

Update on super- parameterization work at CSU

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Since the BAMS paper ...

- Change of the host model: from CAM1 to CAM2 (CAM1.8)
- CAM2 allows one to run the T42 L26 model with CRCP on 256 processors using the NCAR's "Blackforest" IBM SP
- Radiation is now interactively called from within the CRCP itself assuming ICA

CRCP run

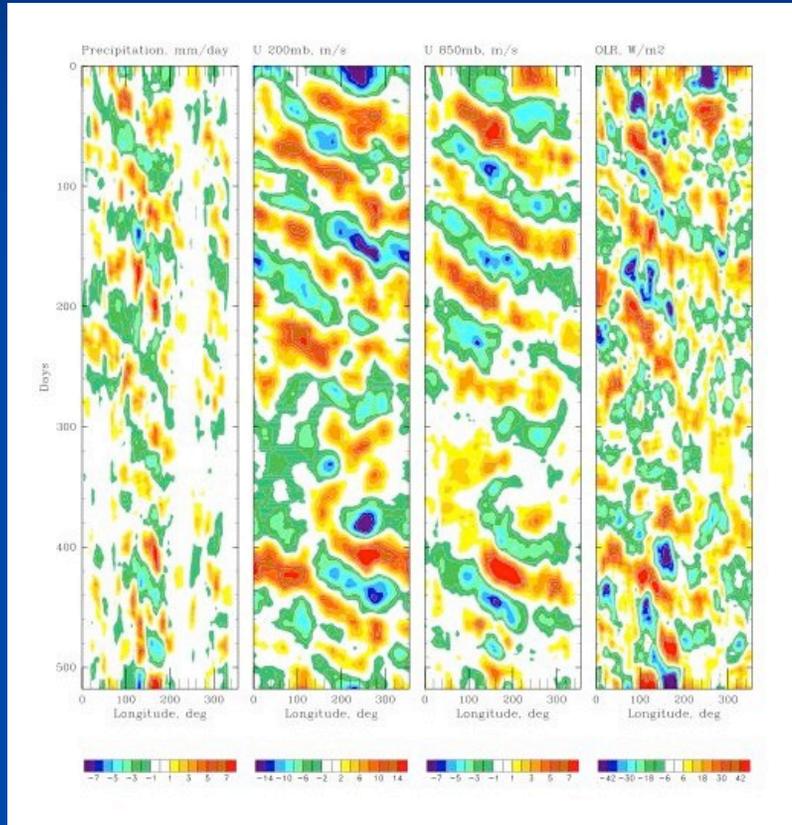
- CAM2; T42 L26 SLD; $\Delta t = 3600$ s
- CRCP: 64×24 domain ($\Delta x = 4$ km); $\Delta t = 20$ s
- CRCP outputs the cloud fraction profile
- Radiation including cloud overlap is done for mean profiles outside the CRCP
- 500+ days (Sept 1, 0000 - Feb 1, 0002)

CRCP RAD run

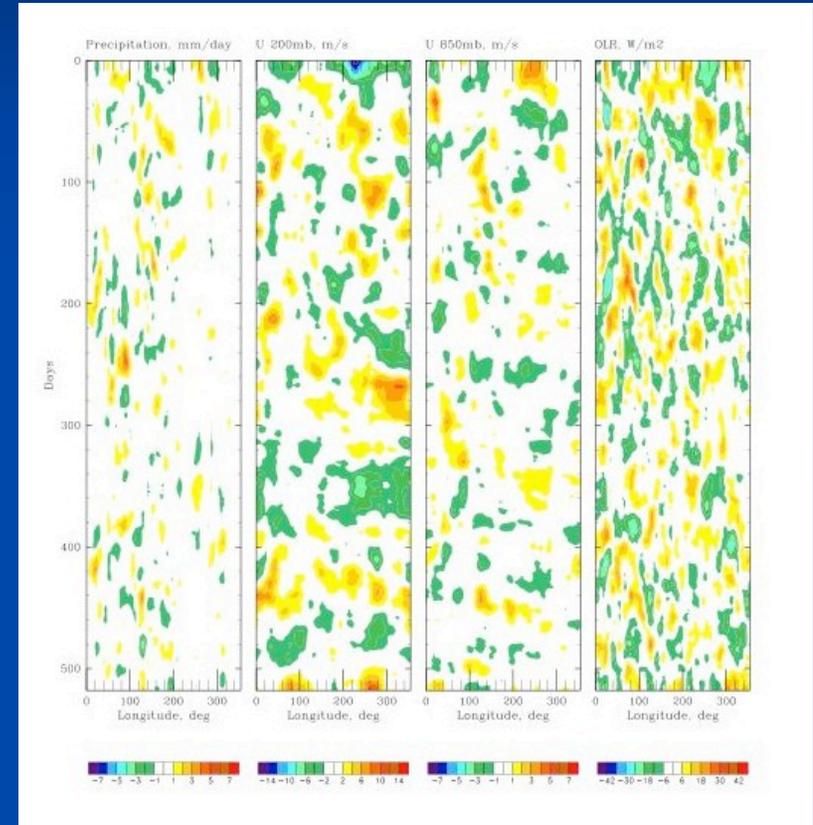
- CAM2; T42 L26 SLD; $\Delta t = 3600$ s
- CRCP: 64 x 24 domain ($\Delta x = 4$ km); $\Delta t = 20$ s
- Radiation is computed for each CRCP column with 0-or-1 cloud overlap assumption every 15 minutes (256 times as many radiation calls as in CRCP run)
- Only 20 - 25% more expensive
- 500+ days (Sept 1, 0000 - Feb 1, 0002)

T21 Simulations (500+ days)

CAM + CRCP



CAM

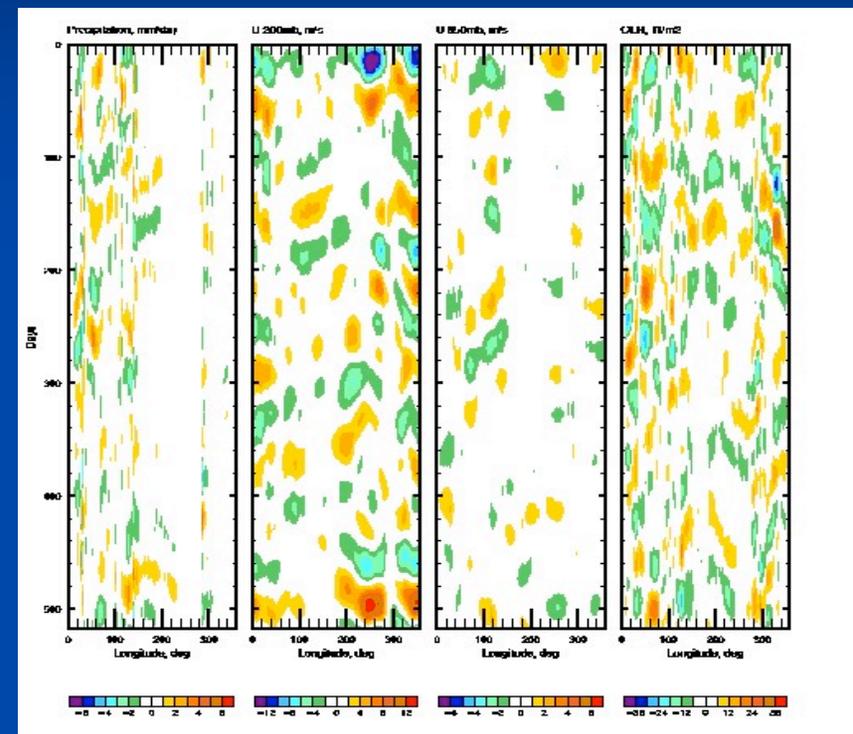
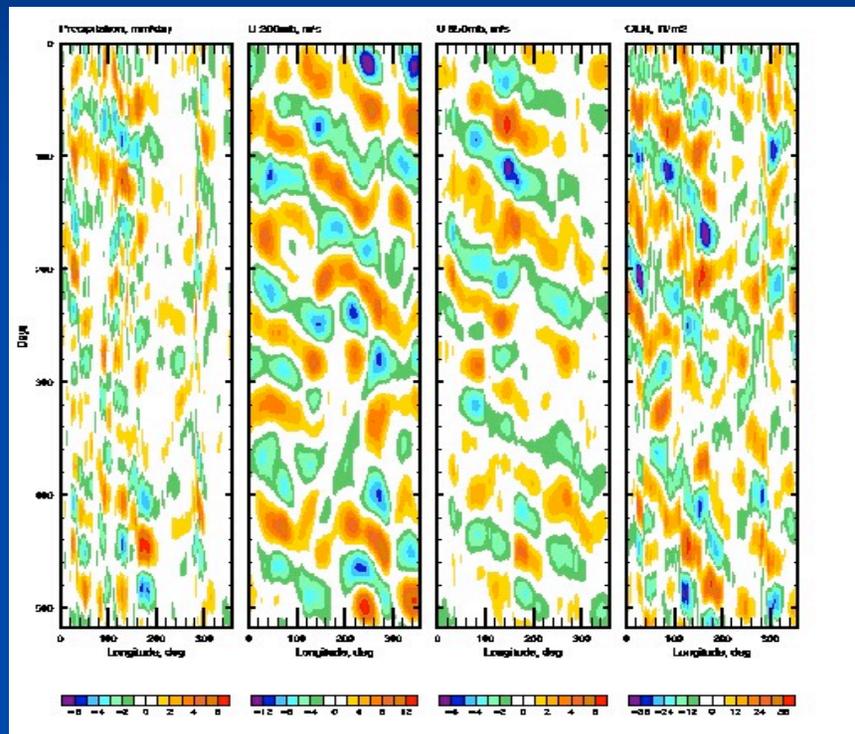


- Hovmuller diagrams of precipitation rate, 200 mb and 850 mb zonal wind and OLR, averaged between 15°S and 15°N filtered to show variability in the range 20 - 100 days.

T42 Simulation (500+ days)

CAM + CRCP

CAM

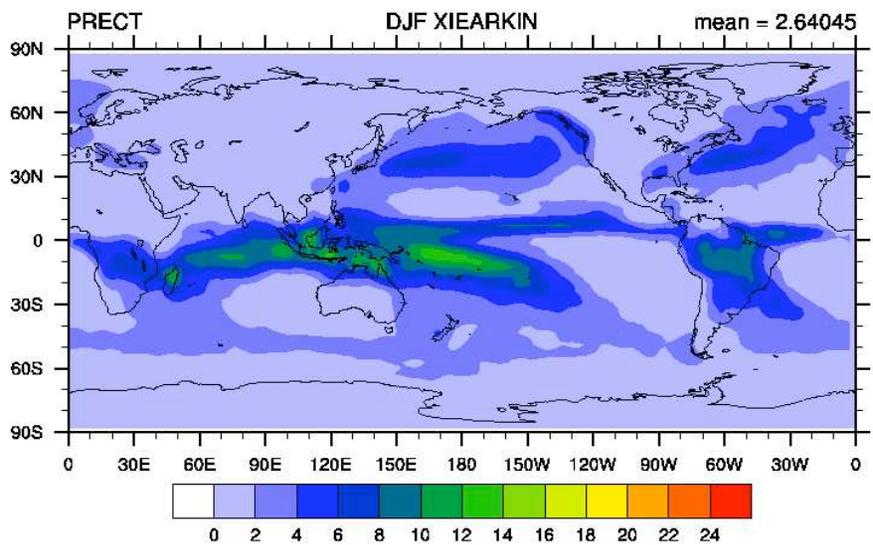
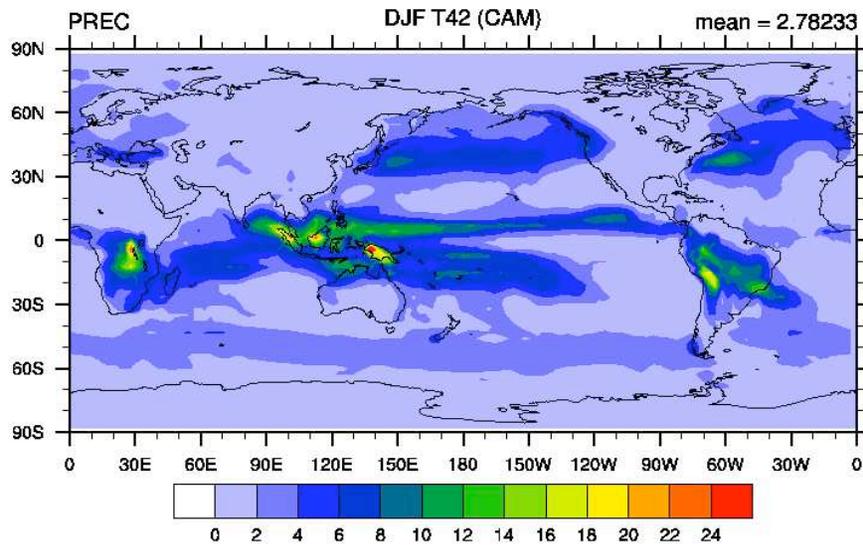
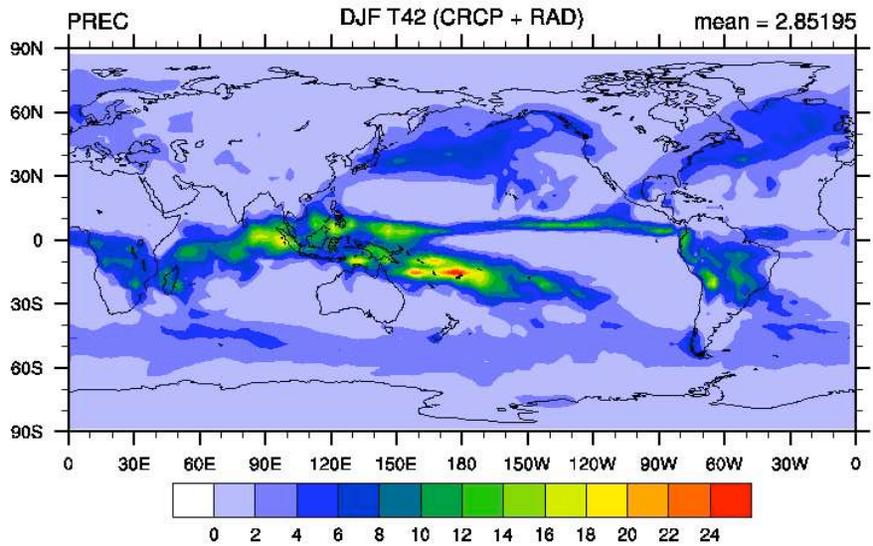
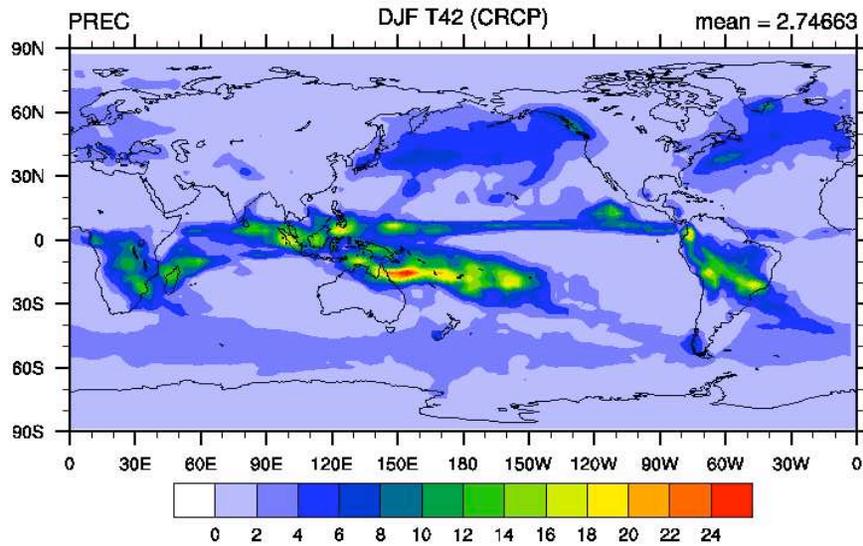


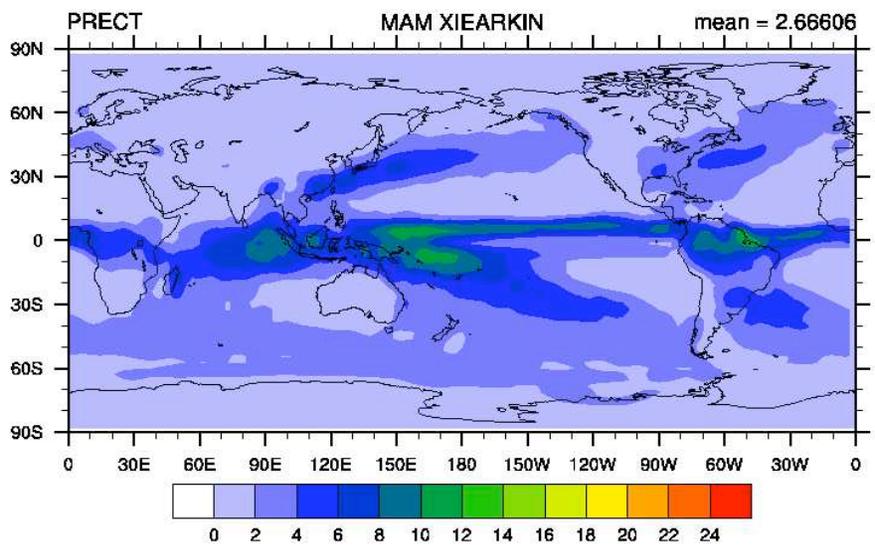
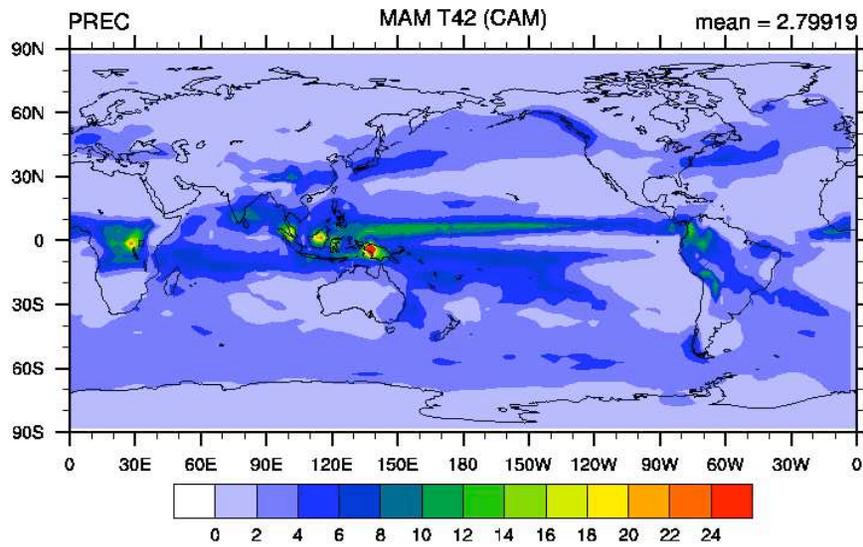
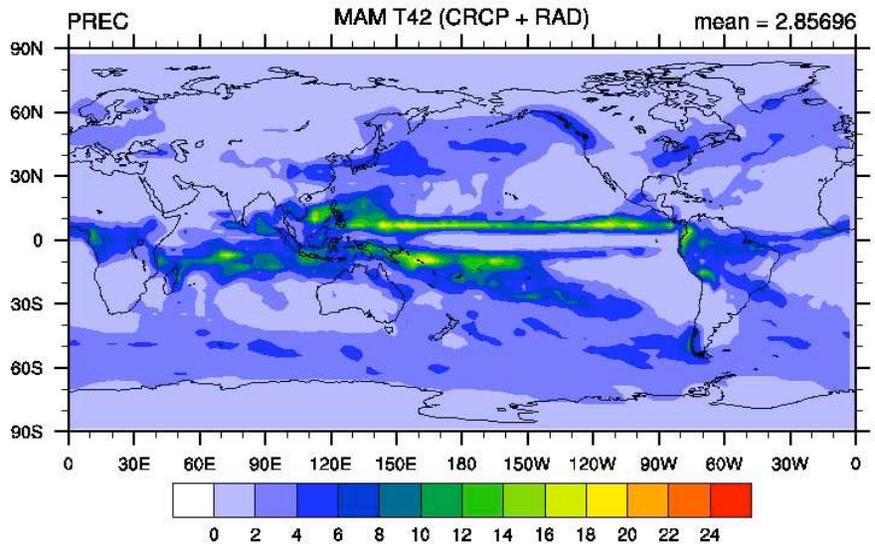
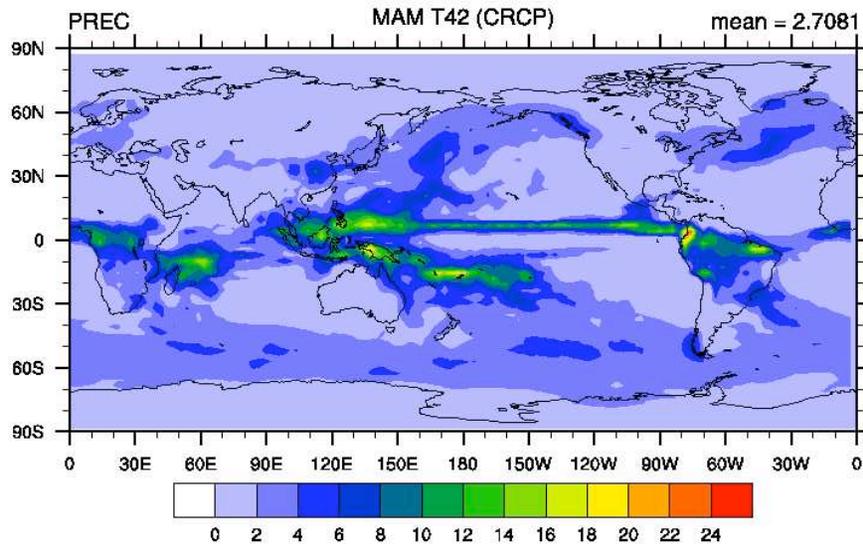
- Hovmuller diagrams of precipitation, 200 mb and 850 mb zonal wind and OLR, averaged between 10°S and 10°N, and filtered to show variability in the range 20 - 120 days.

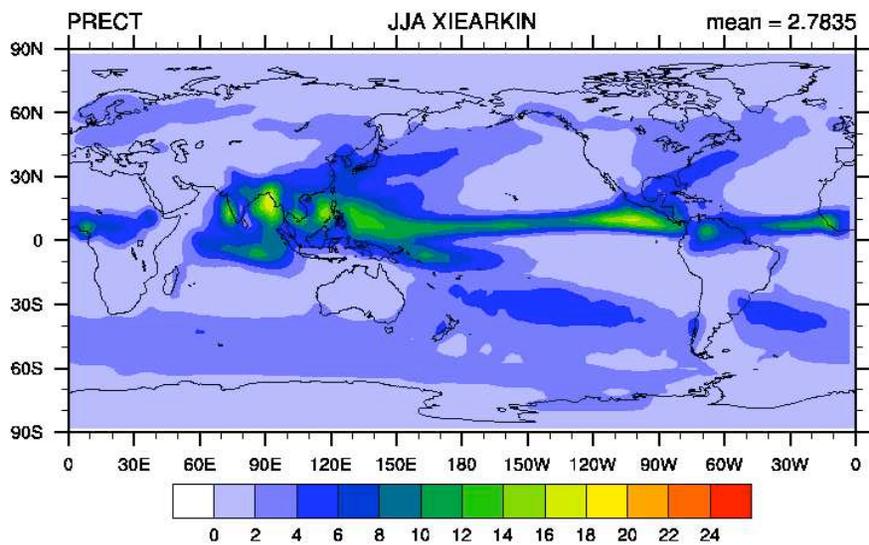
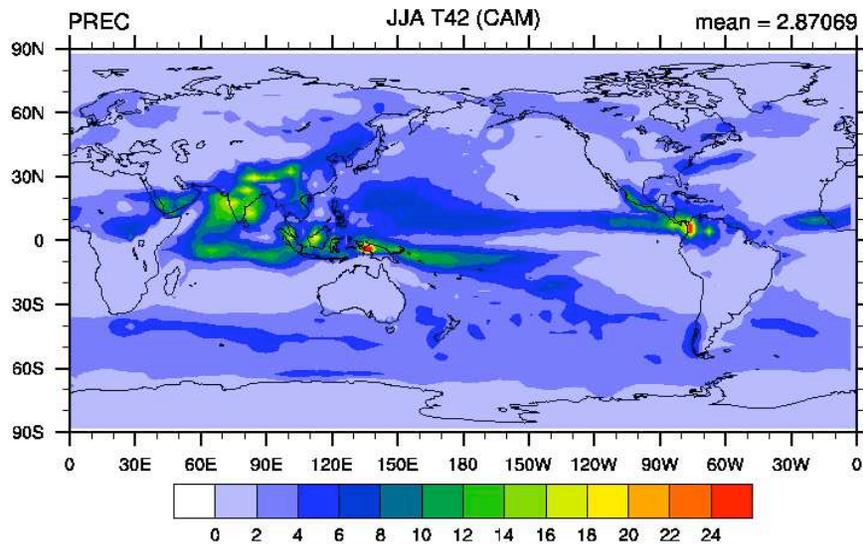
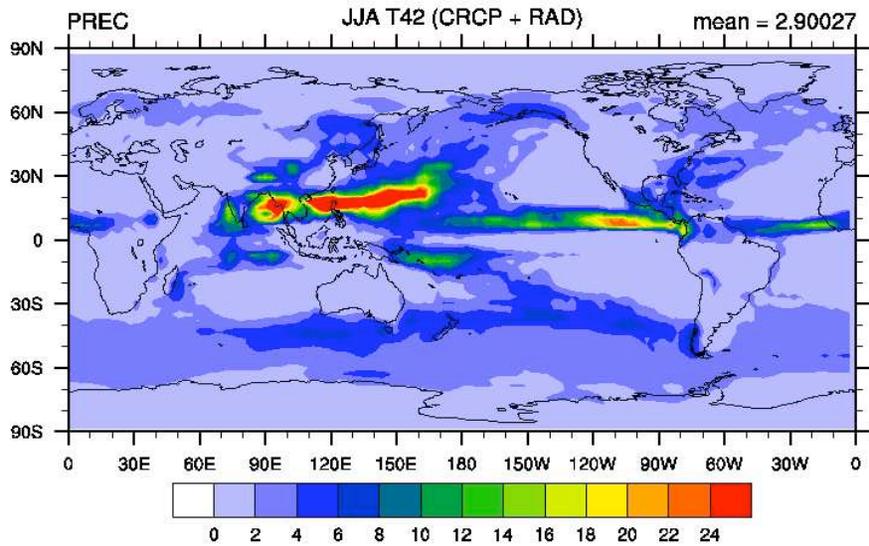
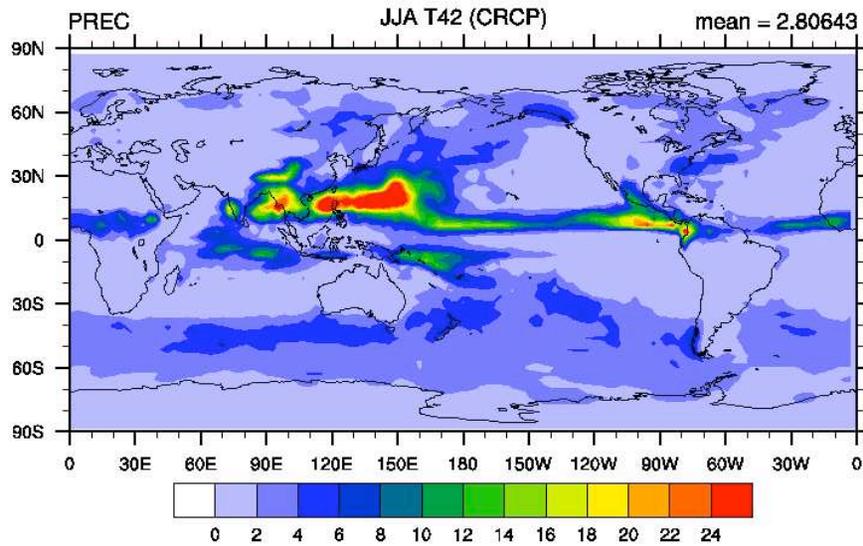
CRCP & CRCPRAD vs OBS

