILS Meeting
March 1-2, 2010
Stony Brook, New York

<http://somas.stonybrook.edu/cgils>

Summary

1. The models simulated the sign of seasonal variation of MBL cloud amount. The amount in winter is too lower; the in-cloud liquid in is too high. These errors compensate to produce a good SW cloud forcing.
2. Track 5 is an improvement to Track 1.
3. The seasonal cycle of the large-scale conditions is well simulated, but the inversion strength is not. This is likely related to the boundary layer height to be too lower.
4. We need to understand the interaction of the parameterization components to better understand the model