South American Low-Level Jet and Precipitation in GFDL AM2

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Overview

- Clouds and convection in AM2p12a
- South American low-level jet in AM2p12a
- South American precipitation patterns in AM2p12a
- Dependence of precipitation on cumulus parameterization

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Clouds and Convection in AM2p12a

- Cumulus parameterization is Relaxed Arakawa-Schubert with closure based on relaxing cloud work function (CAPE for non-entraining clouds) to thresholds
- Prognostic cloud fraction parameterization (Tiedtke, 1993, *Mon. Wea. Rev.*)
- Prognostic microphysics (Rotstayn, 1997, *QJRMS;* Rotstayn et al., 2000, *Mon. Wea. Rev.*)

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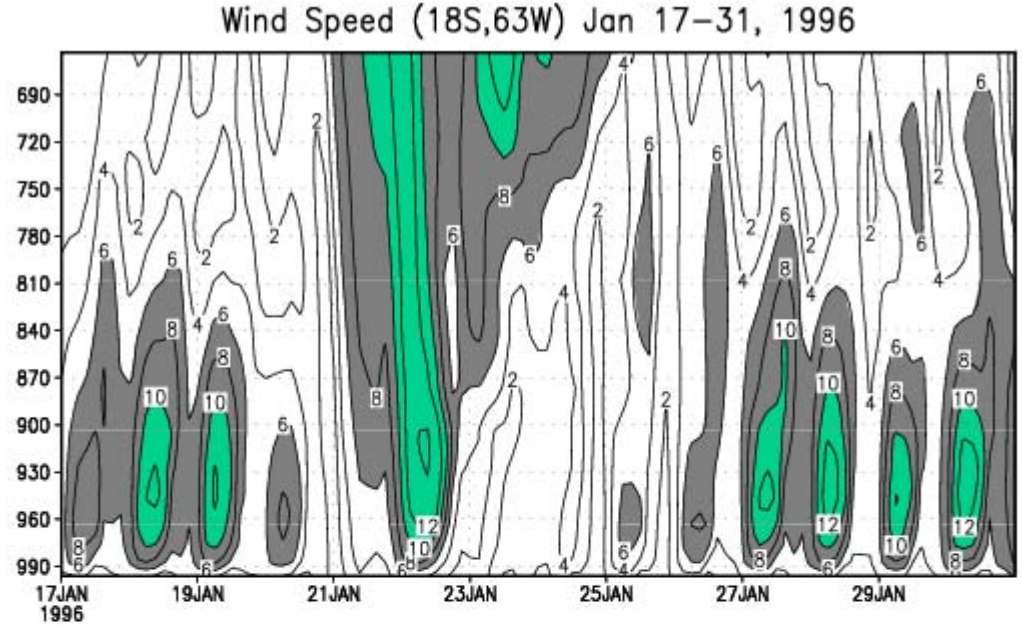