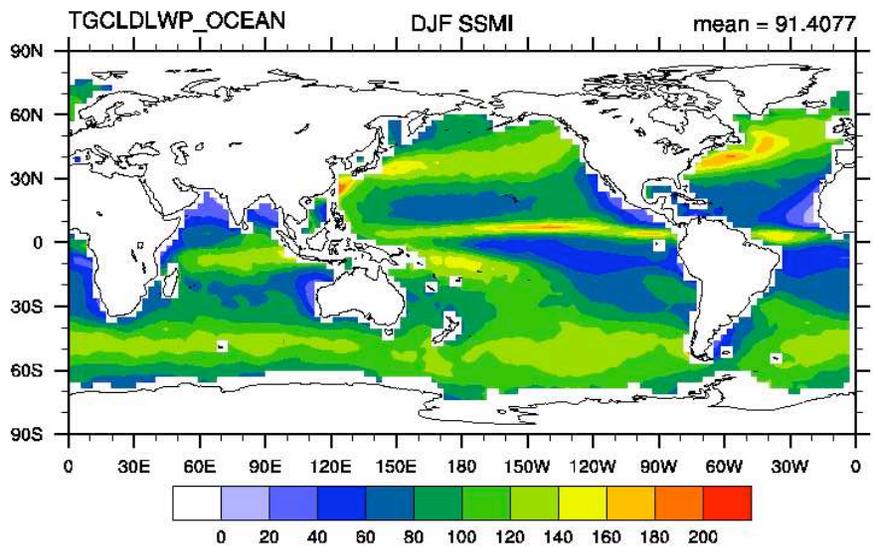
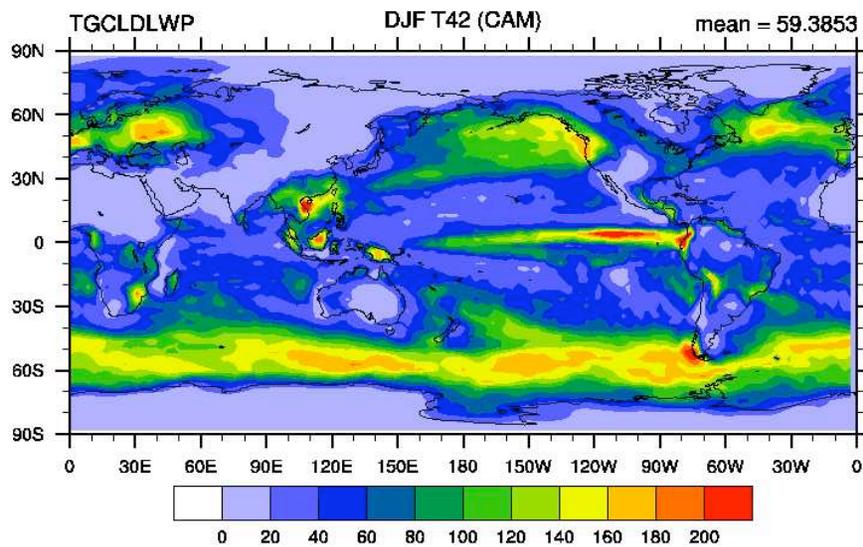
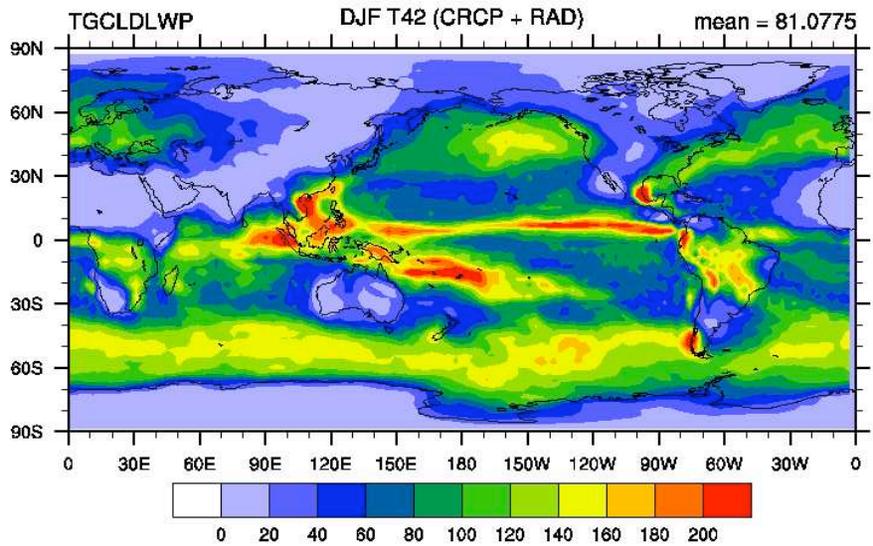
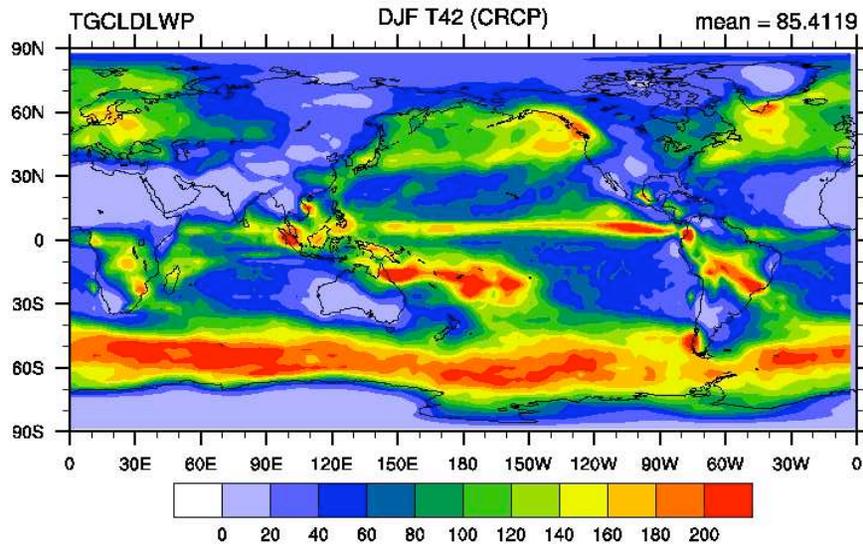
global annual stats

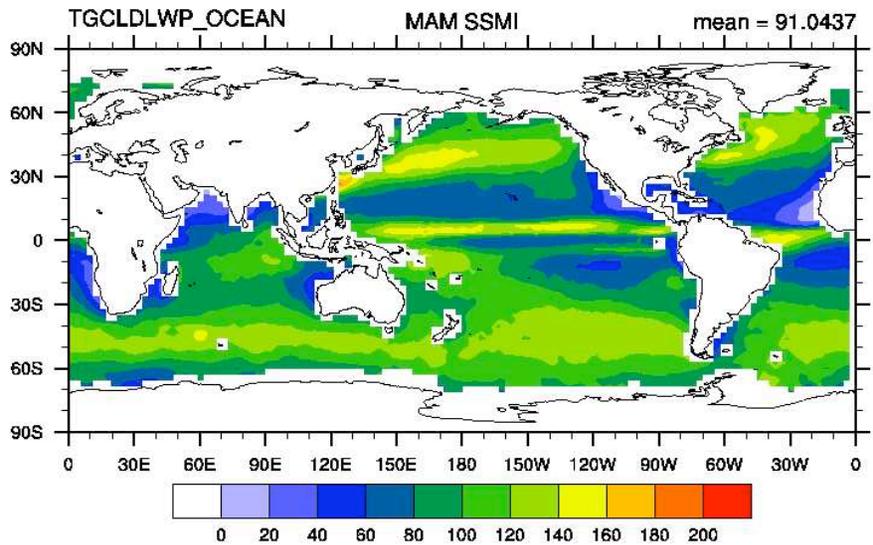
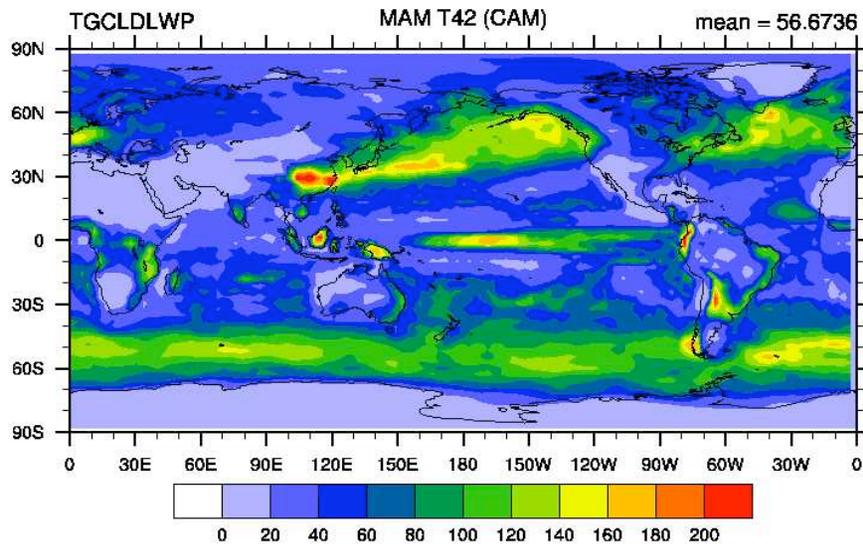
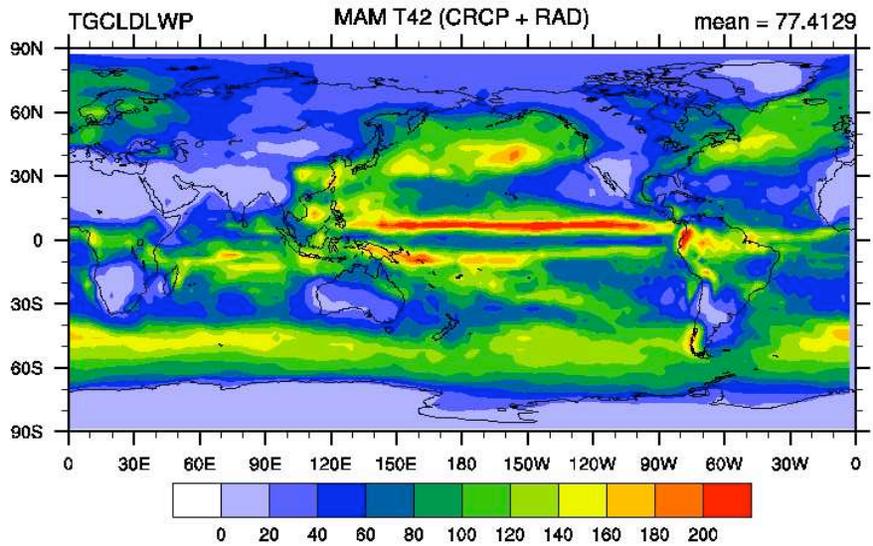
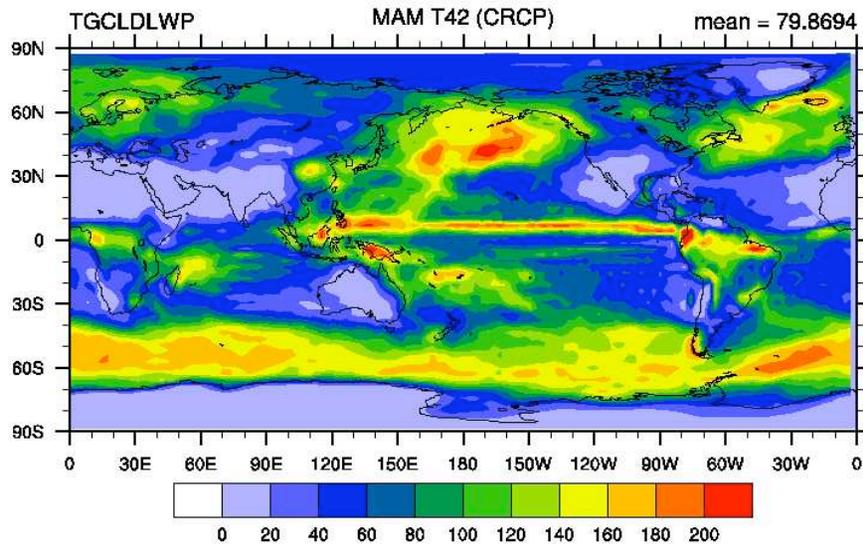
Variable	CRCP	CRCPRAD	OBS
RESTOM	5.753	-3.985	-999.000
RESSURF	6.268	-3.598	-999.000
CLDTOT_ISCCP	53.447	43.272	66.933
FLUT_ERBE	233.234	231.824	233.946
FLUTC_ERBE	266.289	266.170	264.429
FSNTOA_ERBE	240.831	229.677	234.004
FSNTOAC_ERBE	286.258	286.369	289.329
LHFLX_NCEP	78.704	82.274	80.922
LWCF_ERBE	33.055	34.345	30.355
PRECT_GPCP	2.733	2.854	2.607
PREH2O_NVAP	25.599	25.438	24.575
PSL_NCEP	1010.781	1010.775	1011.625
RESTOA_ERBE	7.597	-2.147	0.059
SHFLX_NCEP	20.162	19.960	15.795
STRESS_MAG_ERS	0.076	0.080	0.064
SWCF_ERBE	-45.427	-56.692	-54.163
TREFHT_LEGATES	287.947	287.864	287.645
TS_NCEP	289.460	289.375	287.683
TS_LAND_NCEP	286.417	286.183	281.155
U_200_NCEP	16.851	16.831	15.297
Z3_500_NCEP	56.794	56.755	56.581

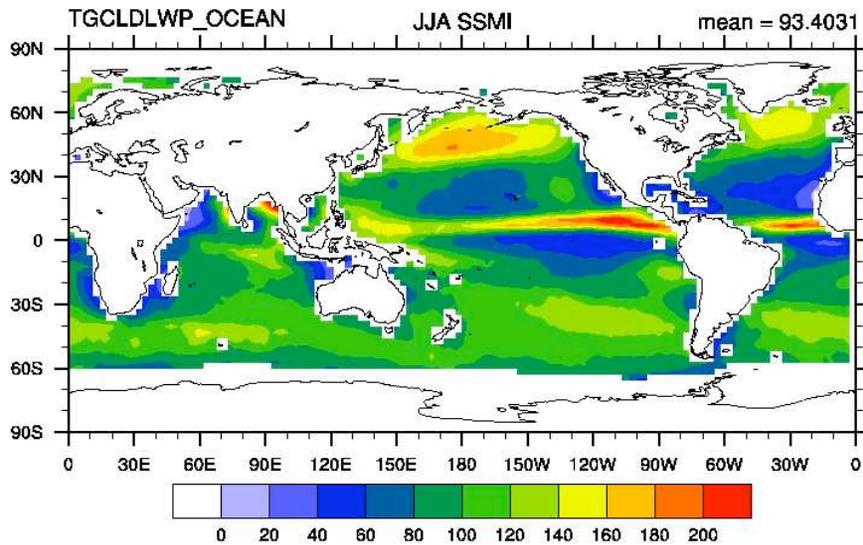
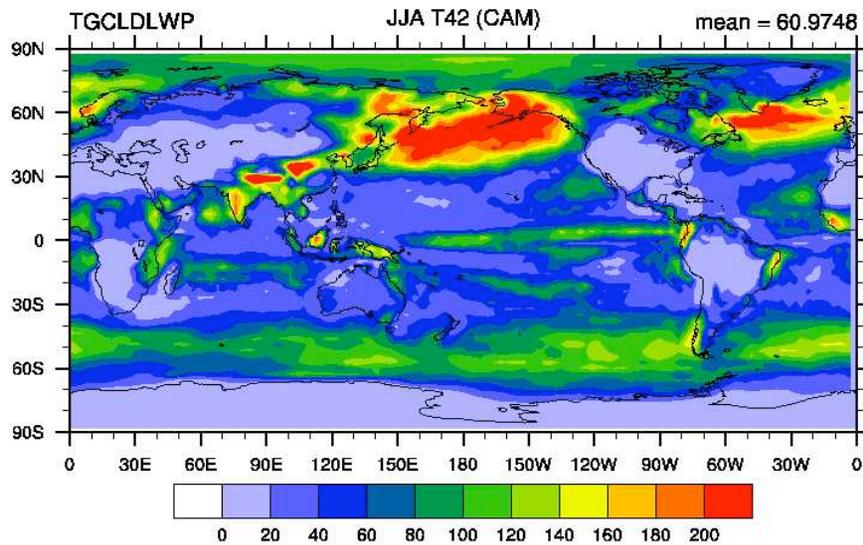
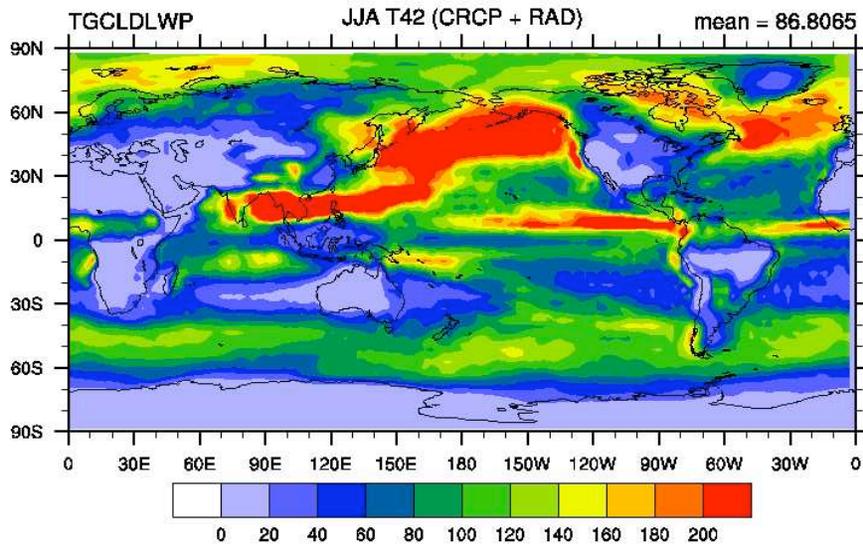
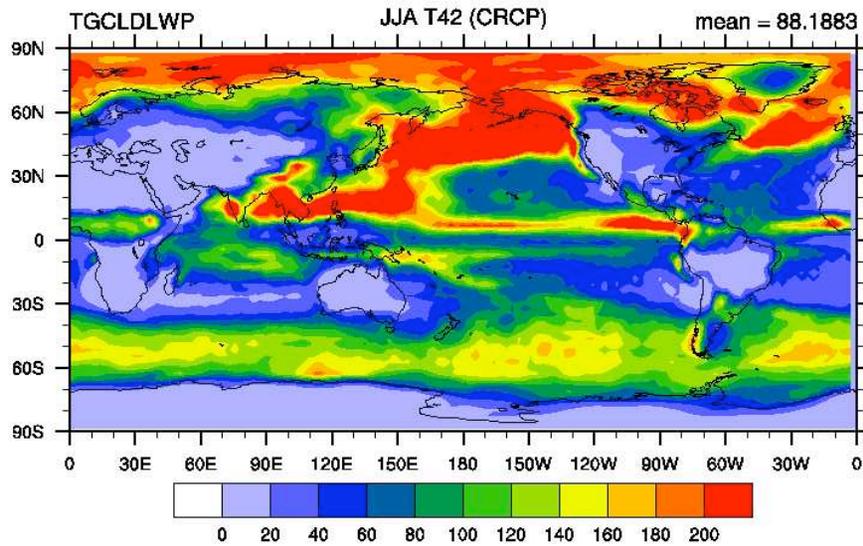


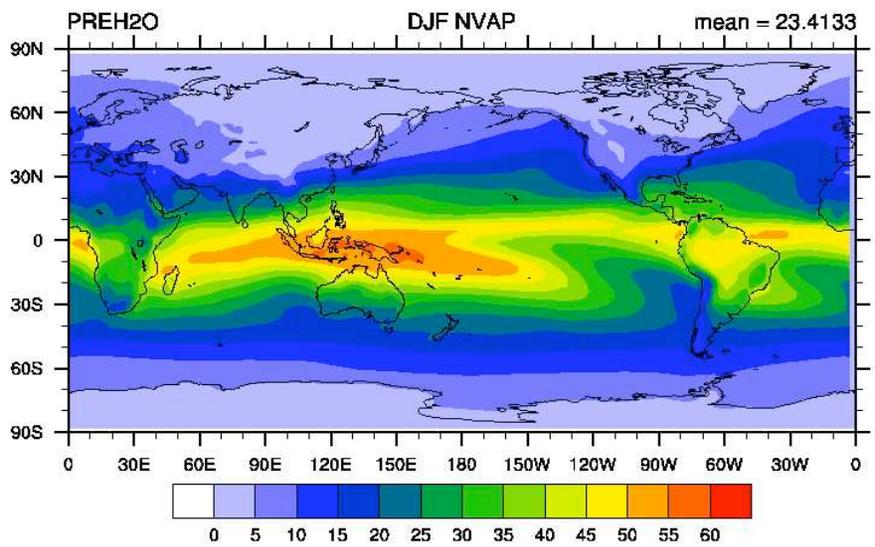
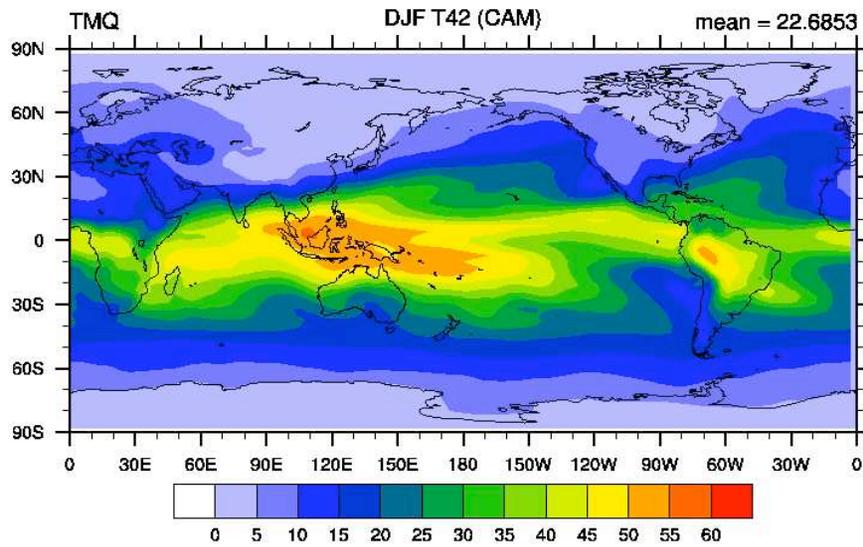
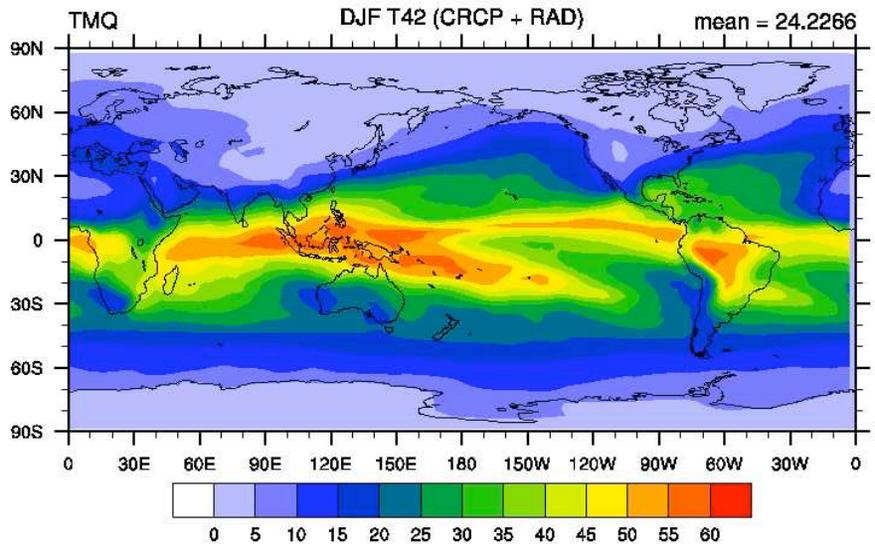
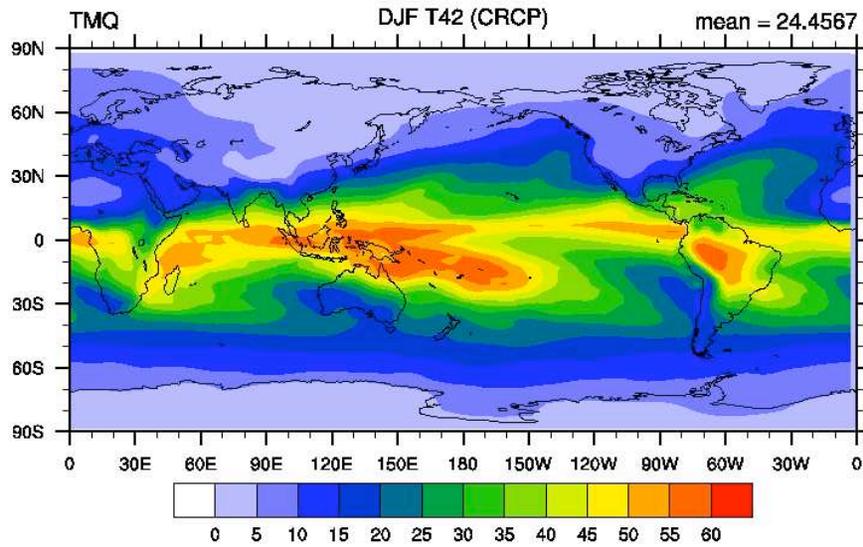


