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

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## SW CRF

## Track 1

## JJA

f40_amip_t1_01 (yrs 1978-2002)

$\operatorname{Min}=-205.28 \mathrm{Max}=-0.52$

$\operatorname{Min}=-124.19 \mathrm{Max}=91.01$


## Track 5

## JJA

## f40_amip_t5_02b (yrs 1978-2002)



Min $=-220.18 \mathrm{Max}=-0.17$

f40_amip_t5_02b - CERES2

$\operatorname{Min}=-111.92 \operatorname{Max}=95.26$


## Cloud Amount In-cloud liquid path



JJA

## DJF



Lin, Zhang, Loeb (2009,JCL)

Cloud Amount and Liquid Water Path

## CLDLOW

## OBS


$\begin{array}{lllllllllllllllll}10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 & 50 & 55 & 60 & 65 & 70 & 75 & 80 & 85\end{array}$


Track 1

$\begin{array}{llllllllllllllll}10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 & 50 & 55 & 60 & 65 & 70 & 75 & 80 & 85\end{array}$


## Track 5



## Track 1 Low Clouds


f40_amip_t1_01 - WARREN


JJA
$\mathrm{Min}=0.00 \mathrm{Max}=96.05$

$\operatorname{Min}=0.43 \mathrm{Max}=87.24$


Min $=-57.77$ Max $=47.28$



WARREN

f40_amip_t1_01 - WARREN

$\mathrm{Min}=-49.80 \mathrm{Max}=38.97$


## Track 5 Low Clouds



## In-Cloud Liquid Path

## OBS



0102030405060708090100102013040150607080


0102030405060708090100101201301015016070180

Track 1


0102030405060708090100102030140150607018096

Track1」CLWP_DJF


010203040506070809010010203014015060708990

Track 5


010203040506070809010010120301401601018090
Track5_CLWP_DJF


01020304050607080901001020130104501607018090

Other features

## PBL Height

## OBS



5006007008009001000110012001300140015001600170

Track 1


100150200250300350400450500650800650700750800850900950

Track 5


1001502002503003504004505006506006507007508018509009500

PBL Height (m) DJF


500600700800900100011001200130014001500160017001


100150200650300350400450500650600650700750800850900950


100050200250300350400450500650600650700750800850900950

## CERES CALIPSO GLAS



Cloud Top Height (Inversion Height)

## Cloud Amount

## Track 1

## Track 5

JJA



CLOUD_T1_DJF $\min =0.00000, \max =0.7817^{\circ}$


JJA

## DJF


(Lin, Zhang, Loeb 2010,JCL)

## Low Tropospheric Stability

OBS

(b)


CAM3.35 (Track1)
a) CAM LTS JJA


## Inversion Strength

## OBS

(c)

(d)


CAM3.35 (Track1)
a) CAM EIS JJA


## CAM PSL and Lowest Model Level Winds

OBS
a) RA2 MSLP + V10, Clim JJA


CAM3.35 (Track1)
a) CAM MSLP + VS, JJA


## 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 

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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