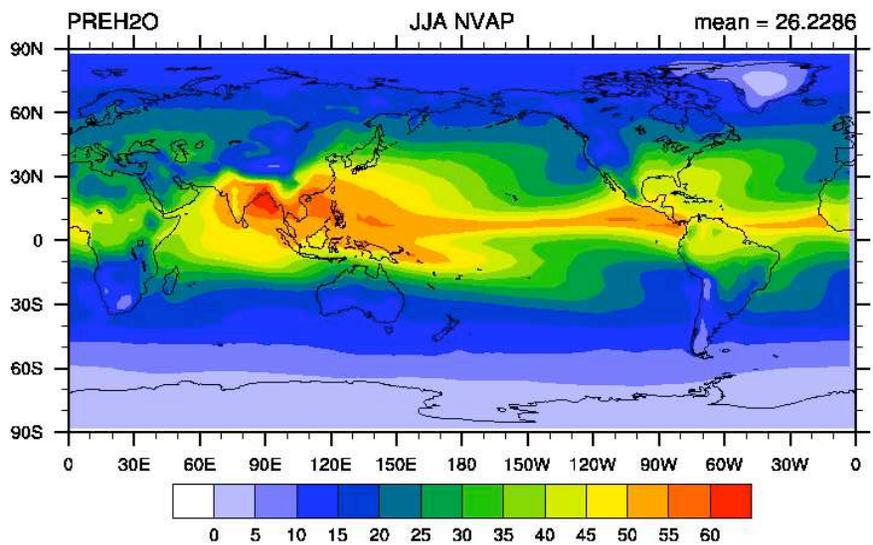
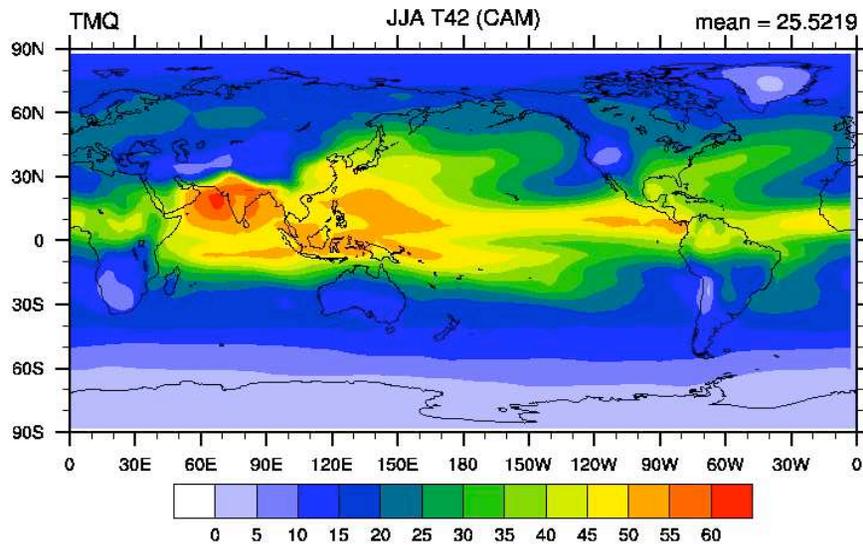
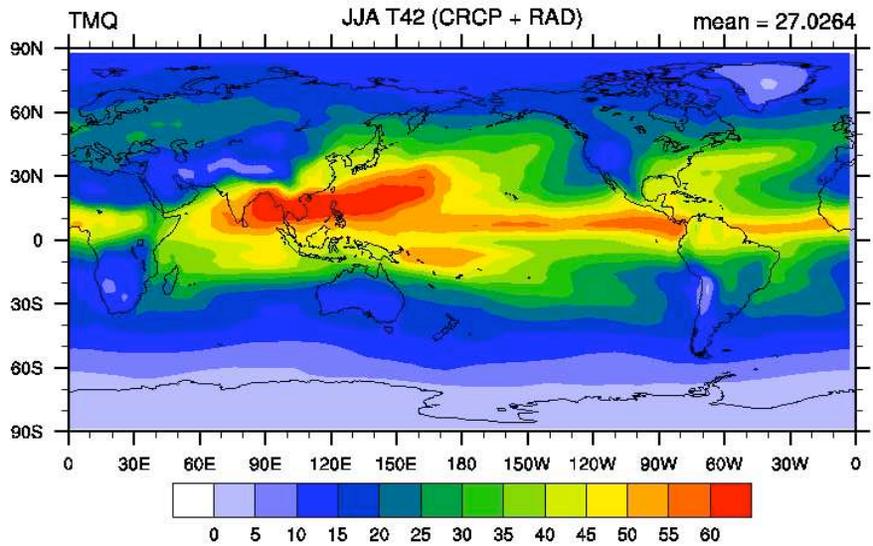
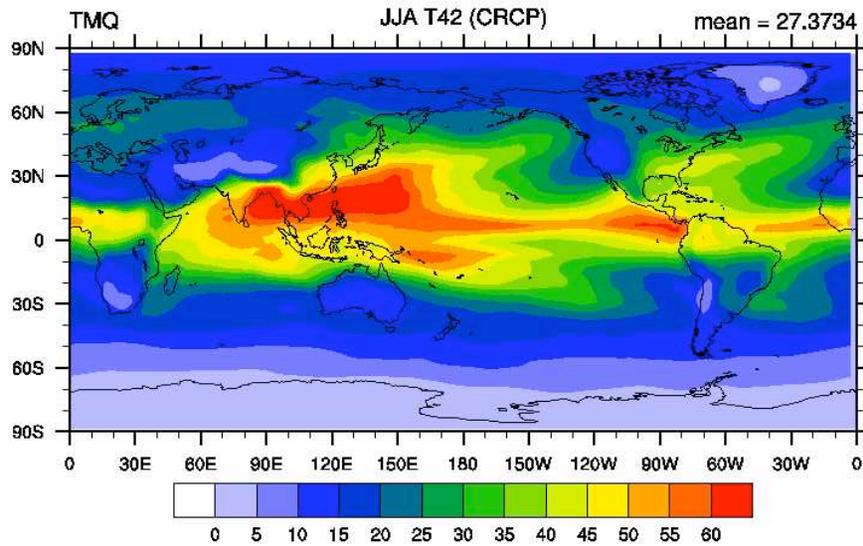


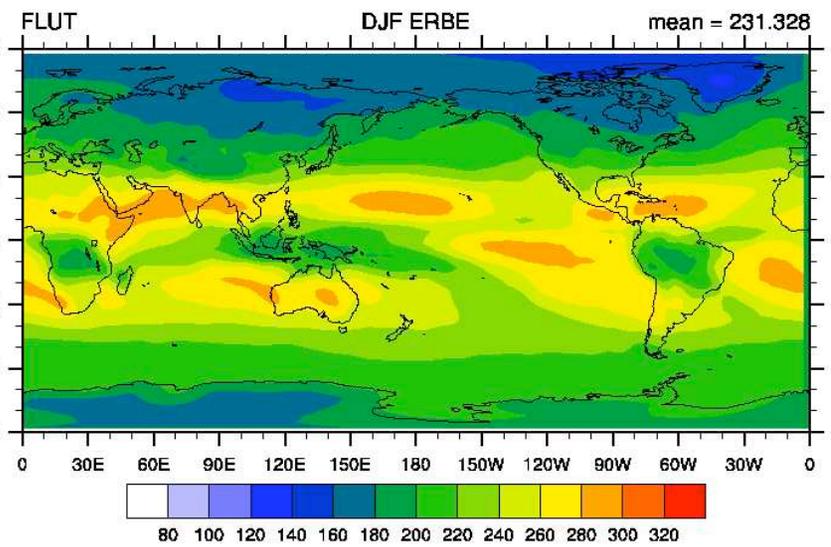
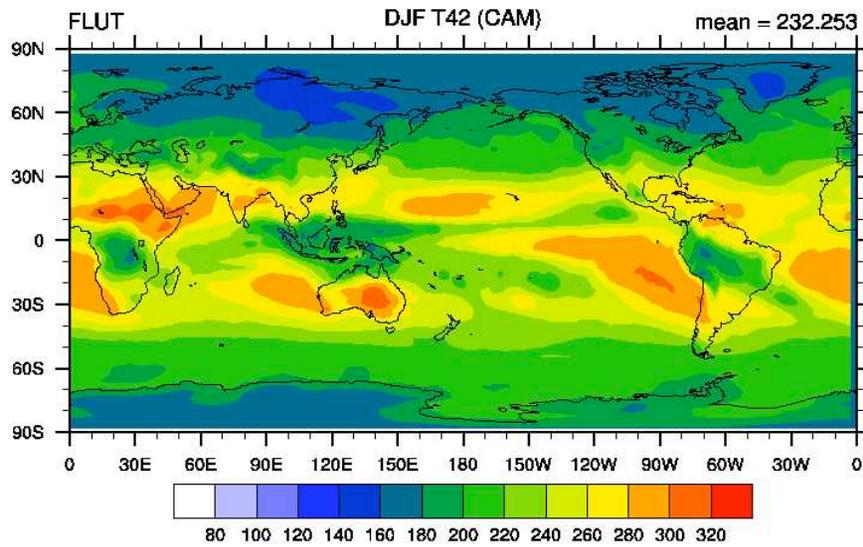
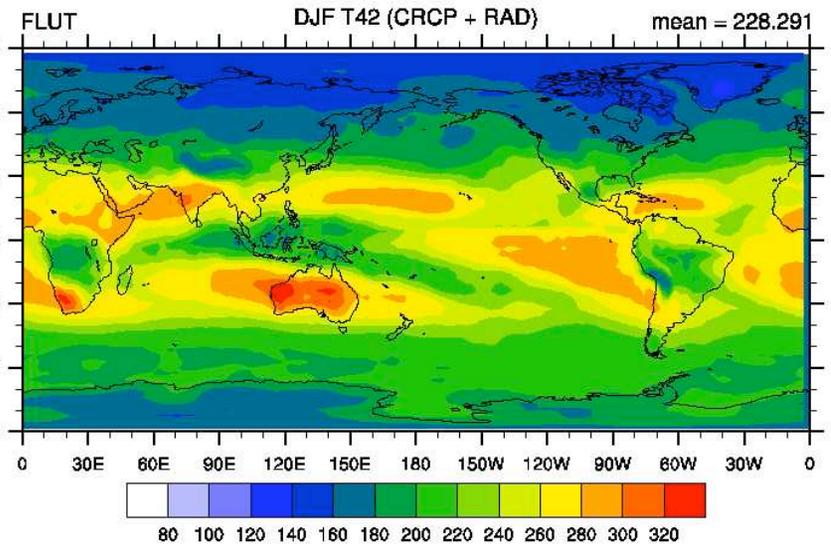
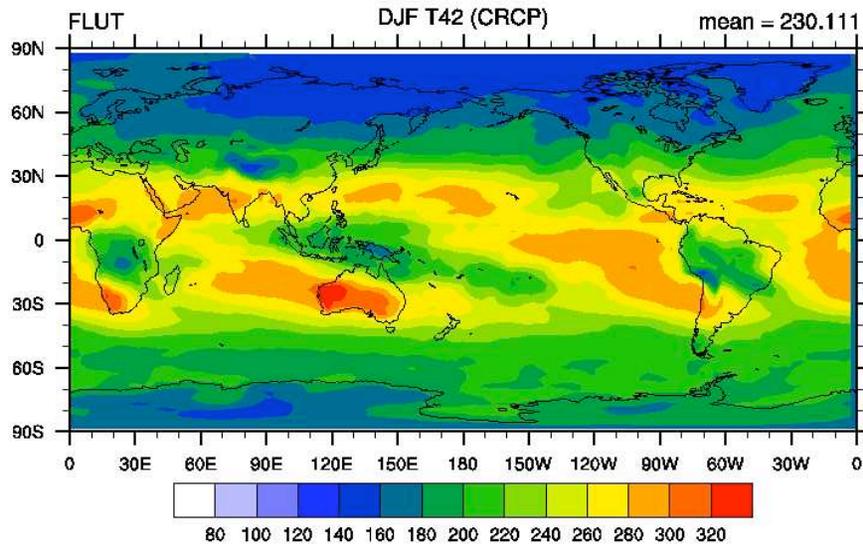


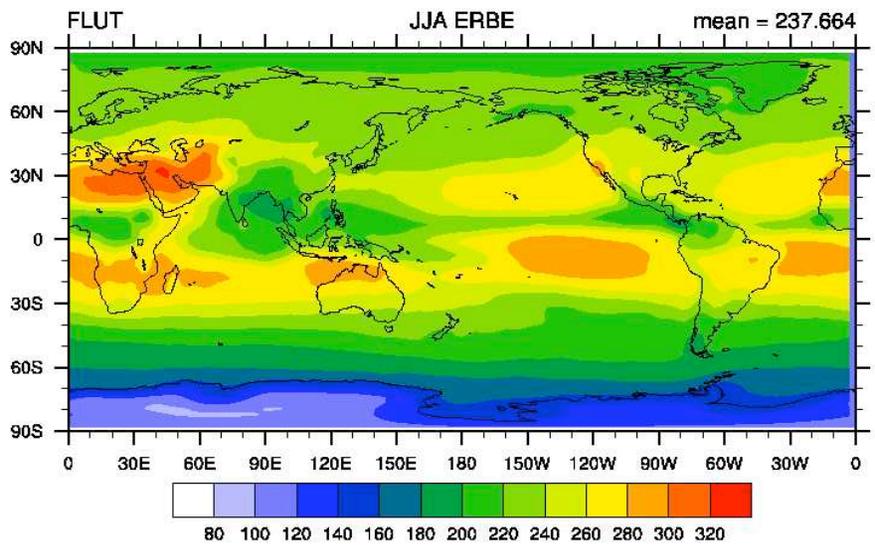
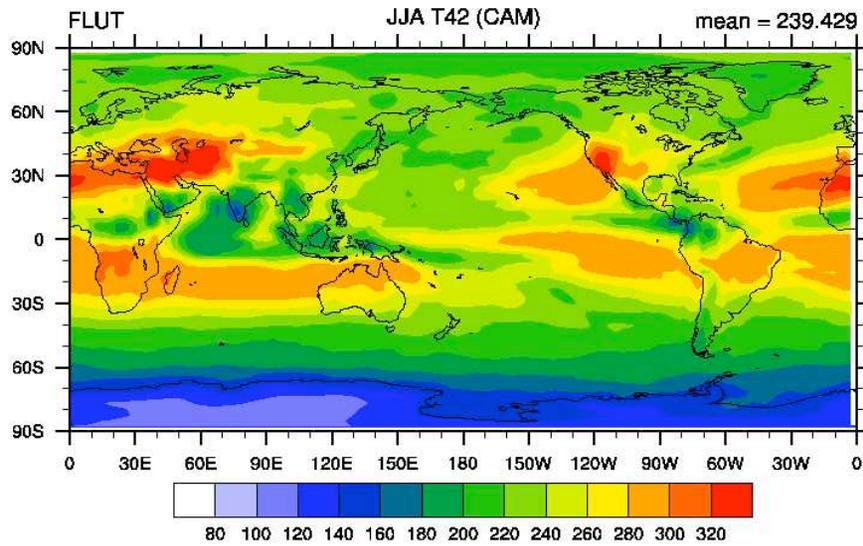
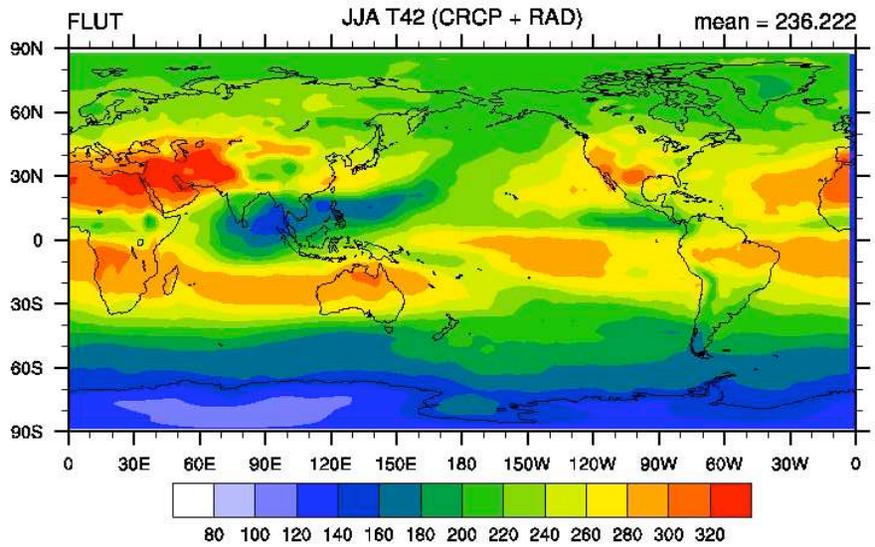
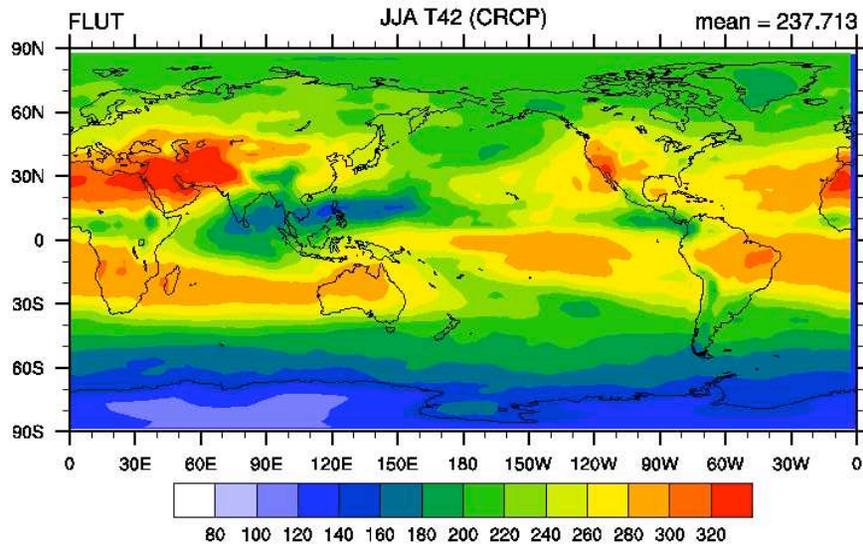


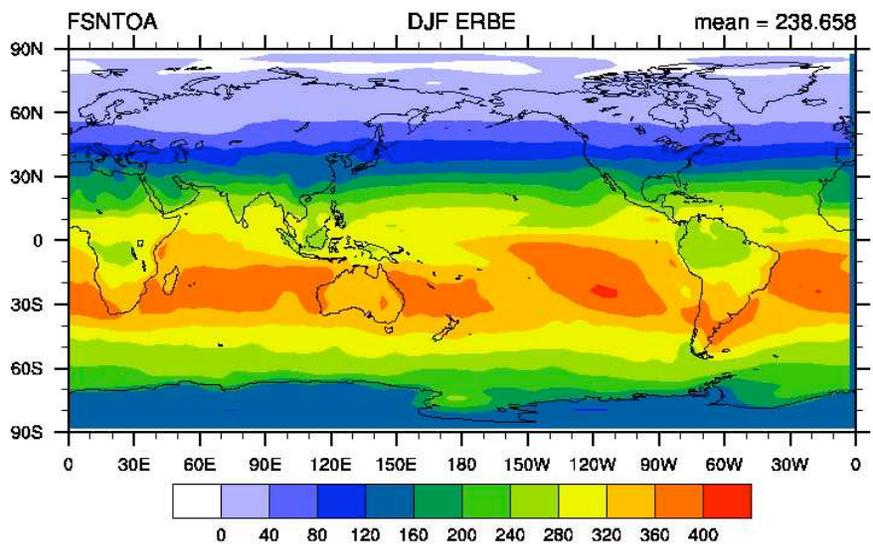
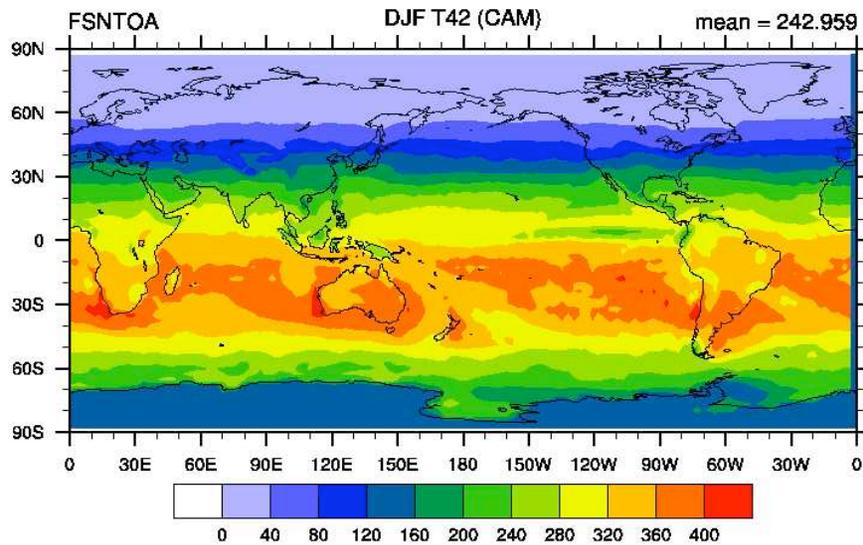
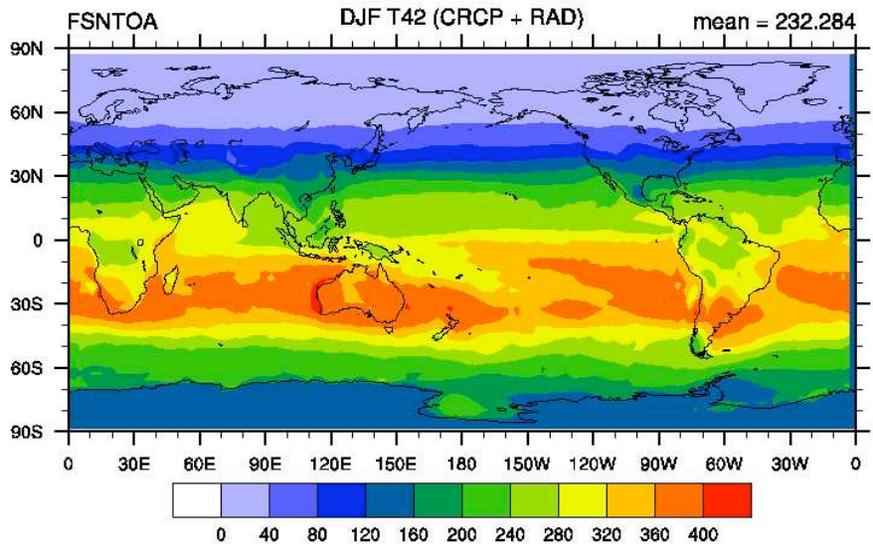
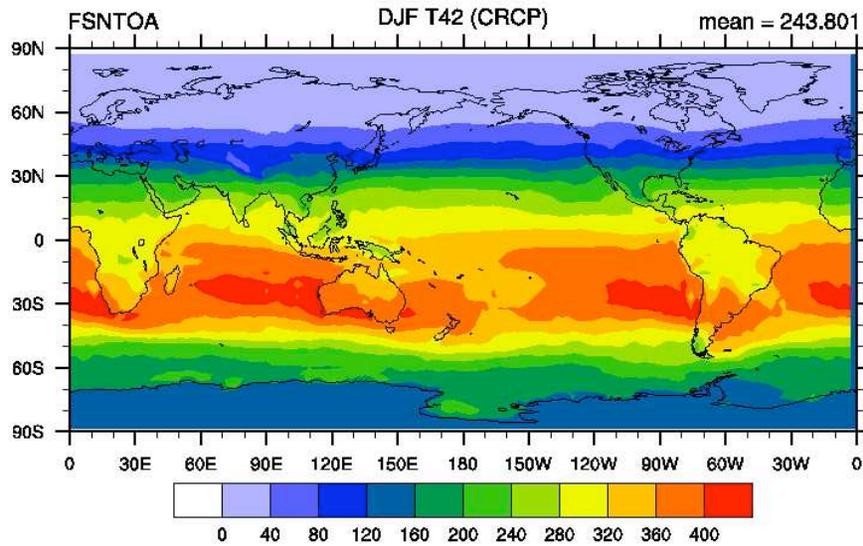


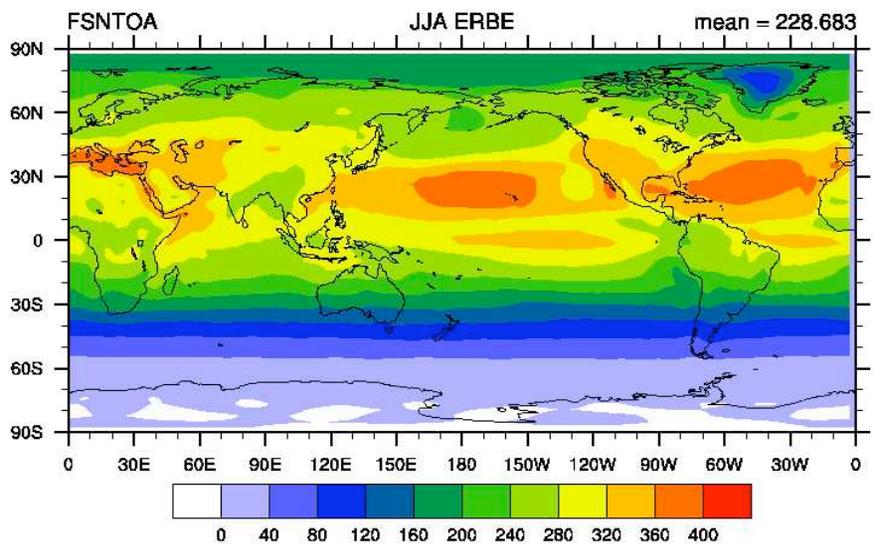
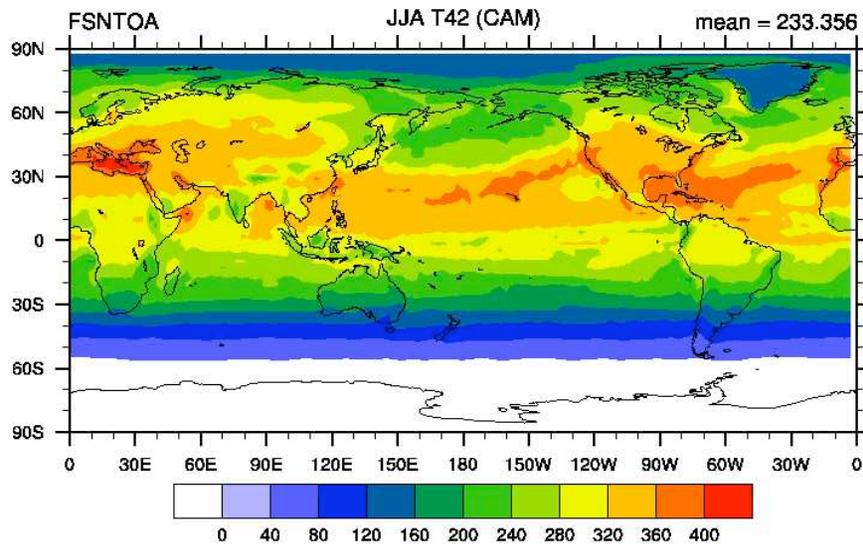
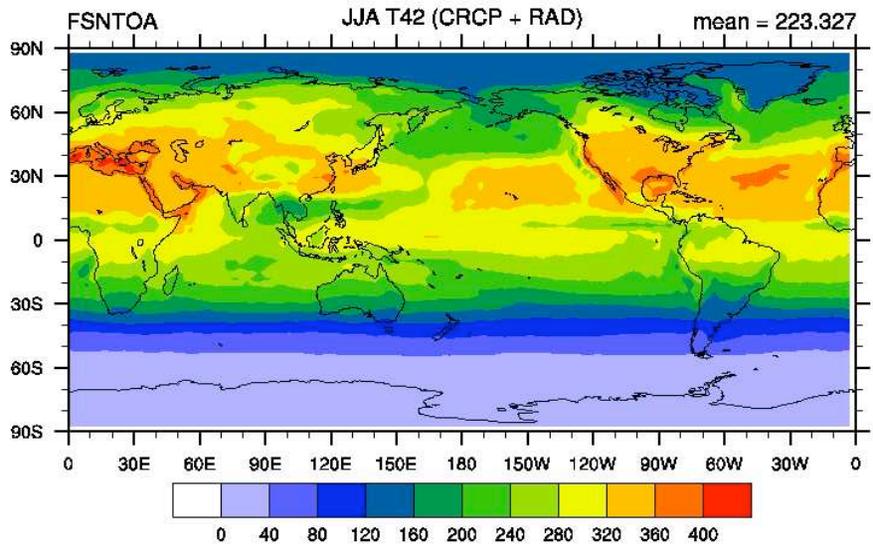
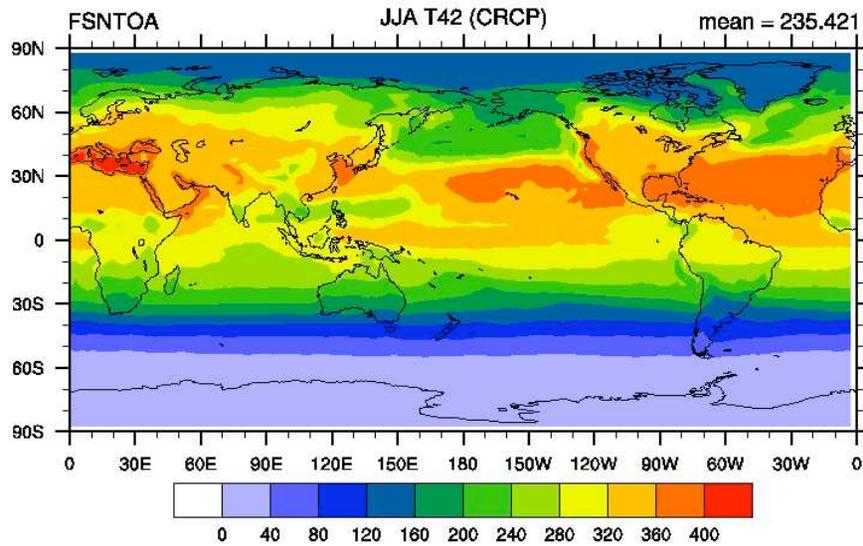


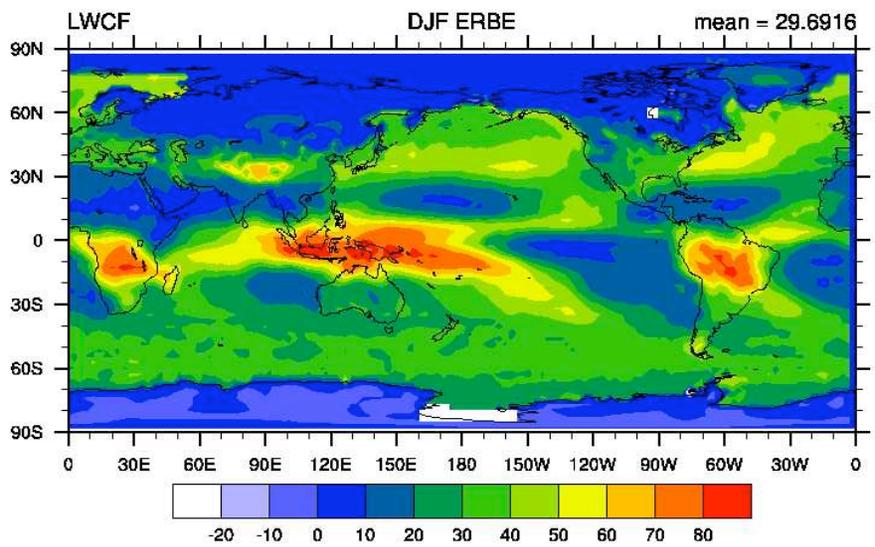
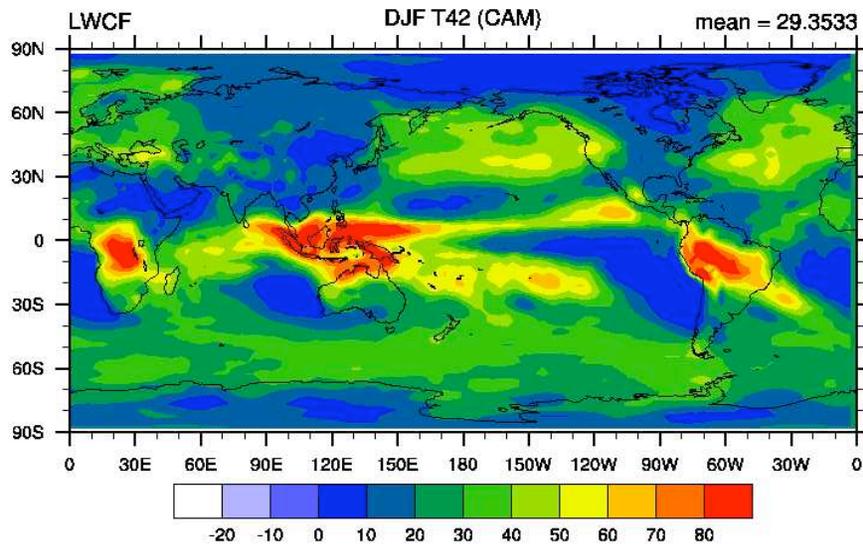
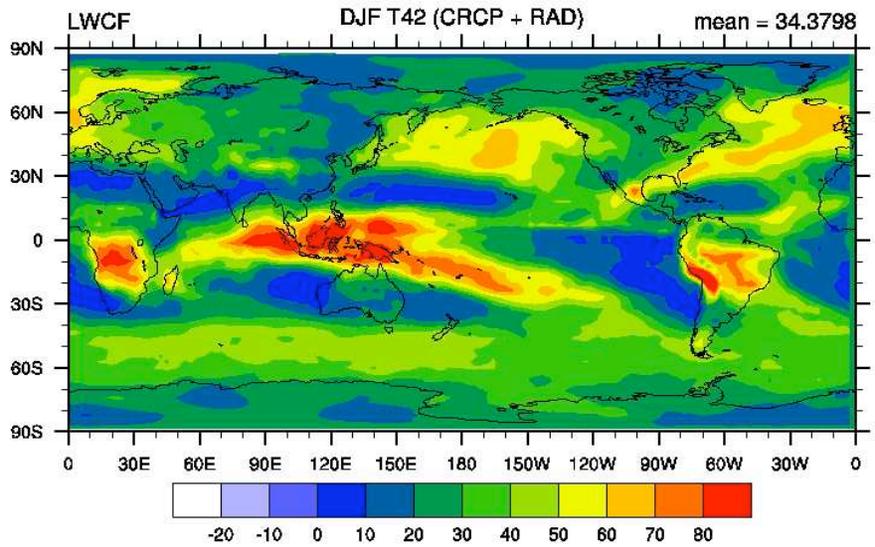
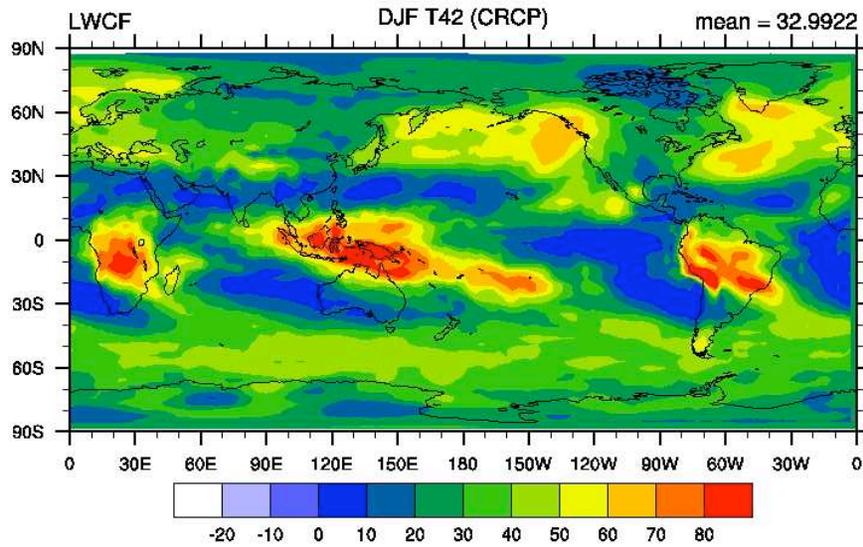


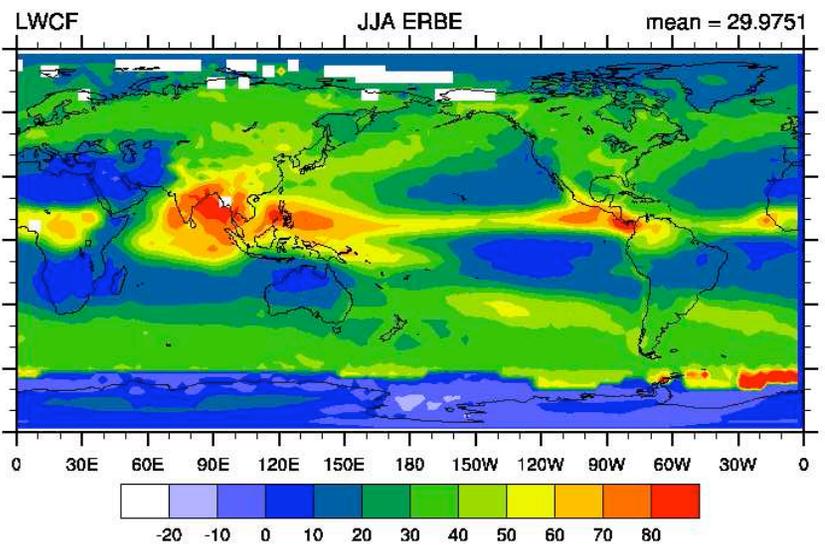
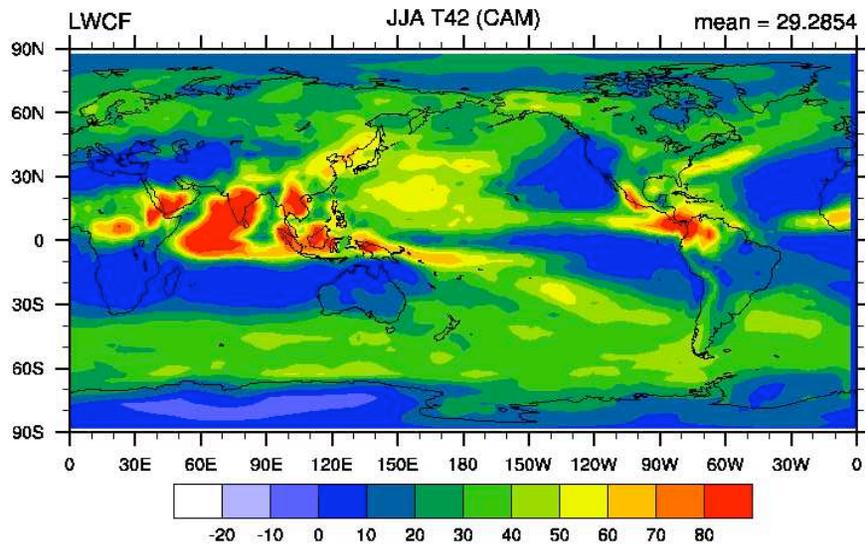
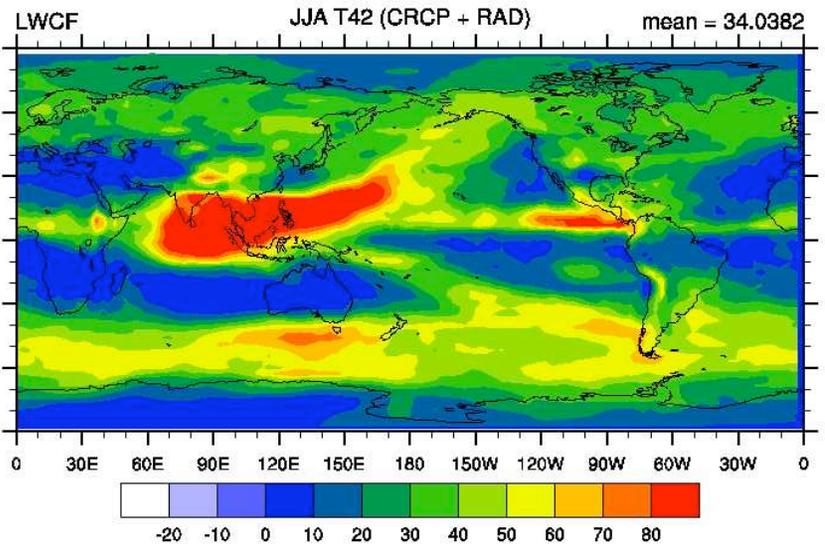
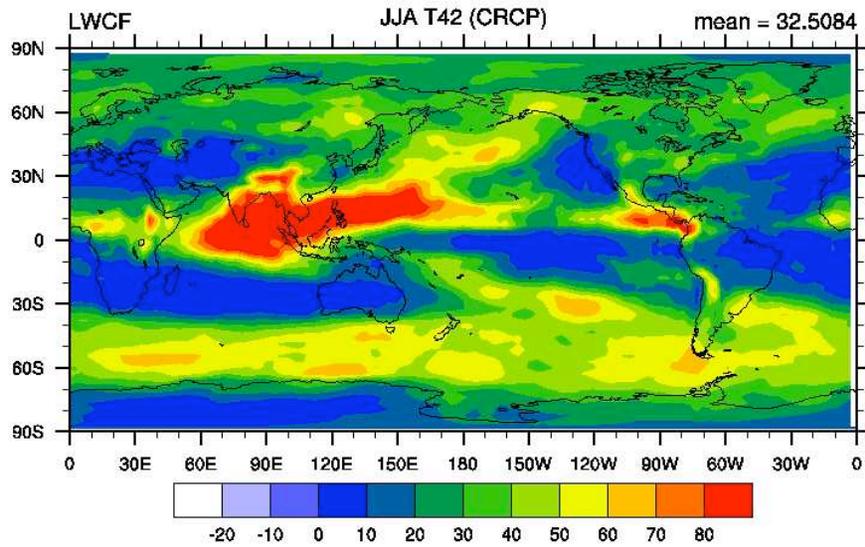


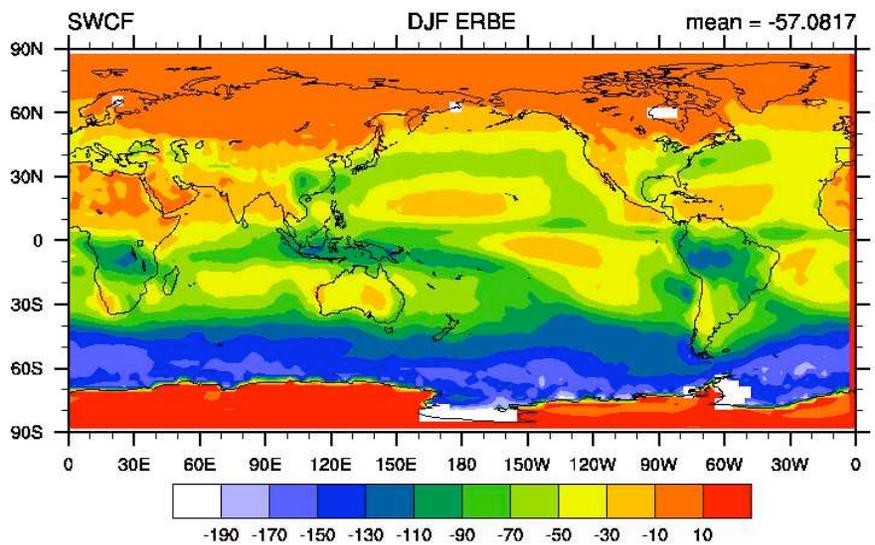
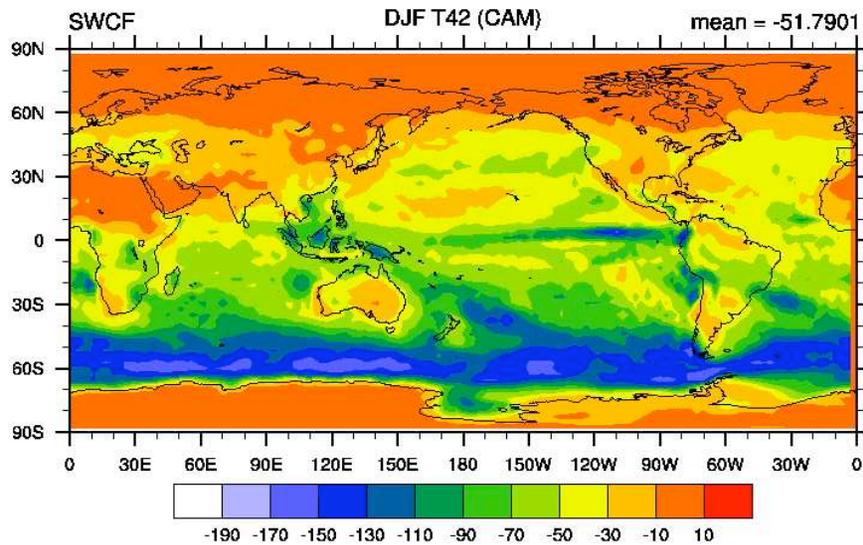
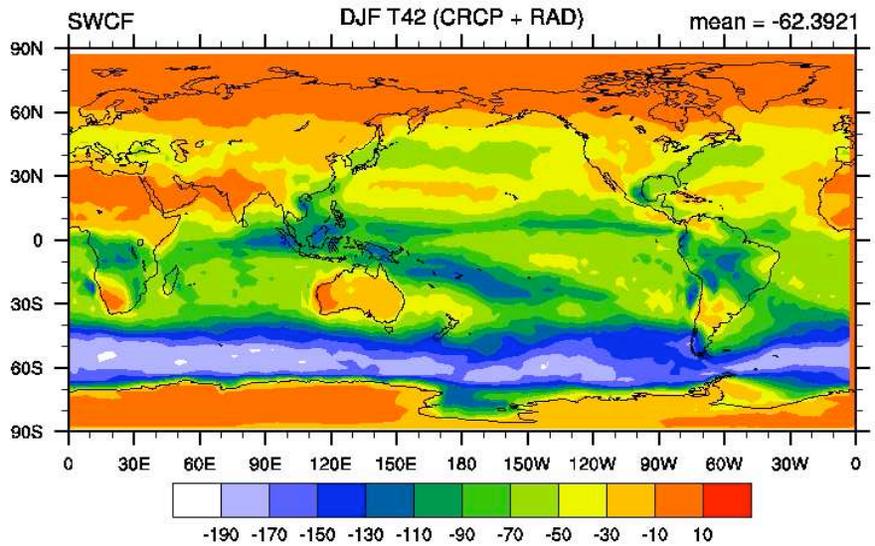
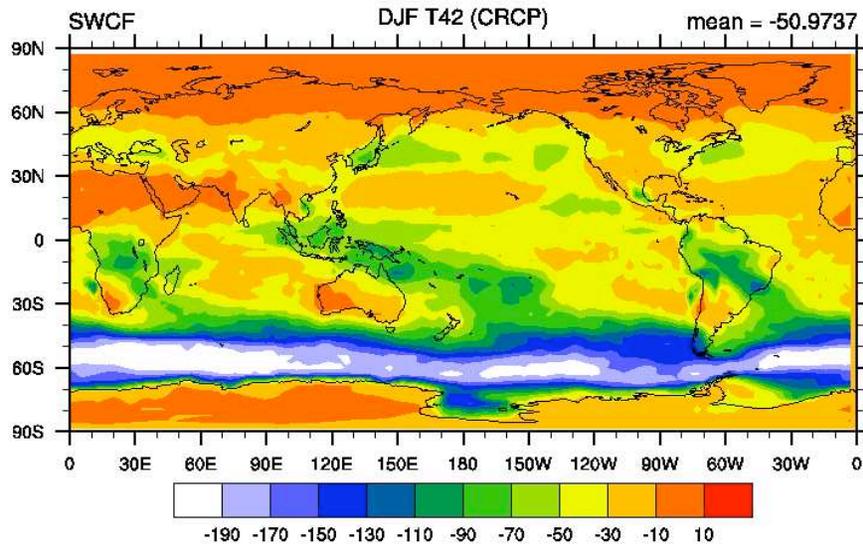


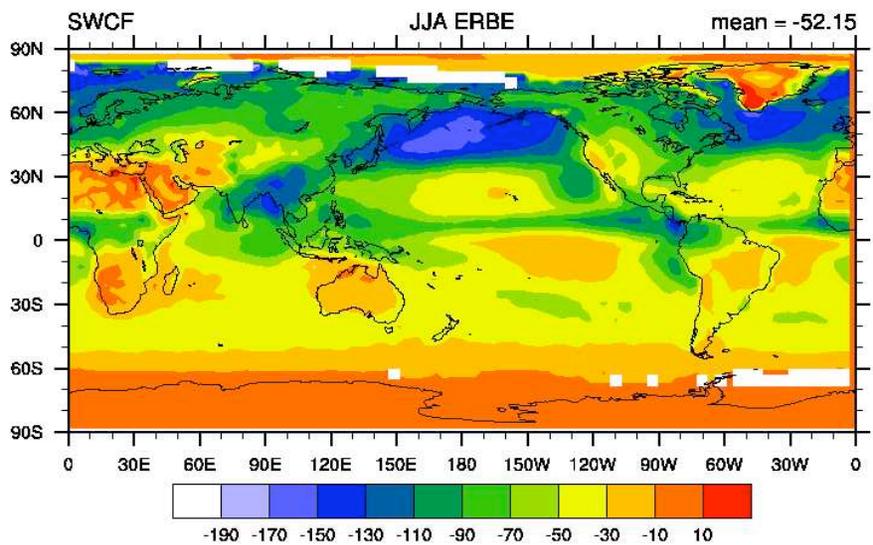
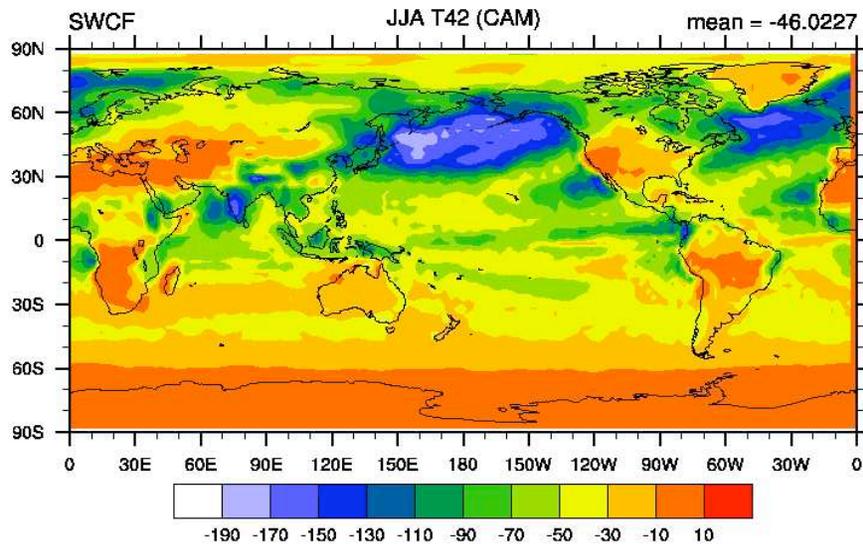
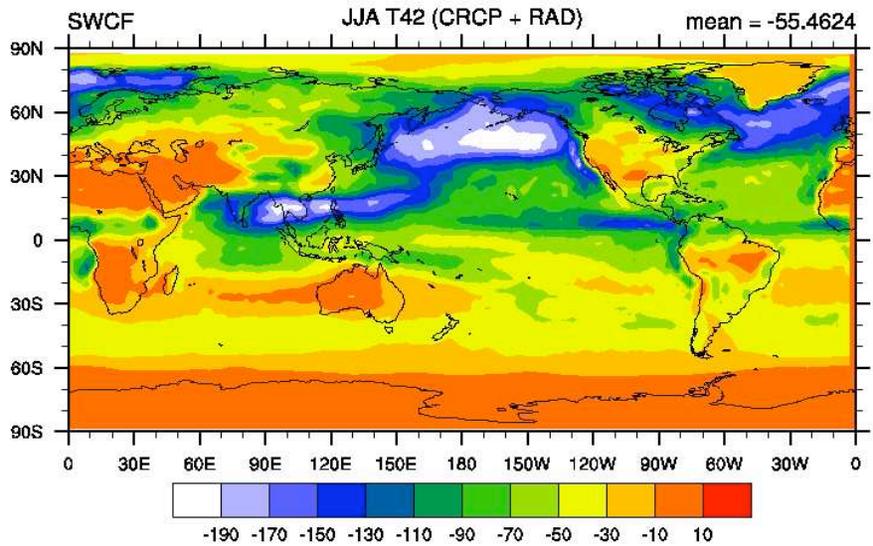
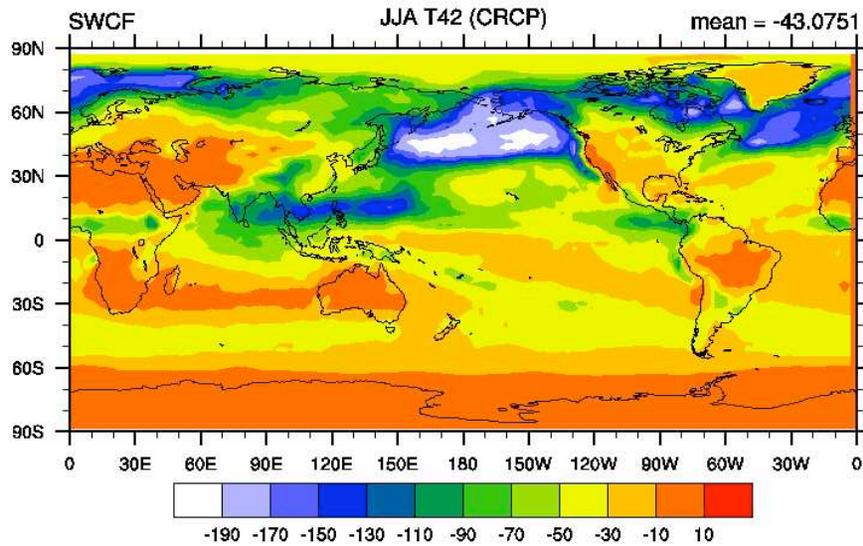


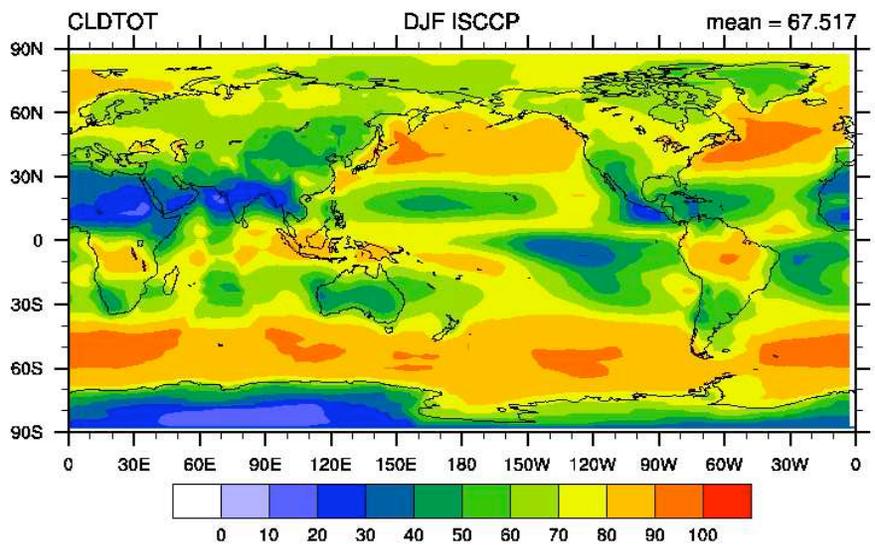
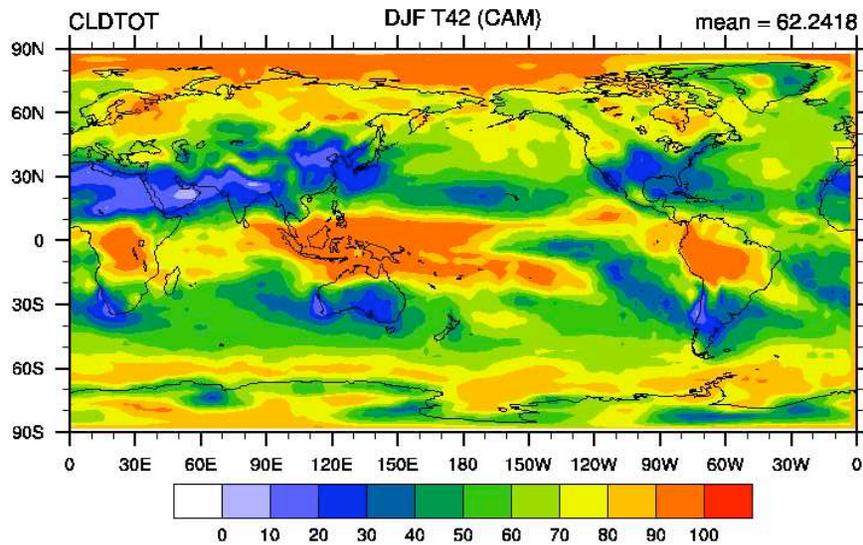
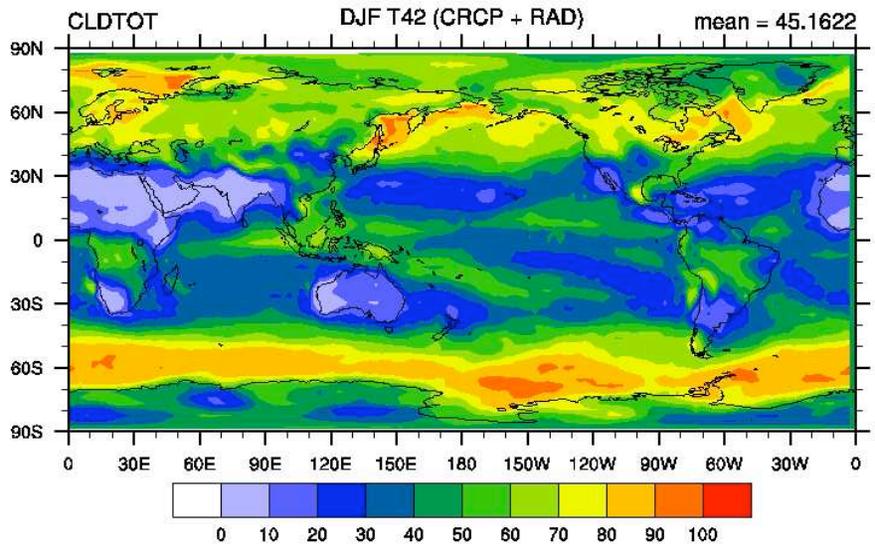
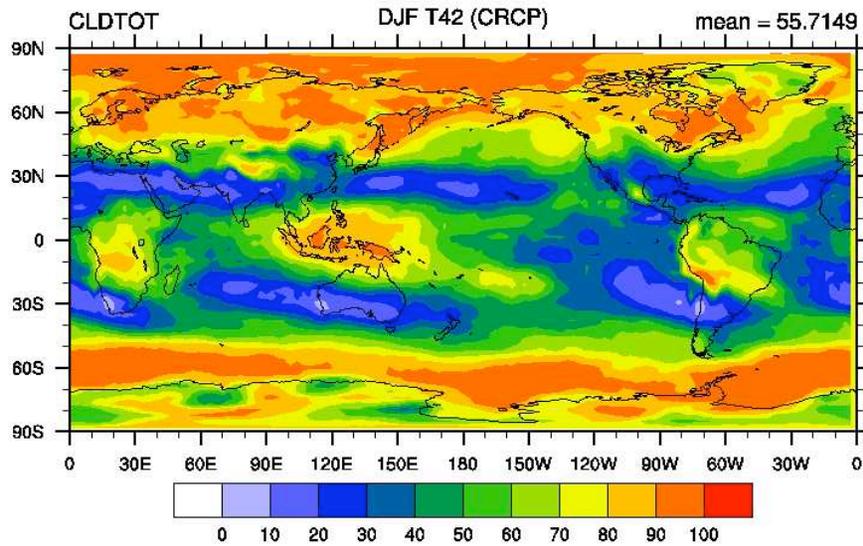


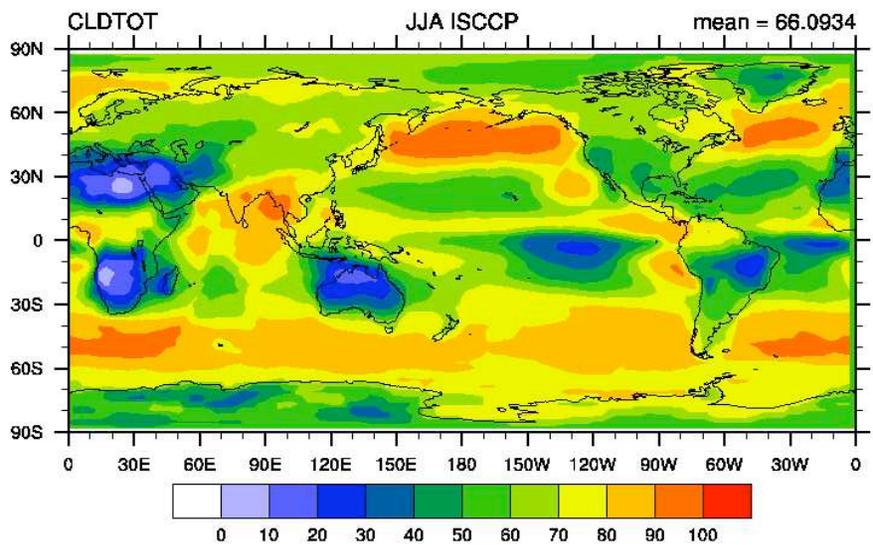
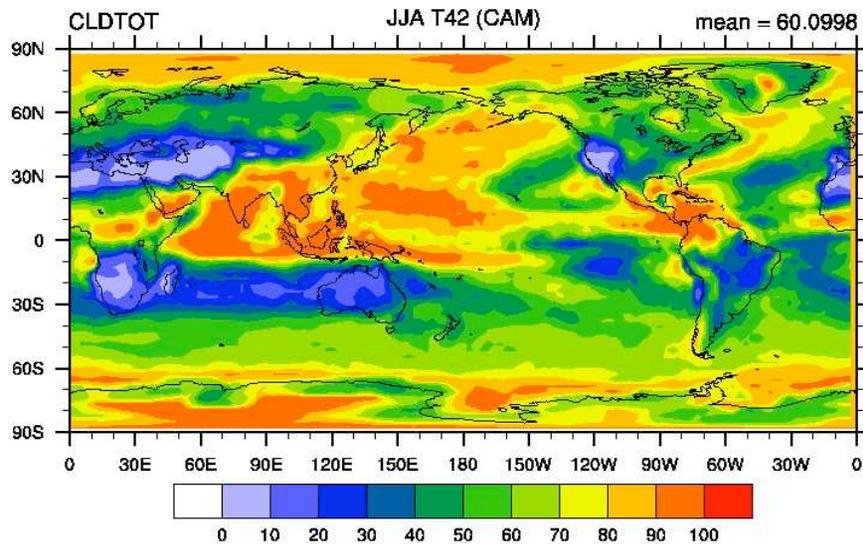
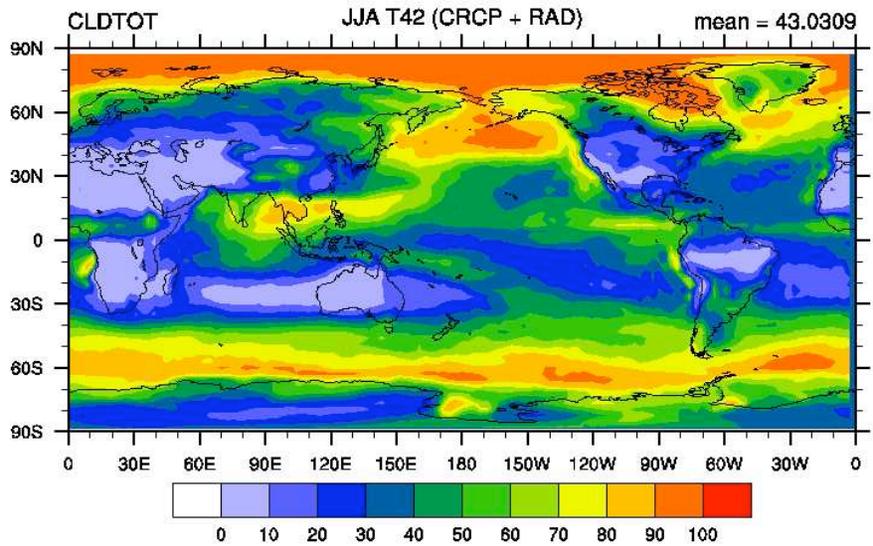
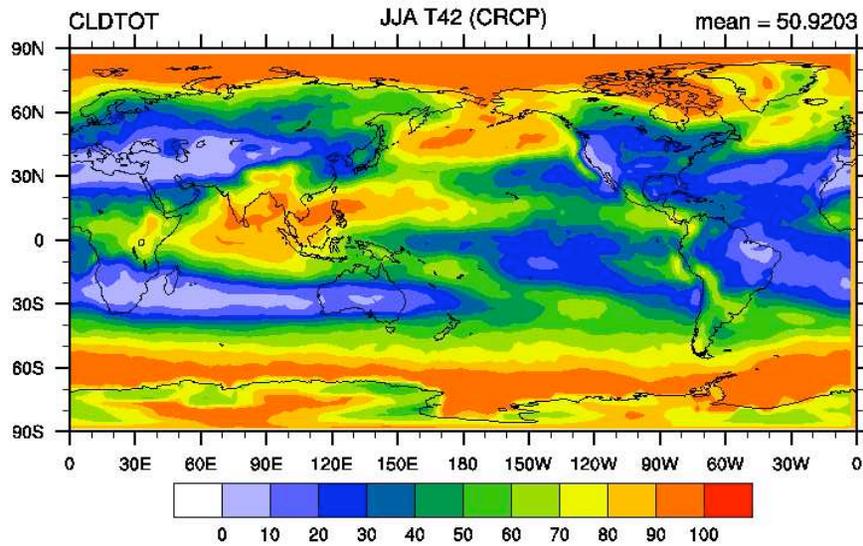


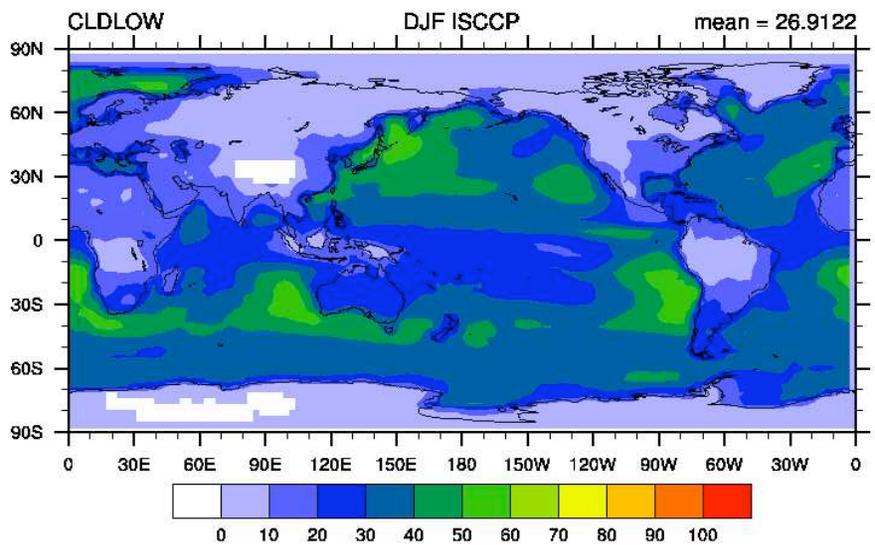
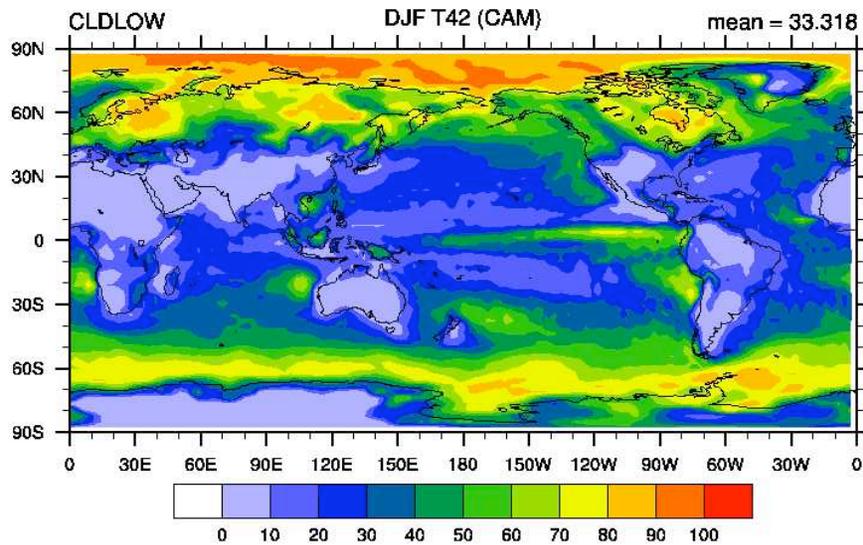
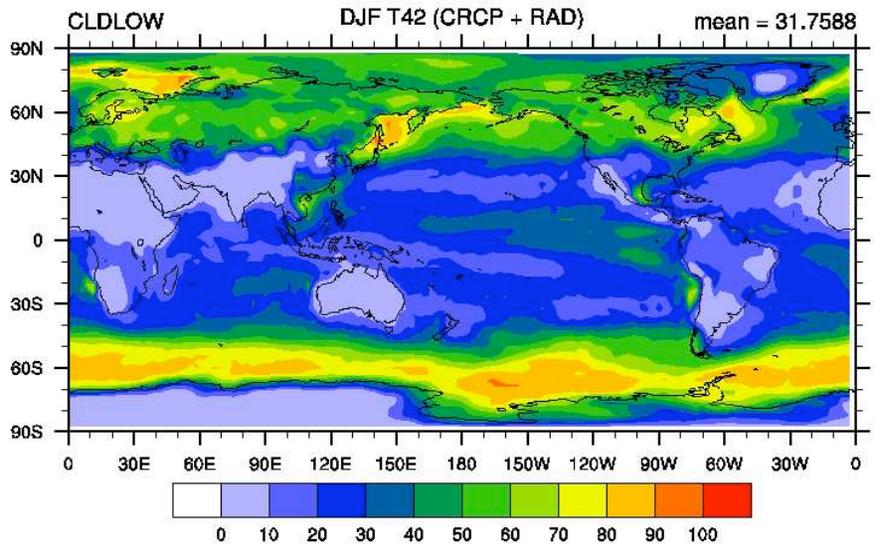
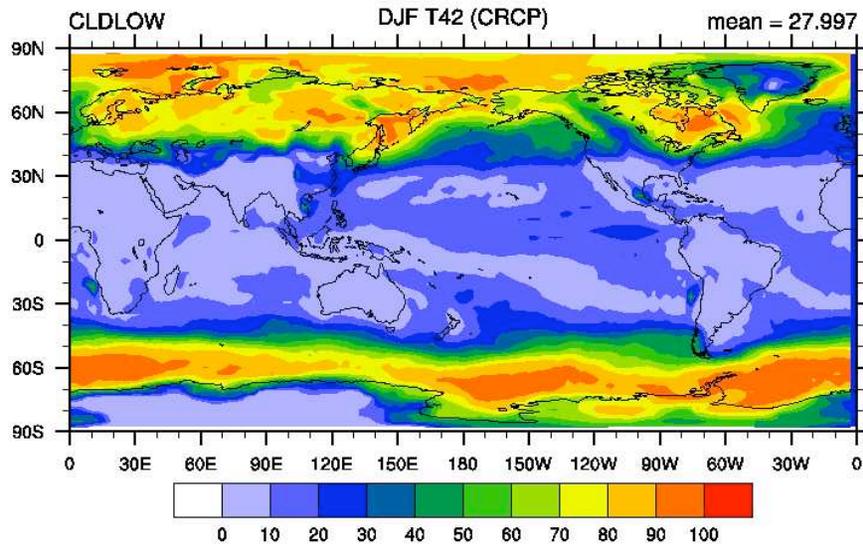


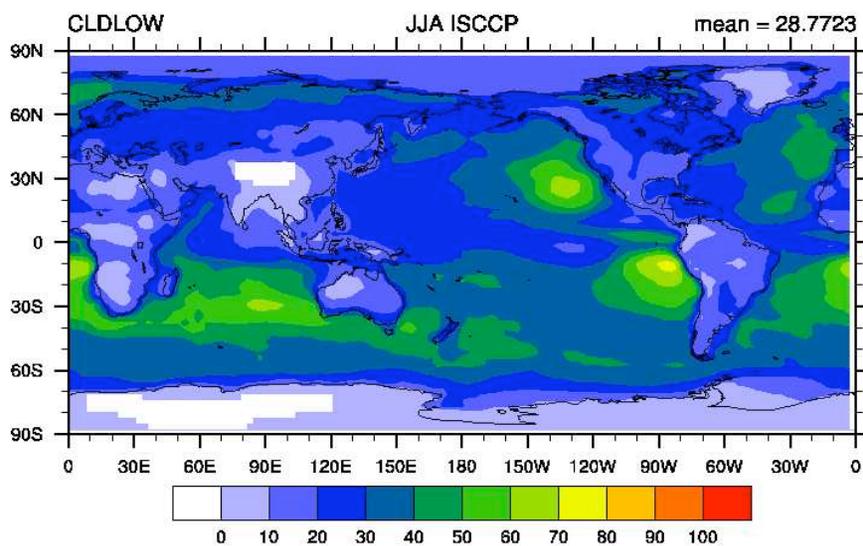
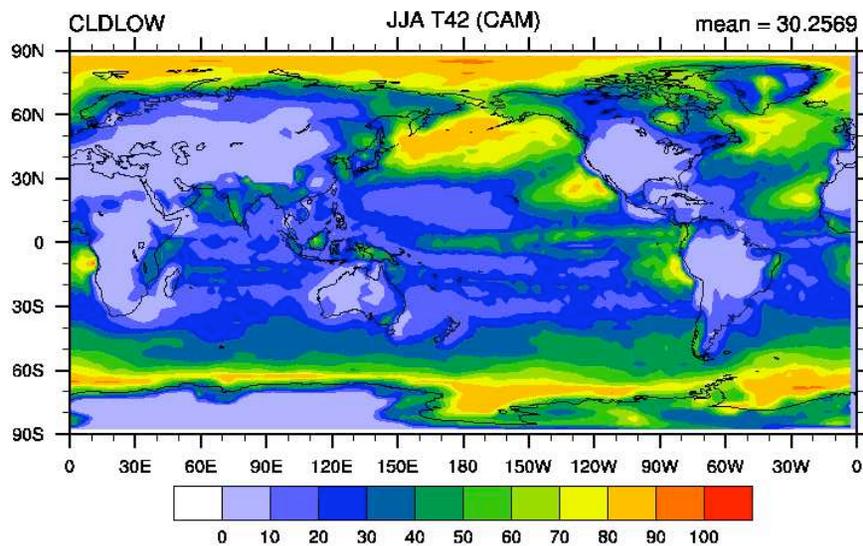
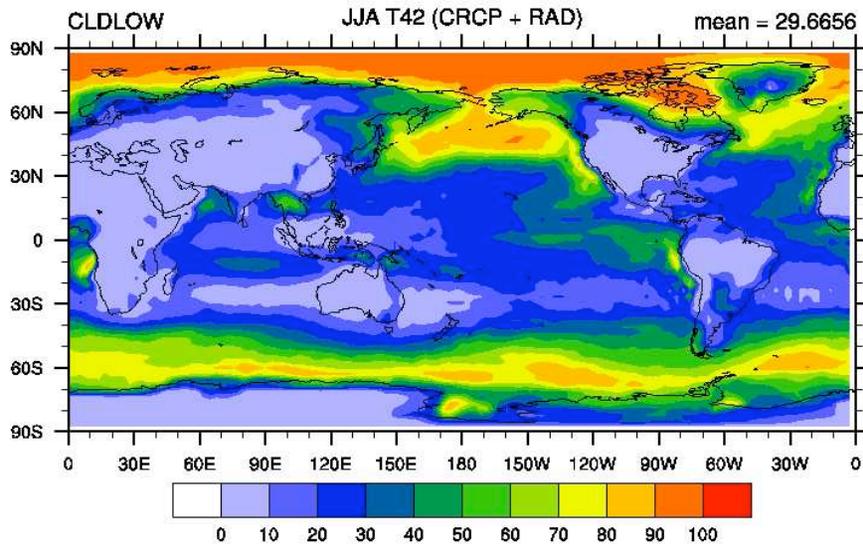
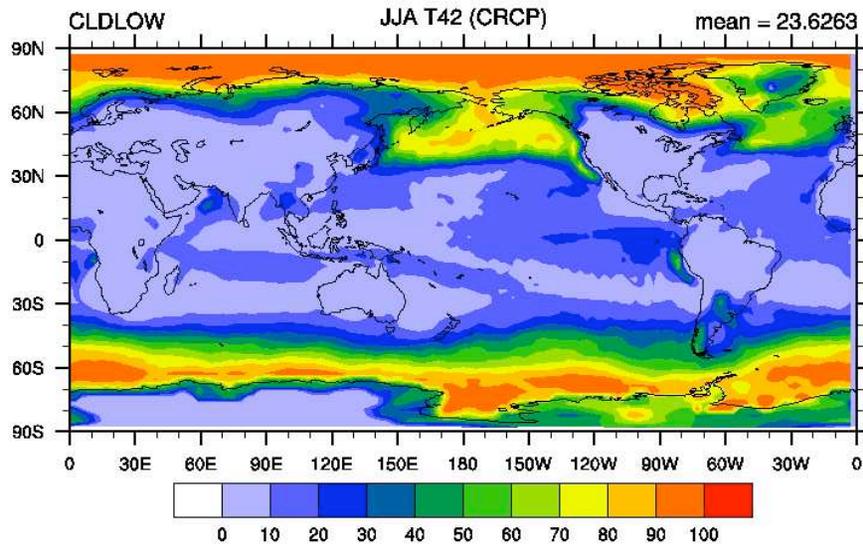


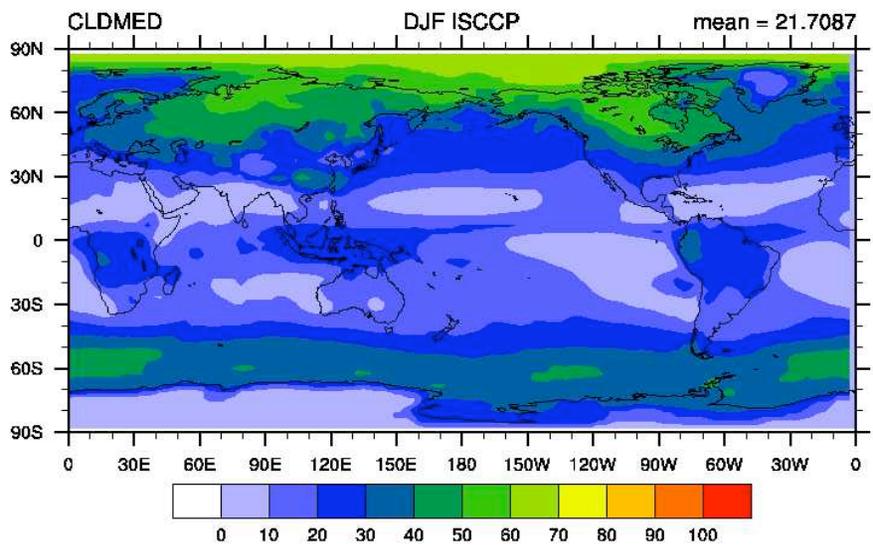
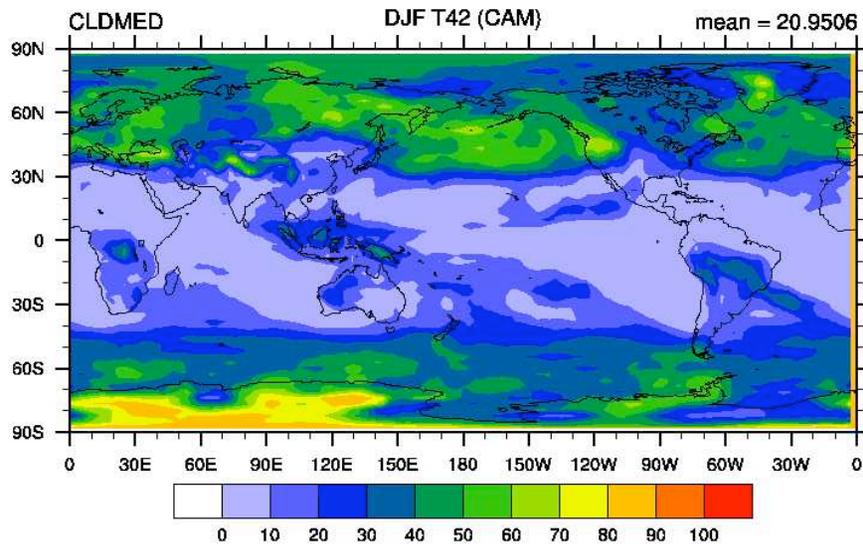
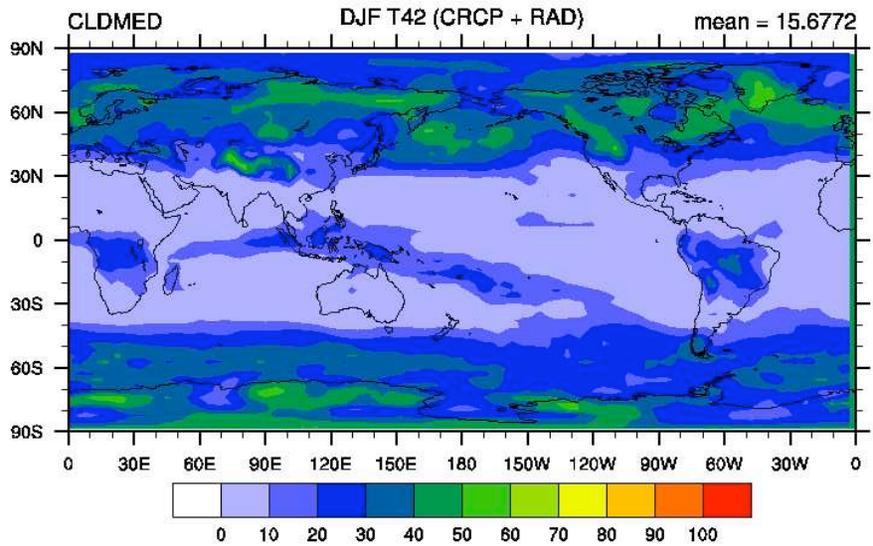
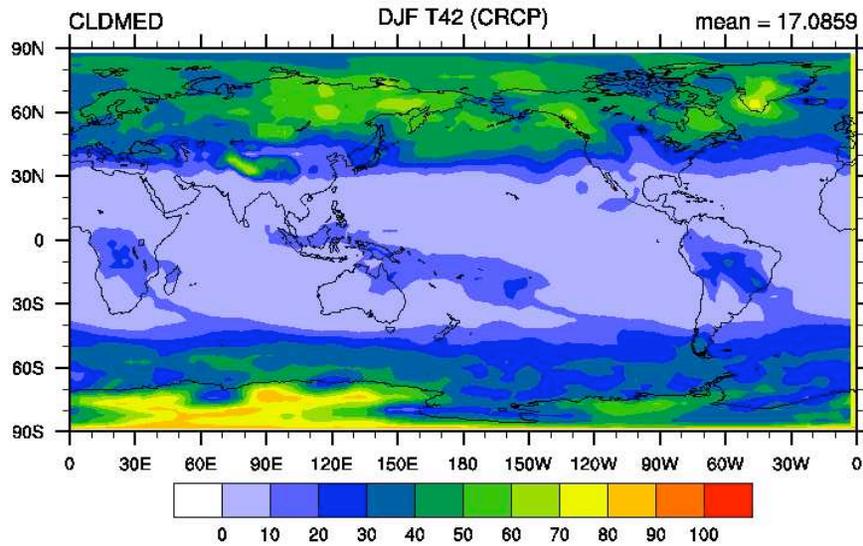


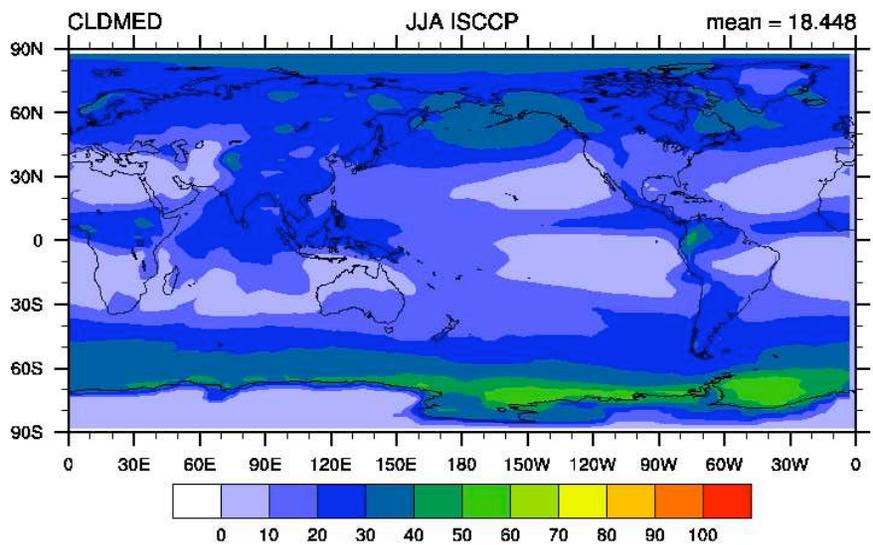
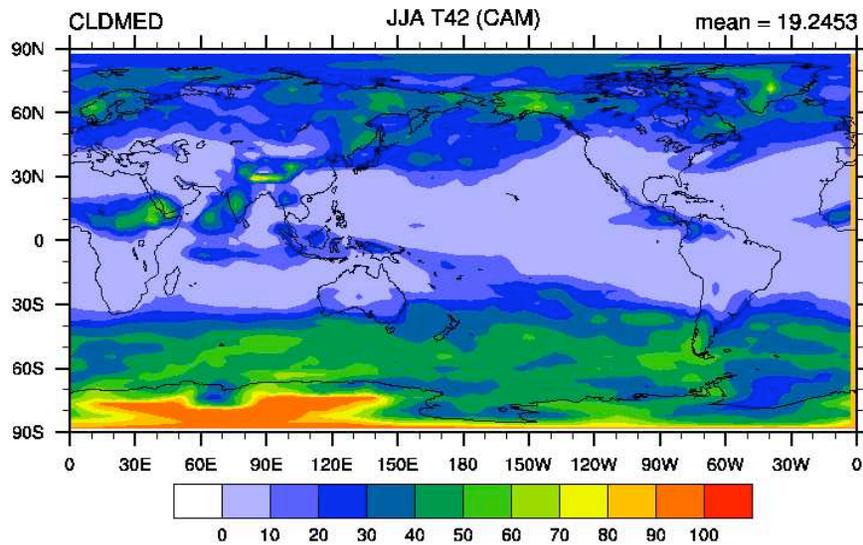
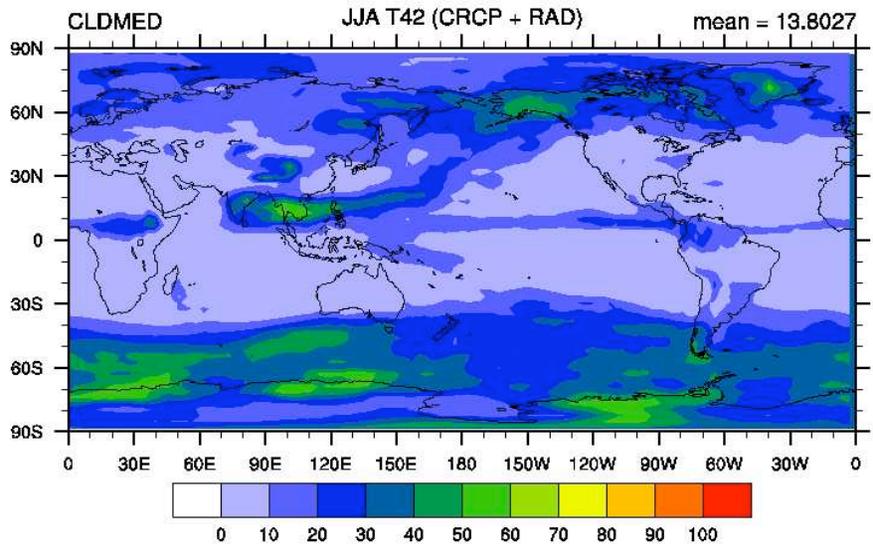
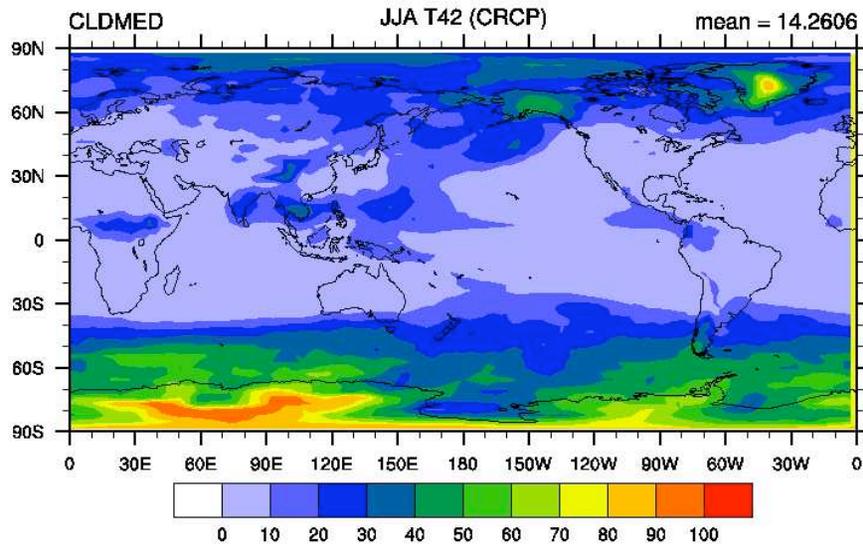


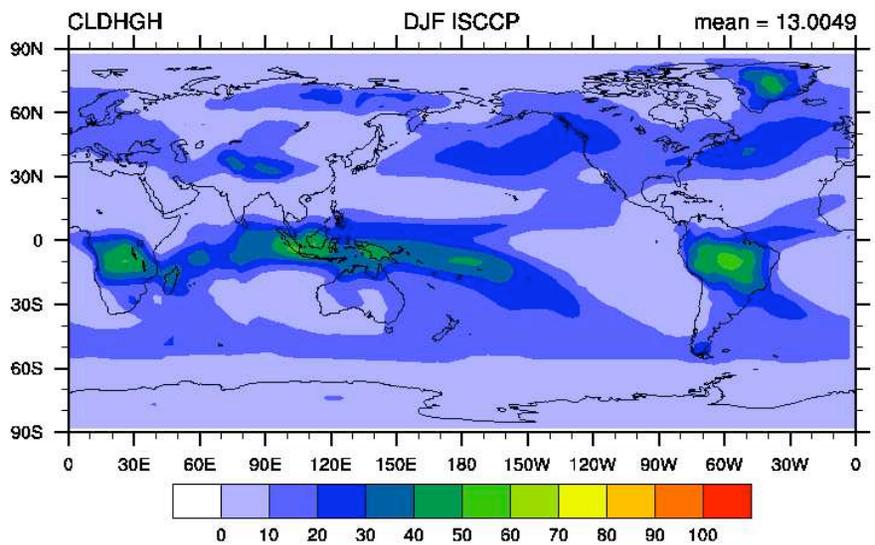
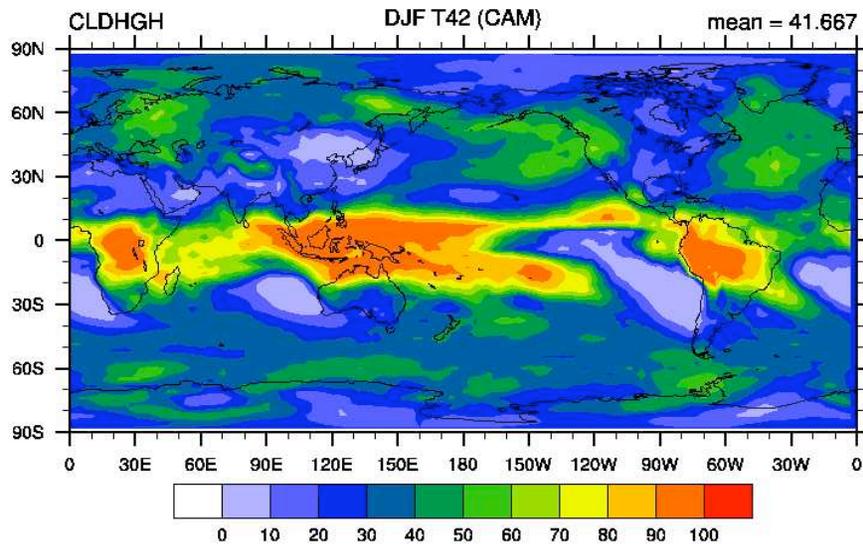
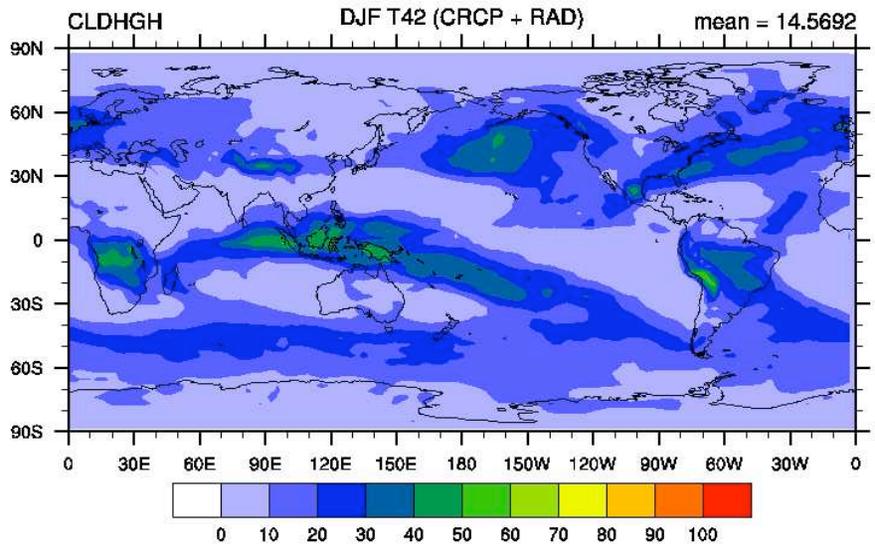
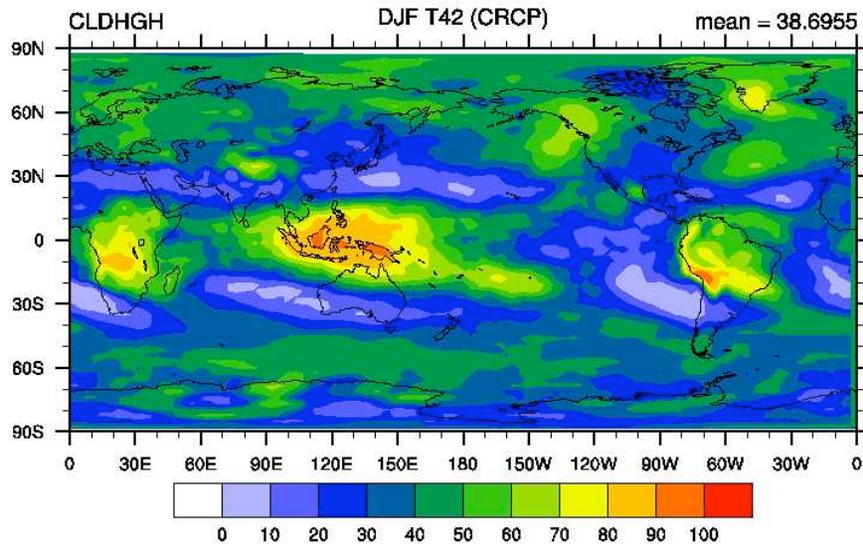


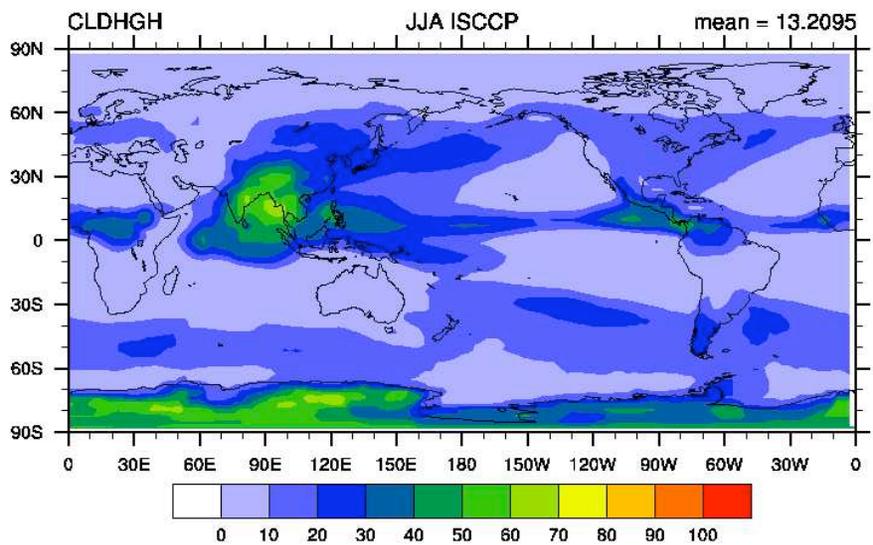
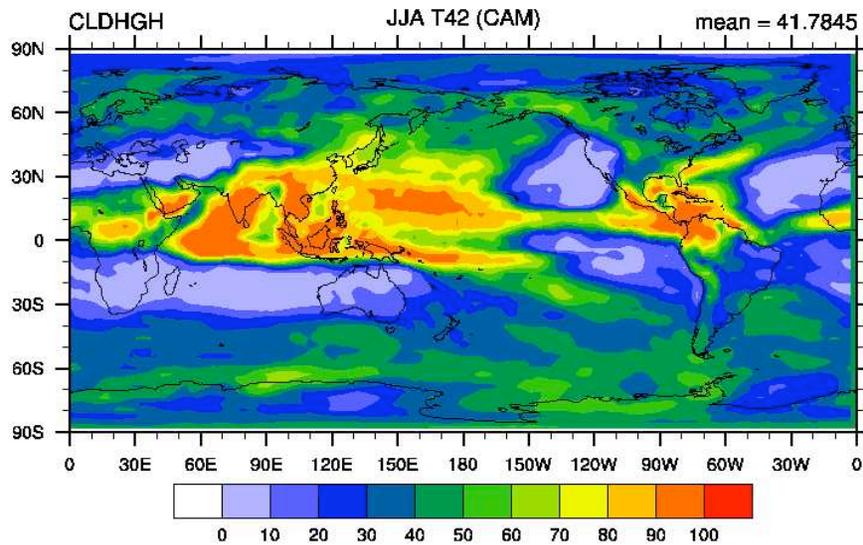
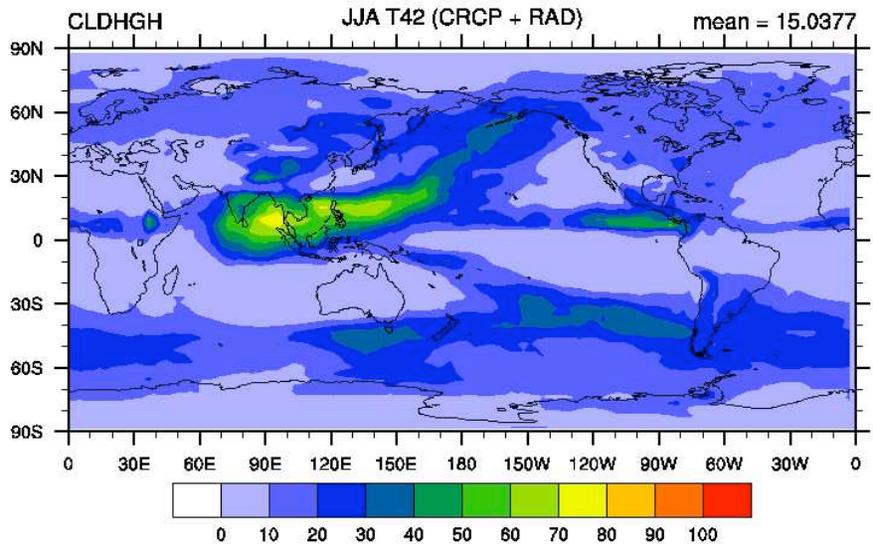
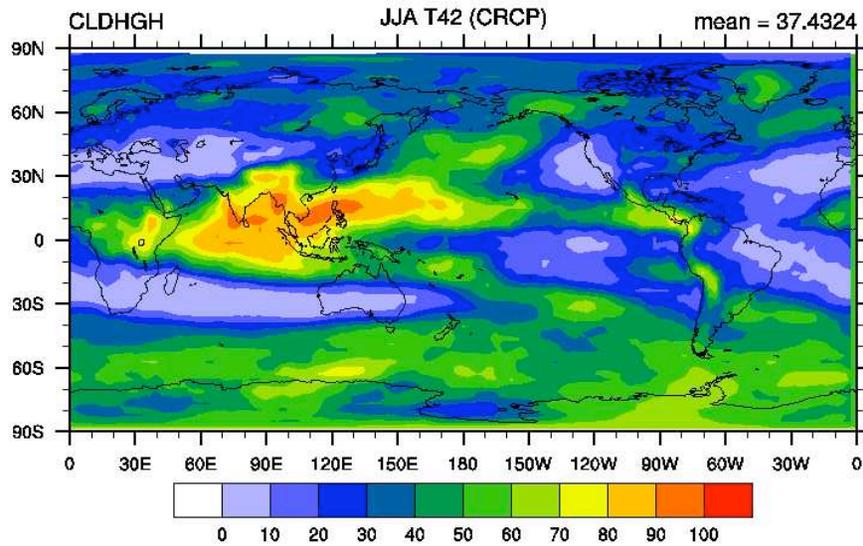


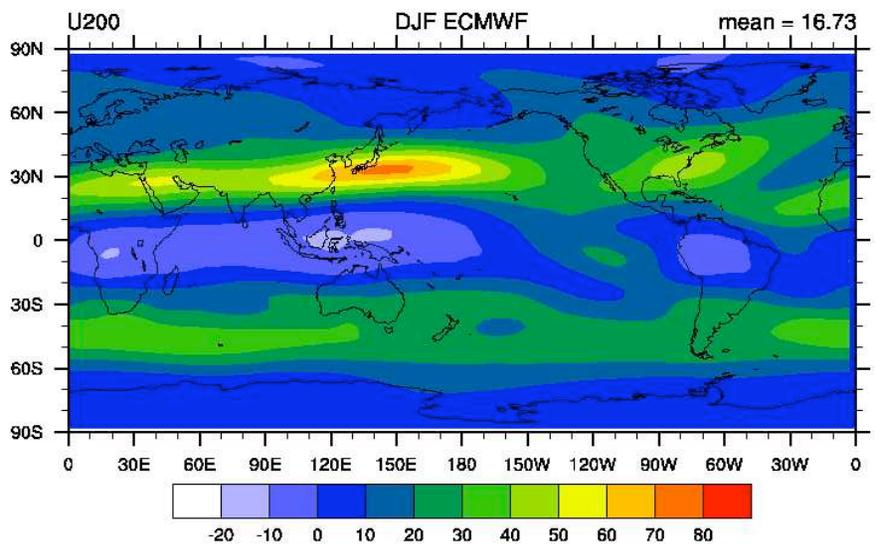
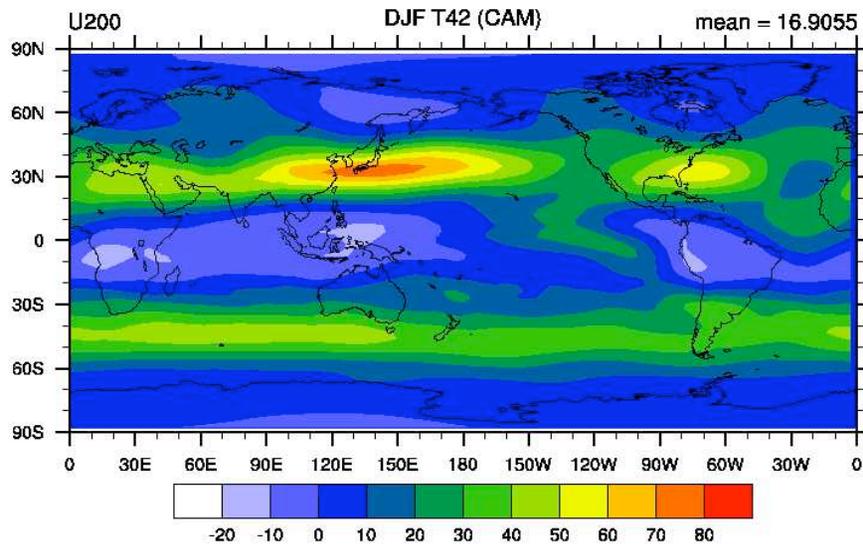
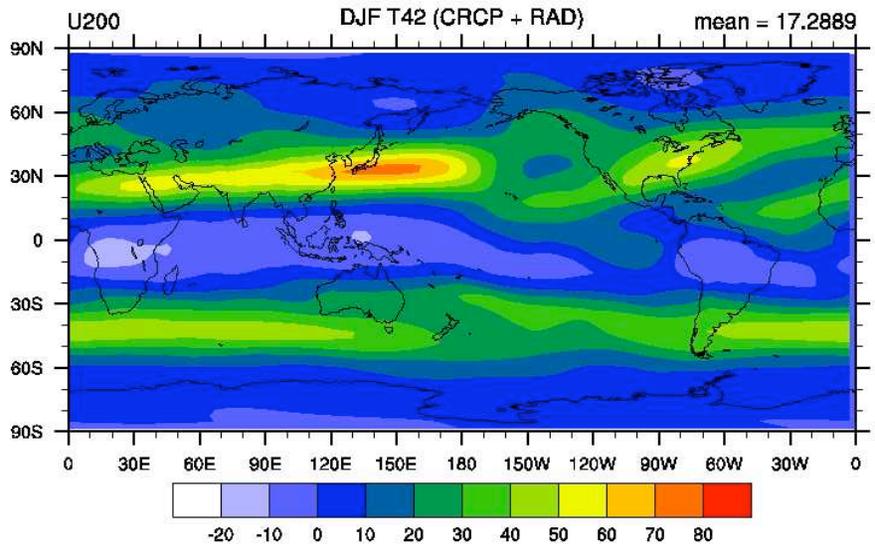
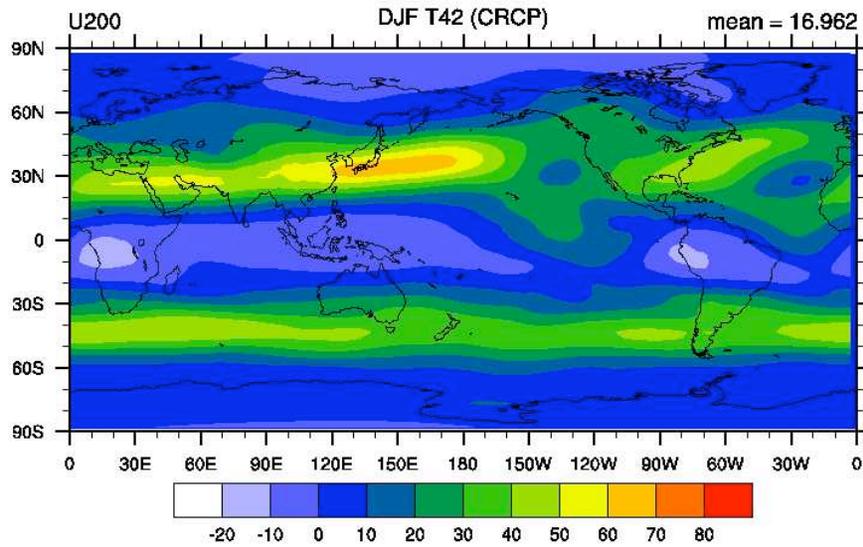




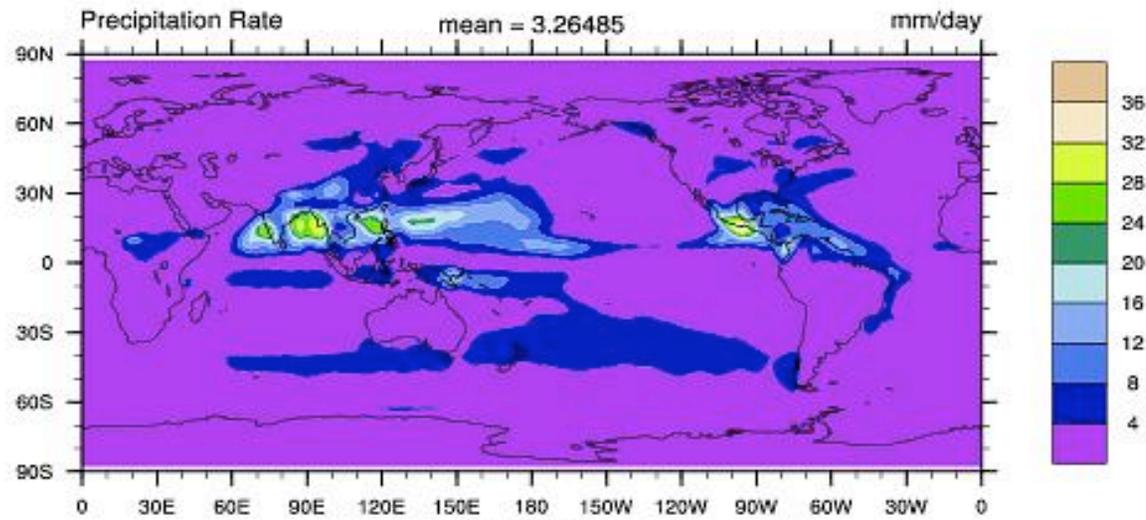




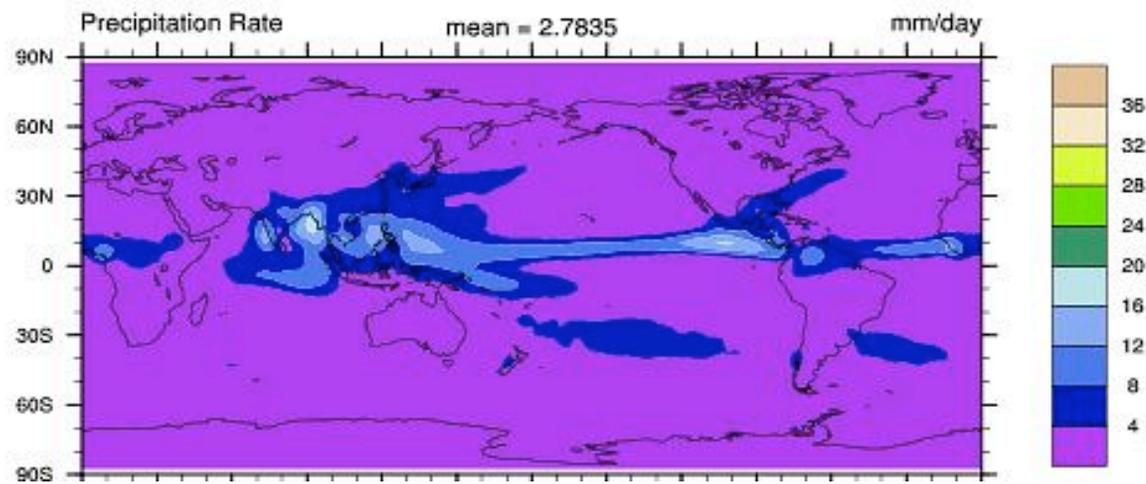




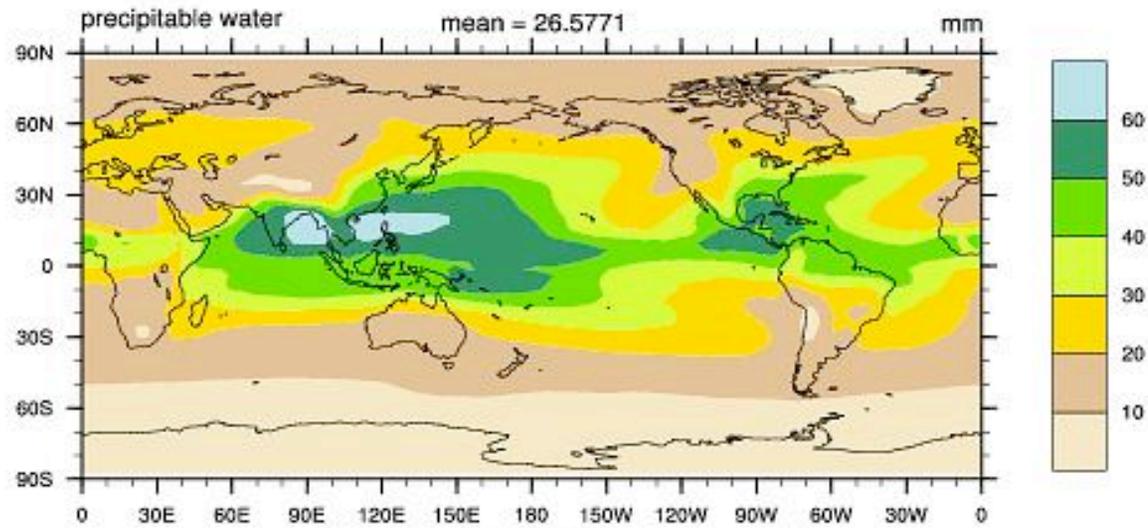
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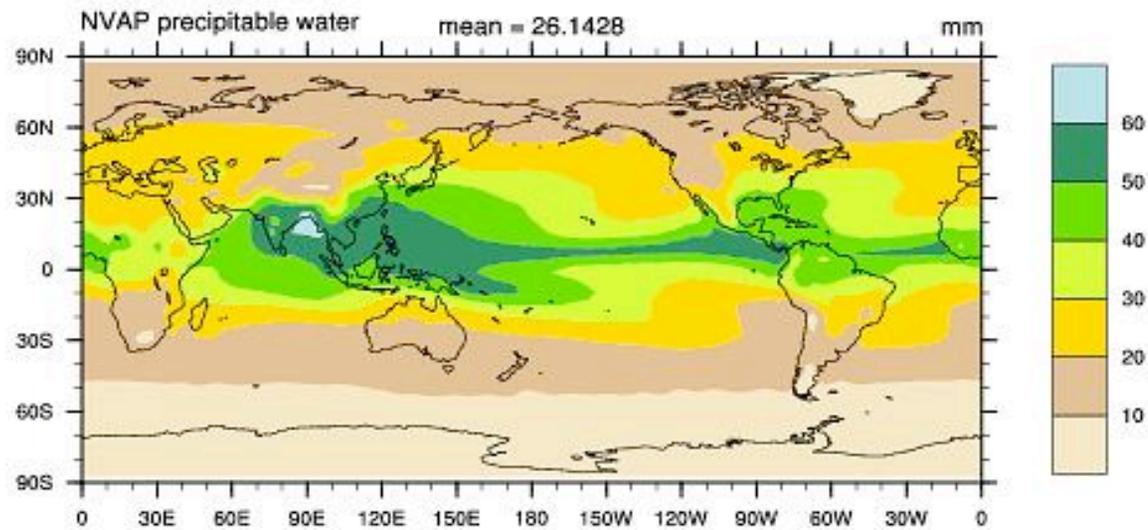
obs data



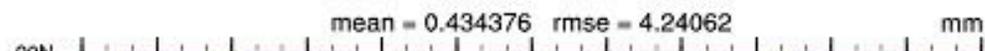
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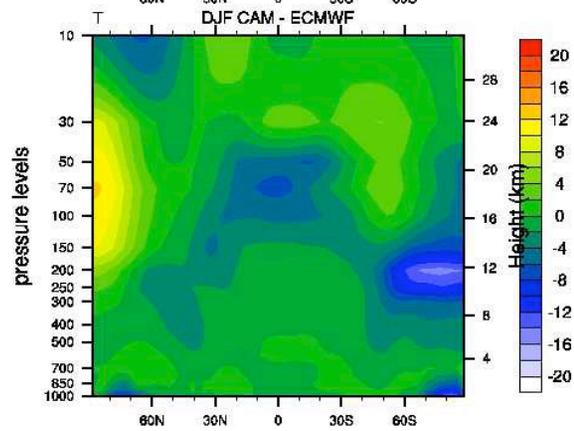
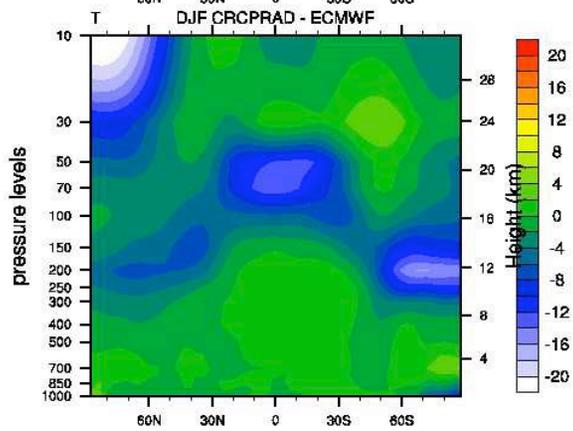
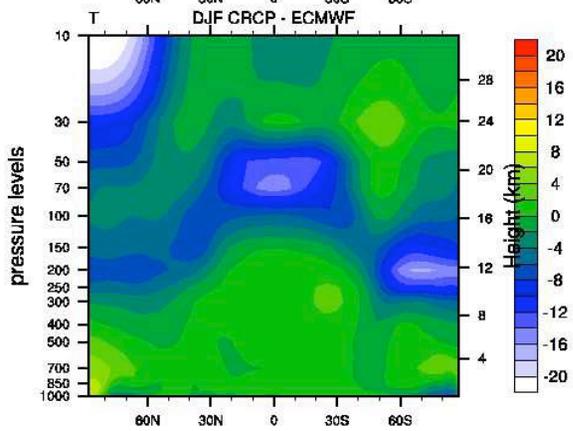
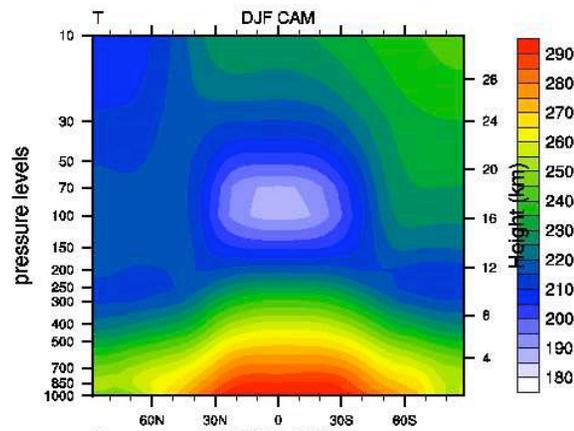
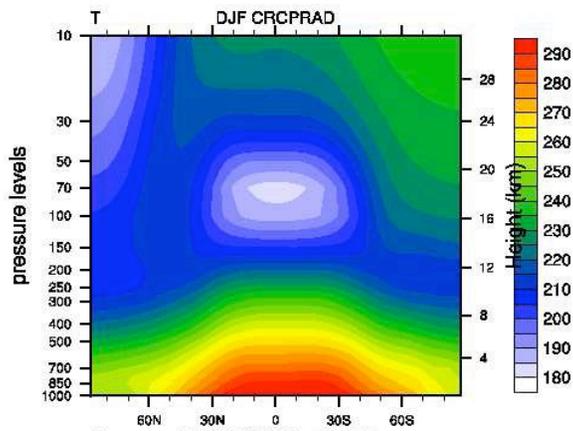
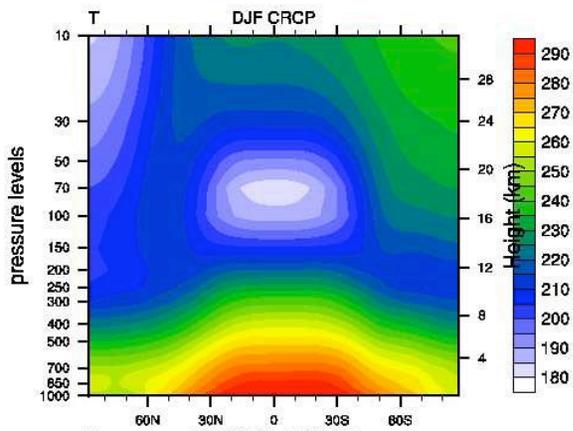


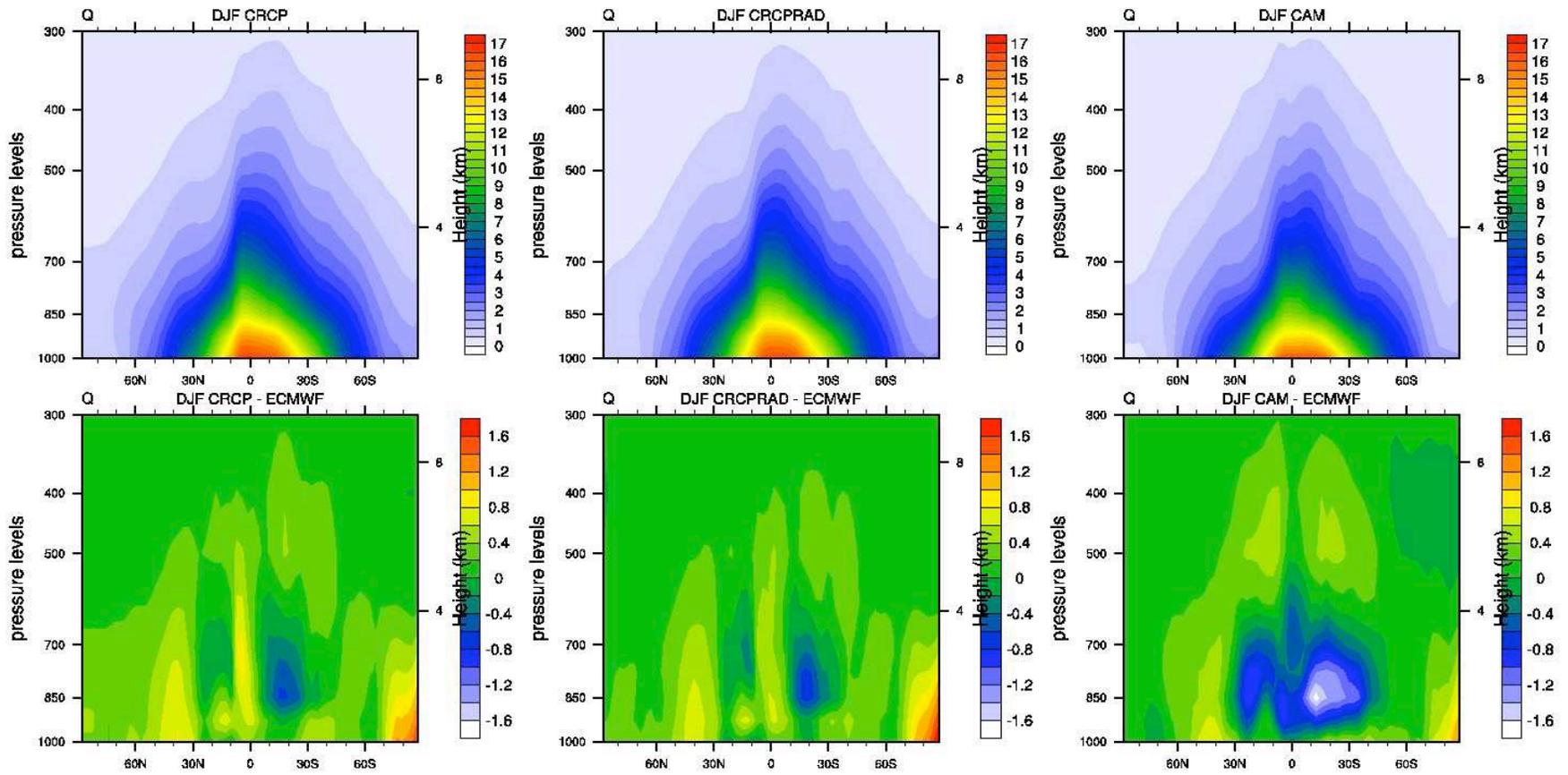
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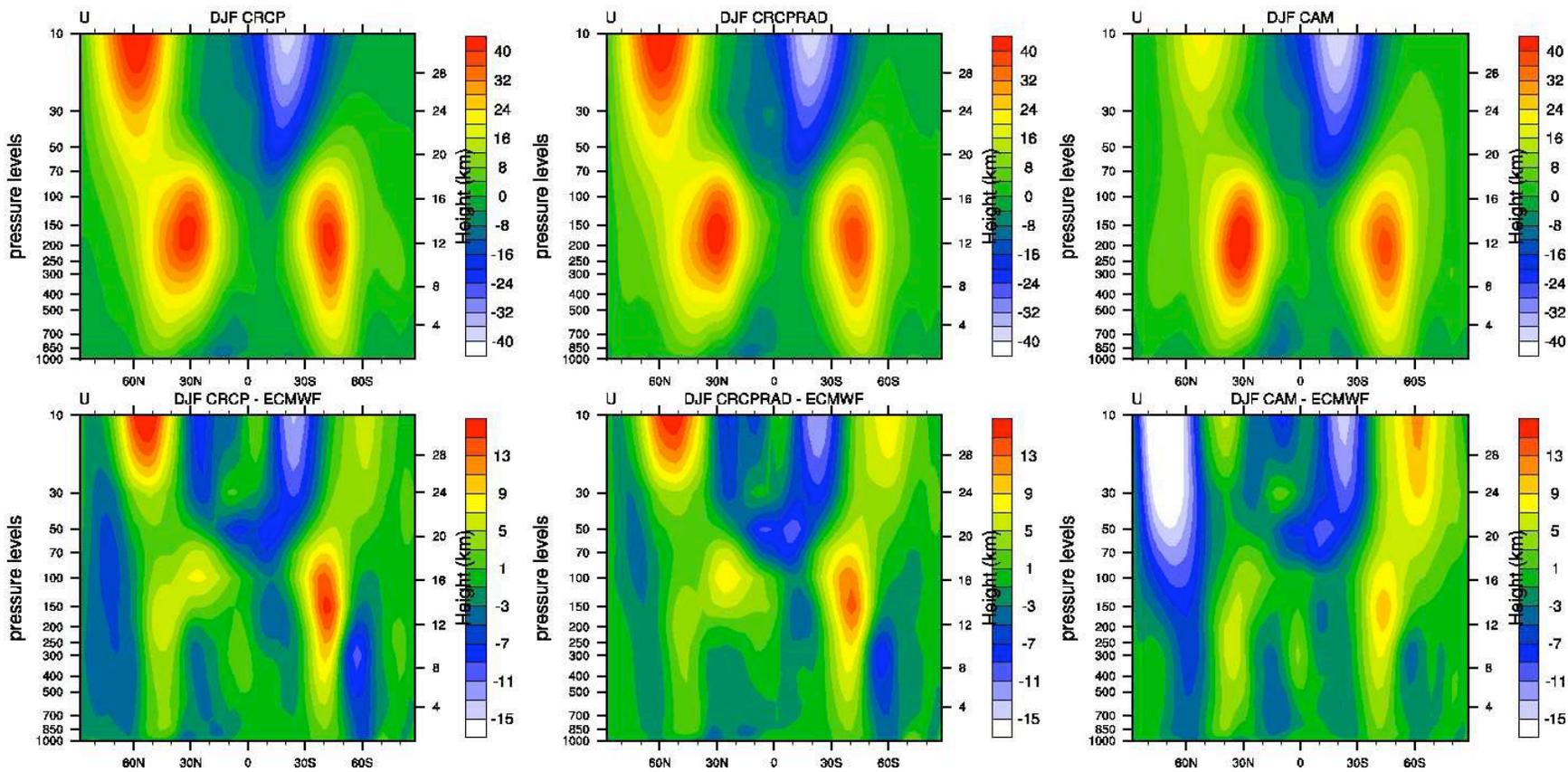


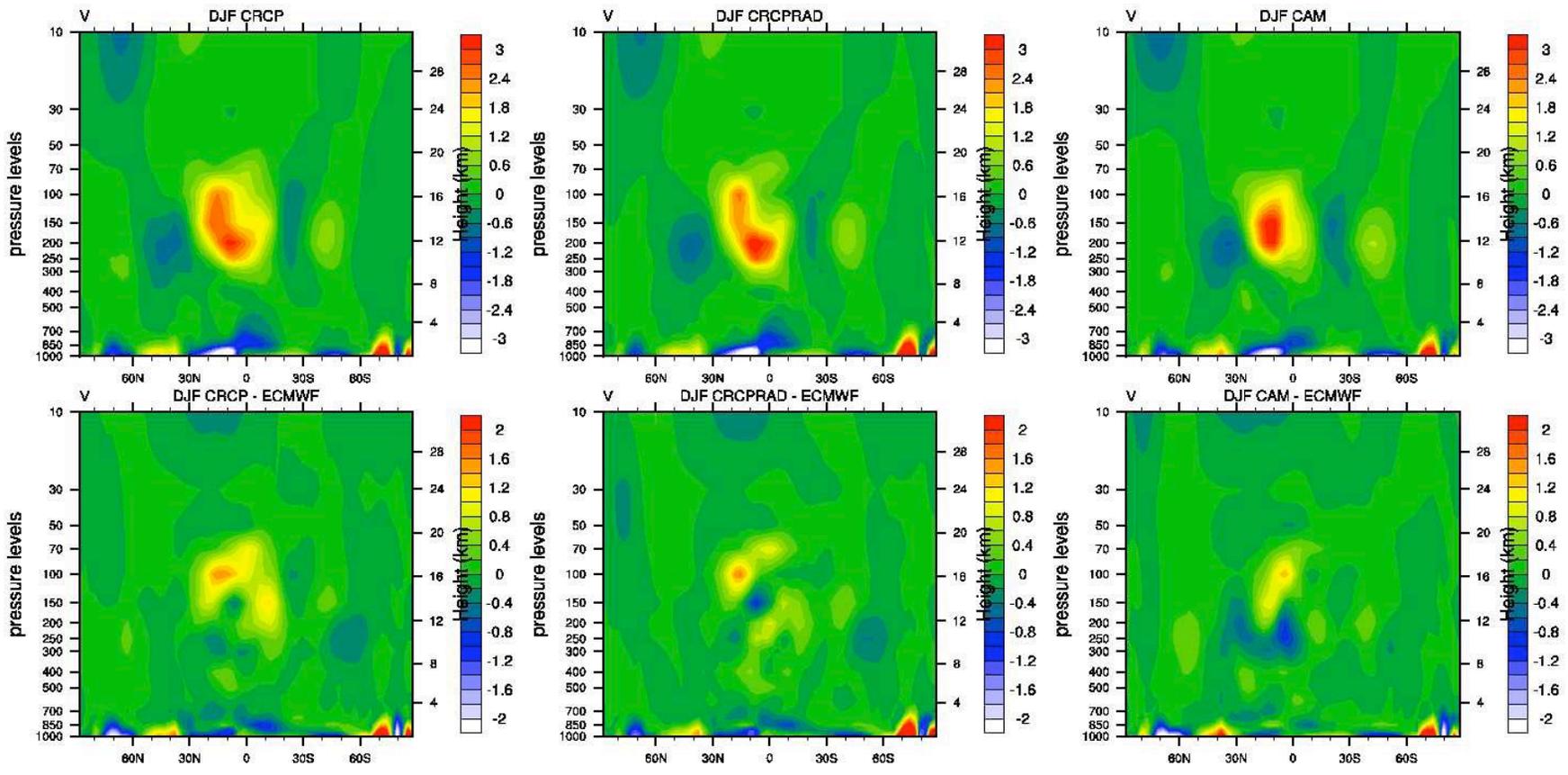
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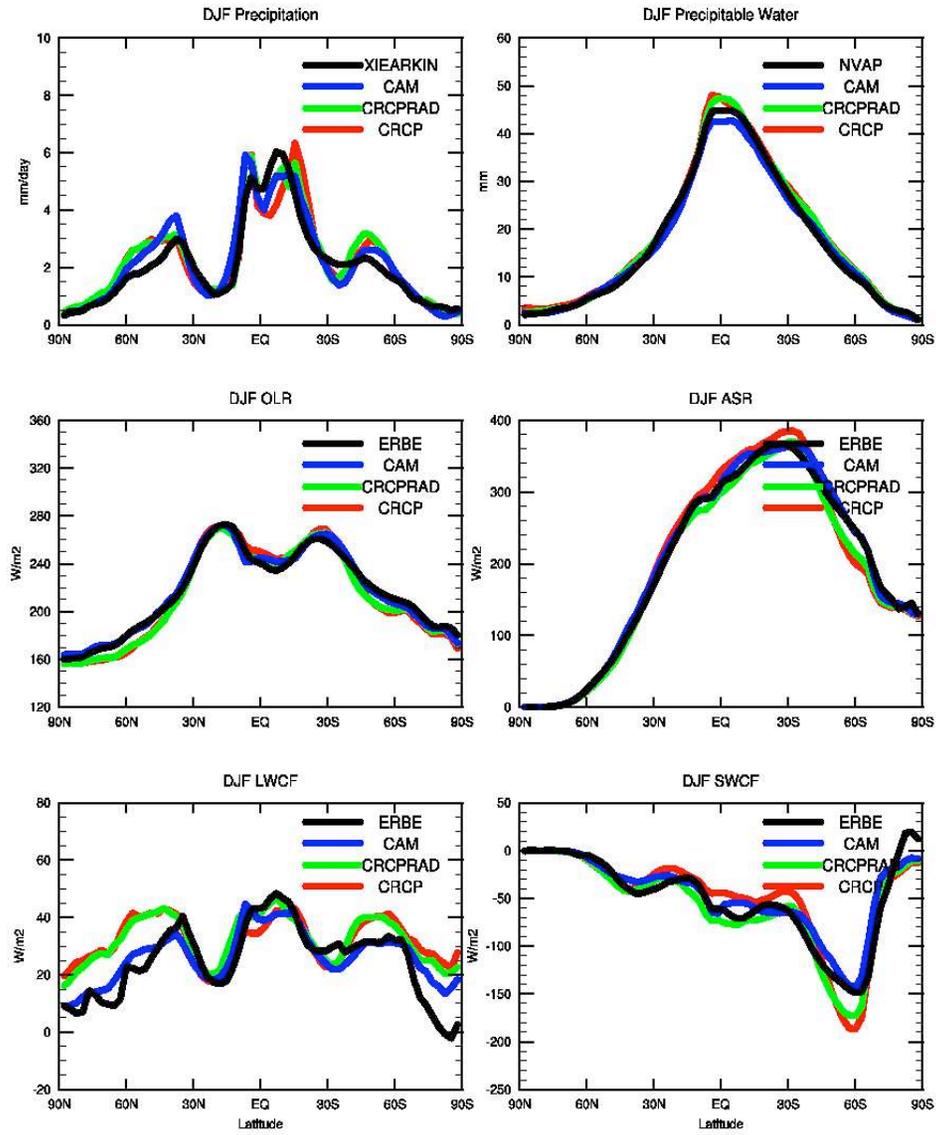


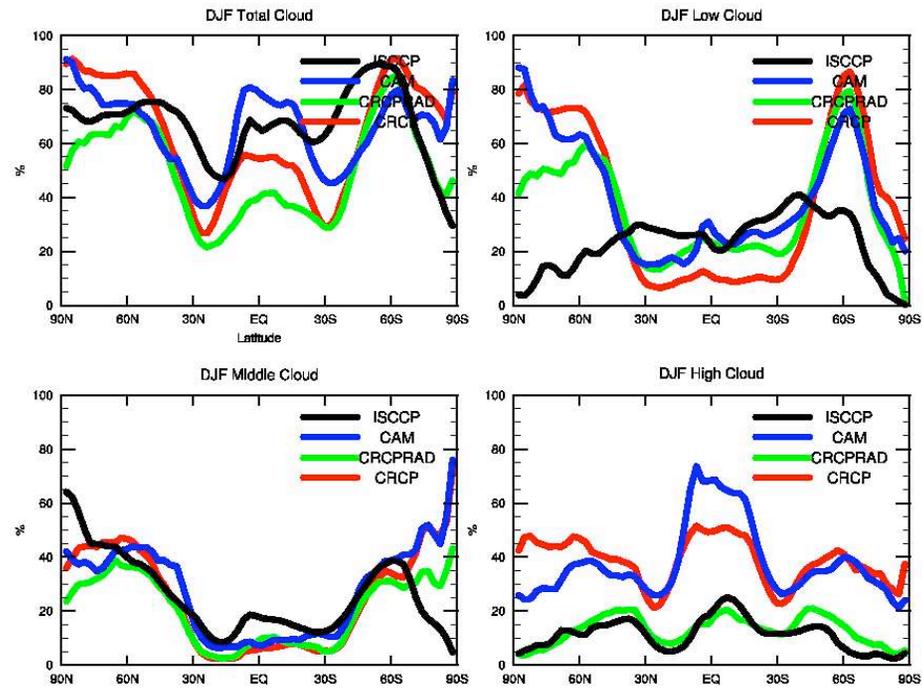


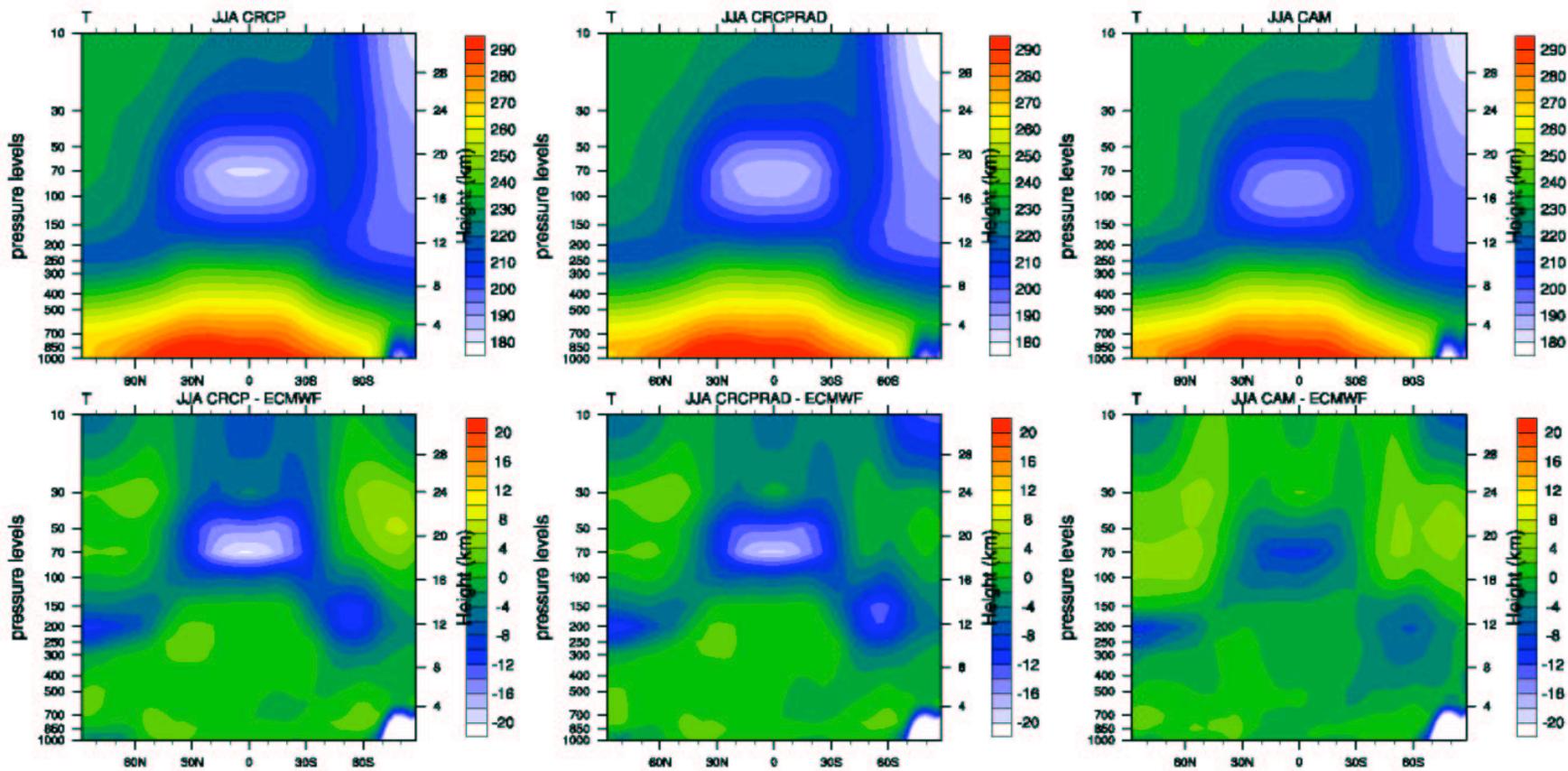


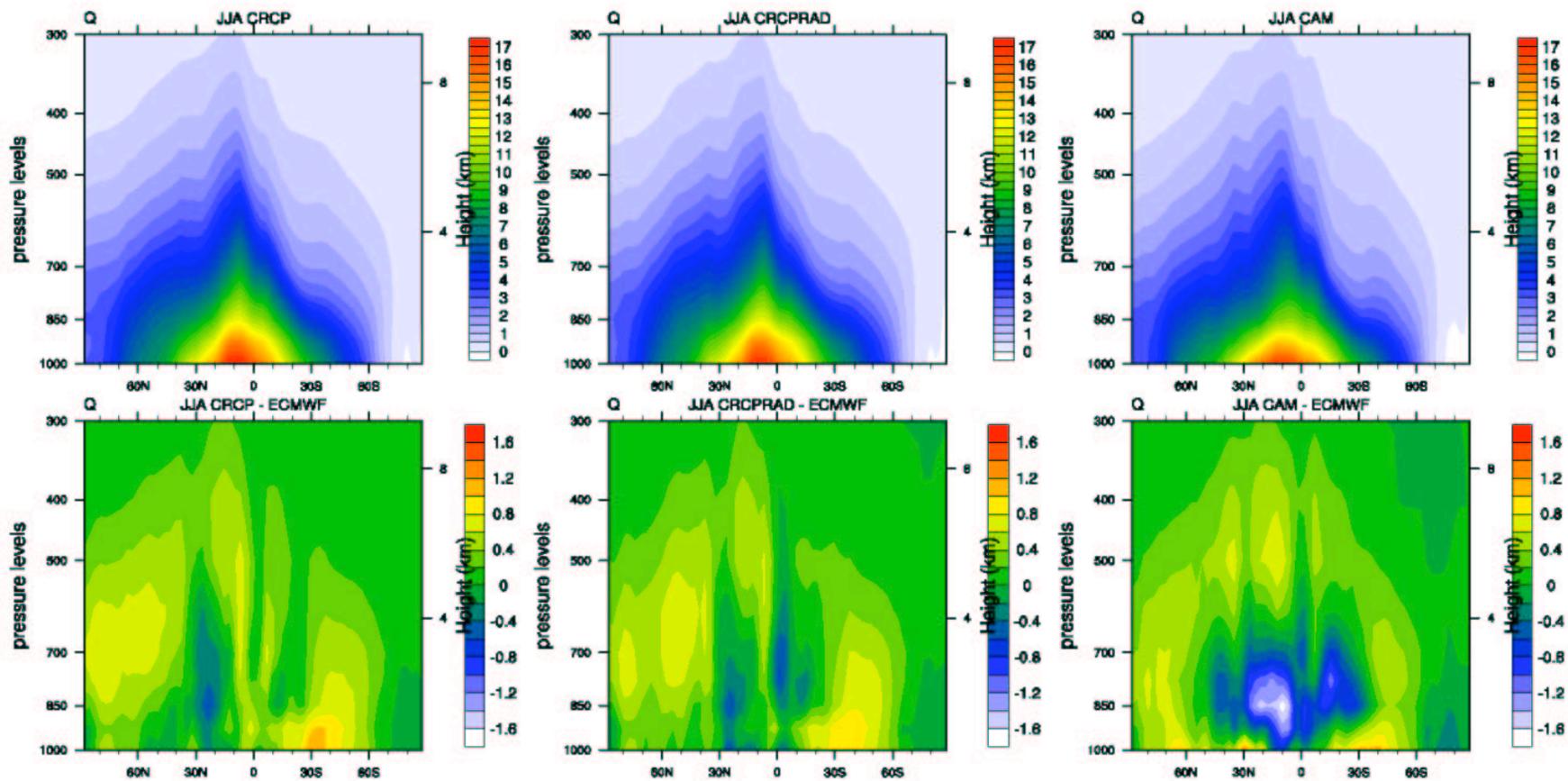


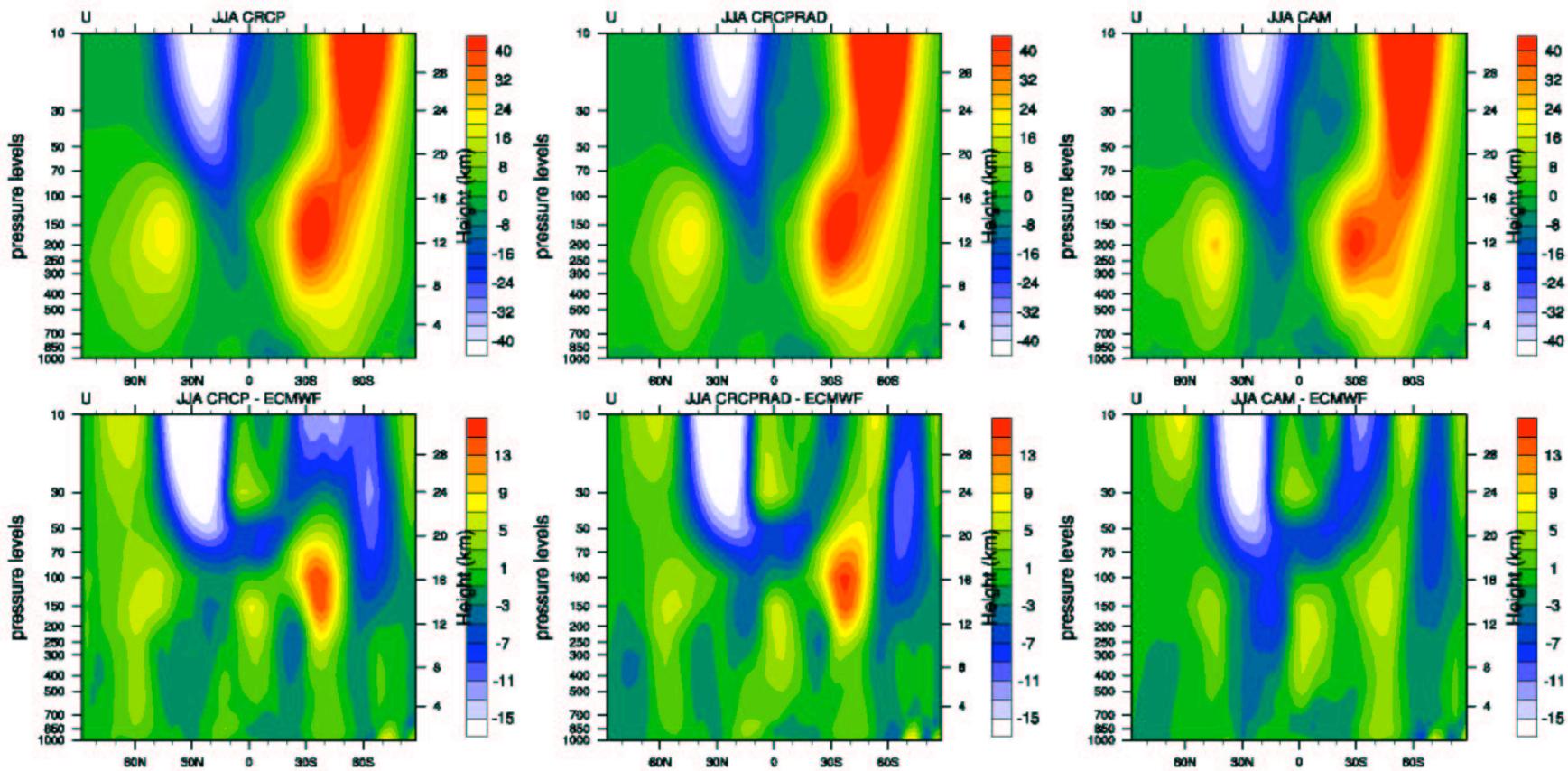


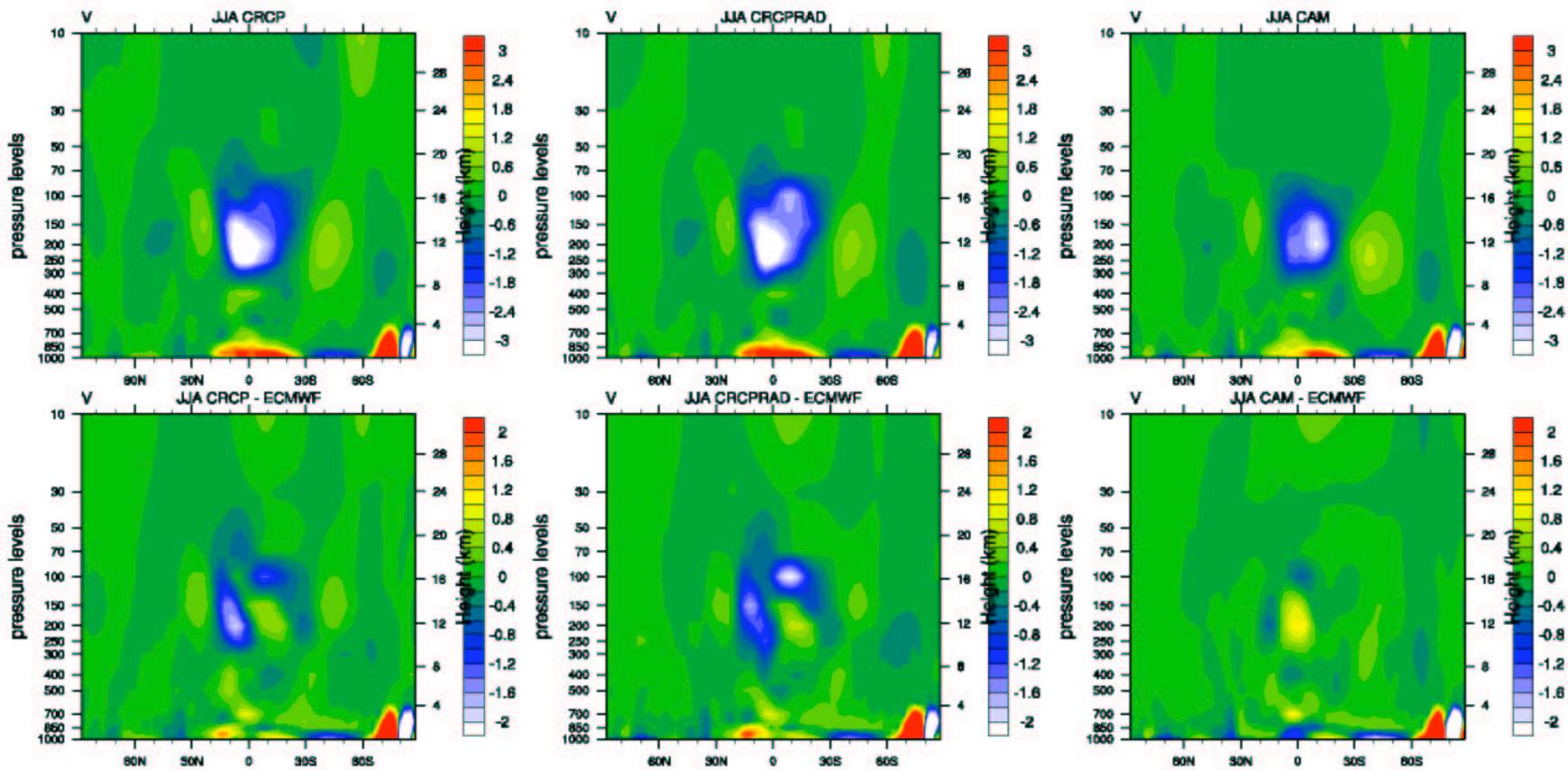


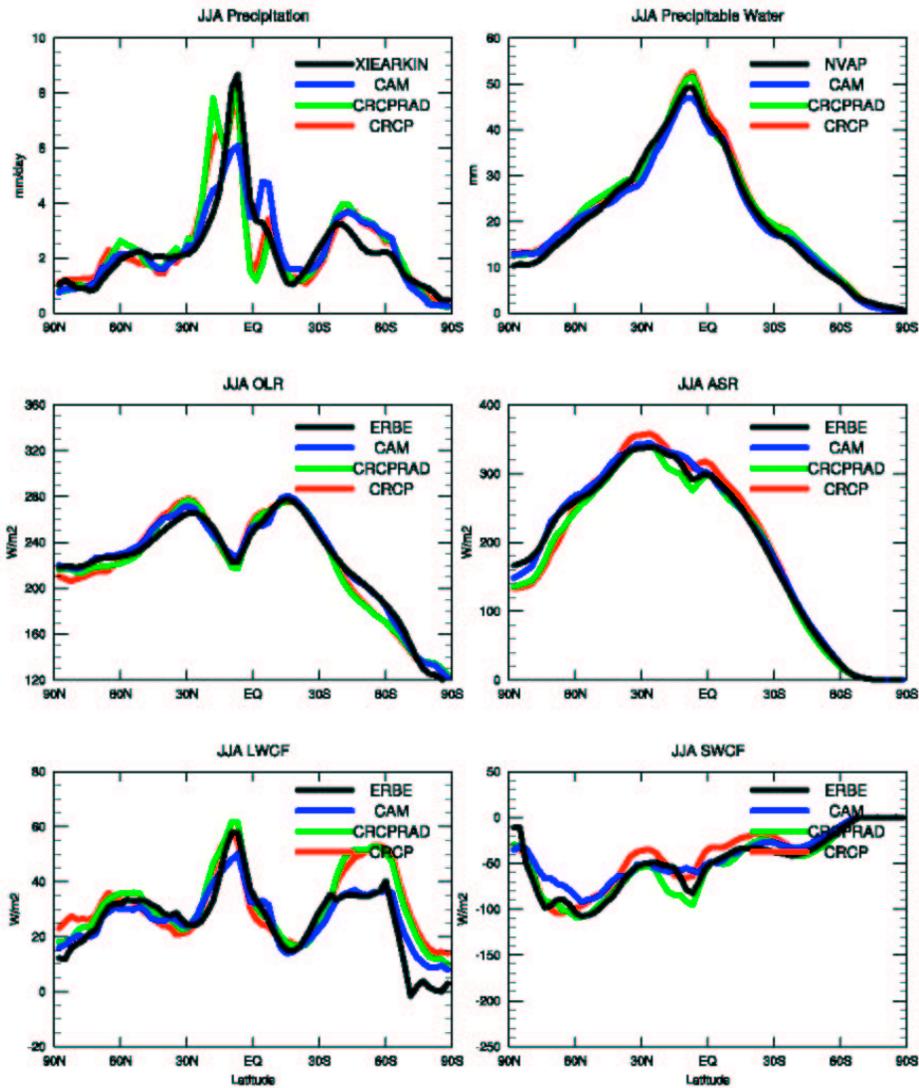


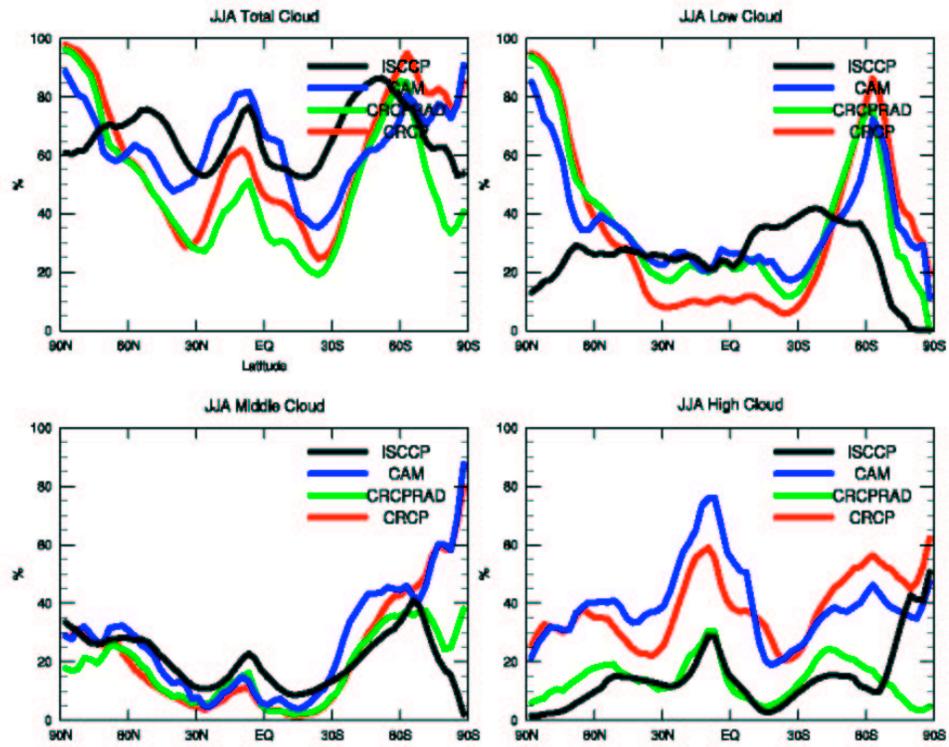












So, what's new since the BAMS paper?

- Two T42 L26 500-day runs
- Interactive CRM-radiation test
- Realistic seasonal cycle of the ITCZ
- Improved low-cloud and high-cloud covers with interactive CRM-radiation
- MJO
- Discovery of the Great Red Spot

Next Steps (by the next workshop)

- Lin-Rood dynamical core runs
- Understanding the GRS
- PBL & Shallow-Cloud CRCP (LEP)
- Additional diagnostics (need suggestions)
- Single-column version runs

PBL & Shallow CRCP?

- Current CRCP is too coarse to resolve the PBL and shallow clouds
- Maybe we need a second 2-D model - Large-Eddy Parameterization (LEP) - that deals specifically with the low clouds?
- Domain: 10 x 24 grid; $\Delta x = 250$ m; $\Delta t = 5$ s
- Vertical grid is the same as the CRCP

PBL & Shallow CRCP?

- **Issue:** Should it talk to the deep CRCP or directly to the GCM?
- **Issue:** What if the LEP wants to make a deep cloud?
- **Issue:** Double Expense?
- **Solution :** Run deep CRCP with a double time step in parallel with the shallow CRCP. Shut down the latter when deep clouds are present. (Criterion???)

Update on super- parameterization work at CSU

Marat Khairoutdinov