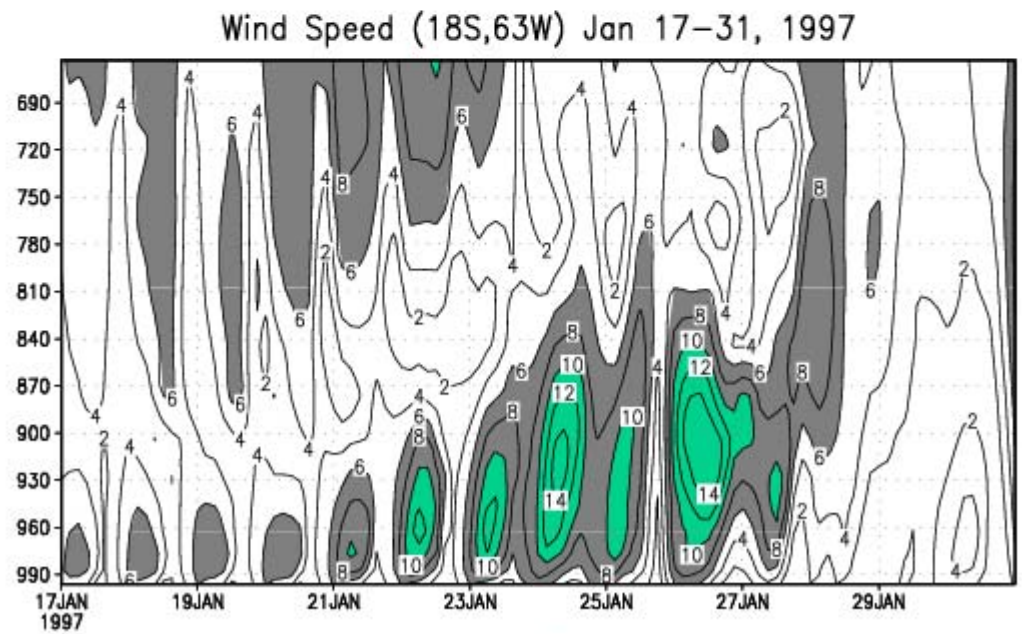

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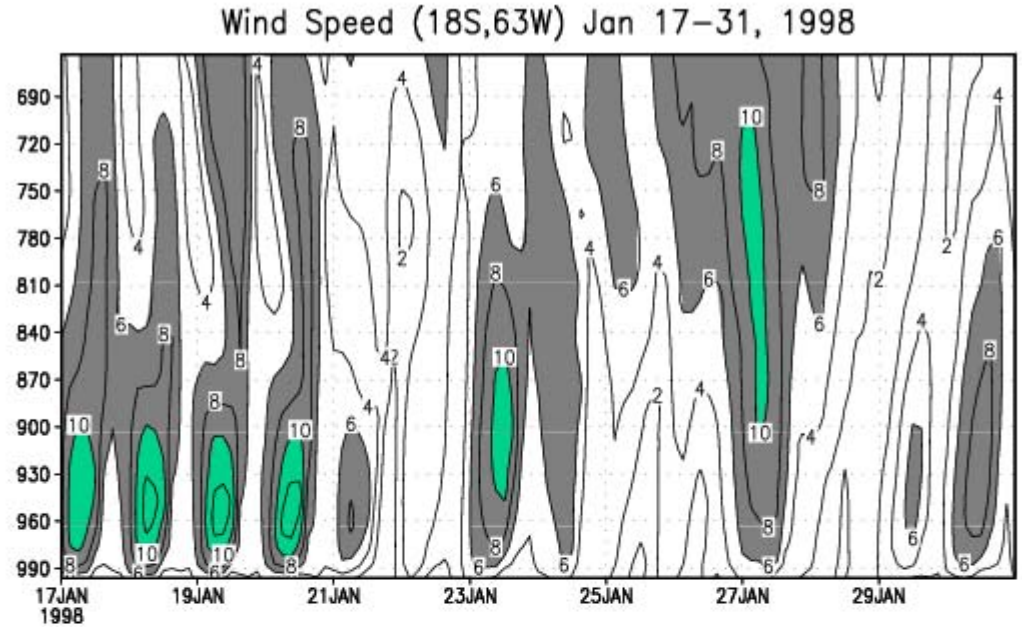

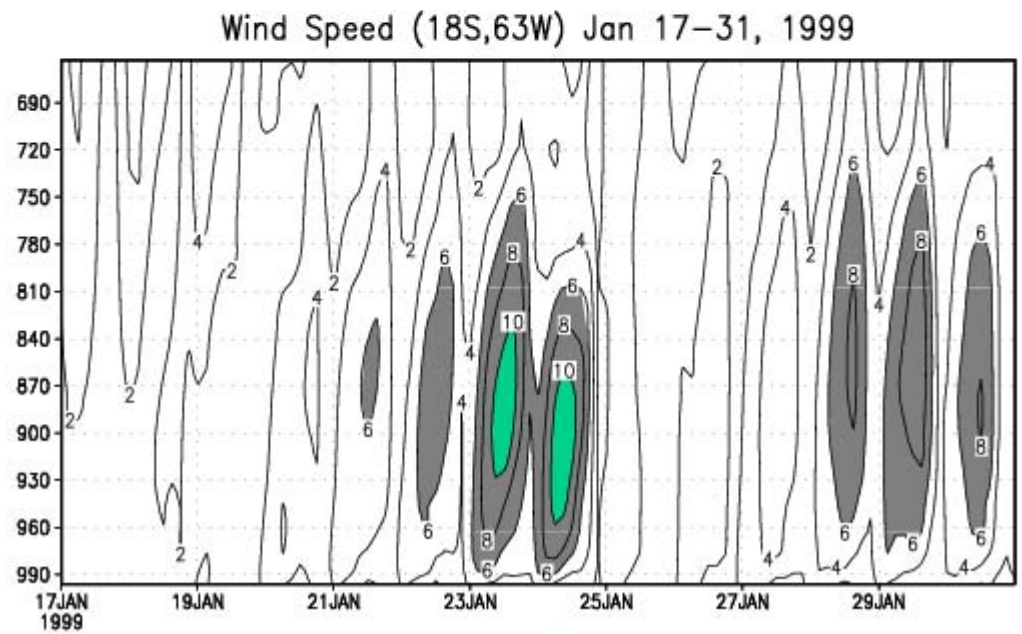

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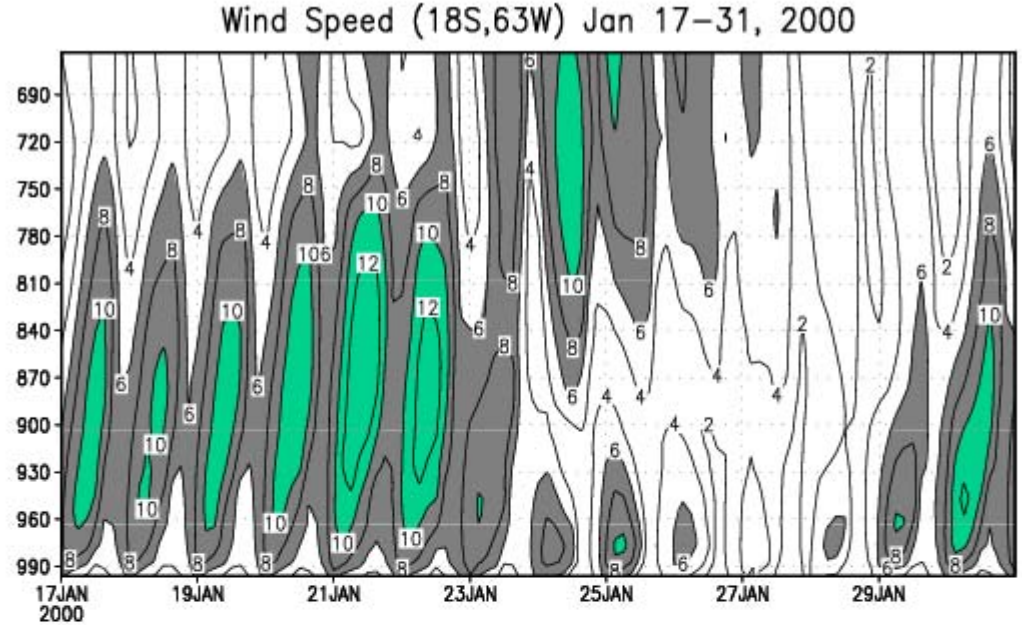
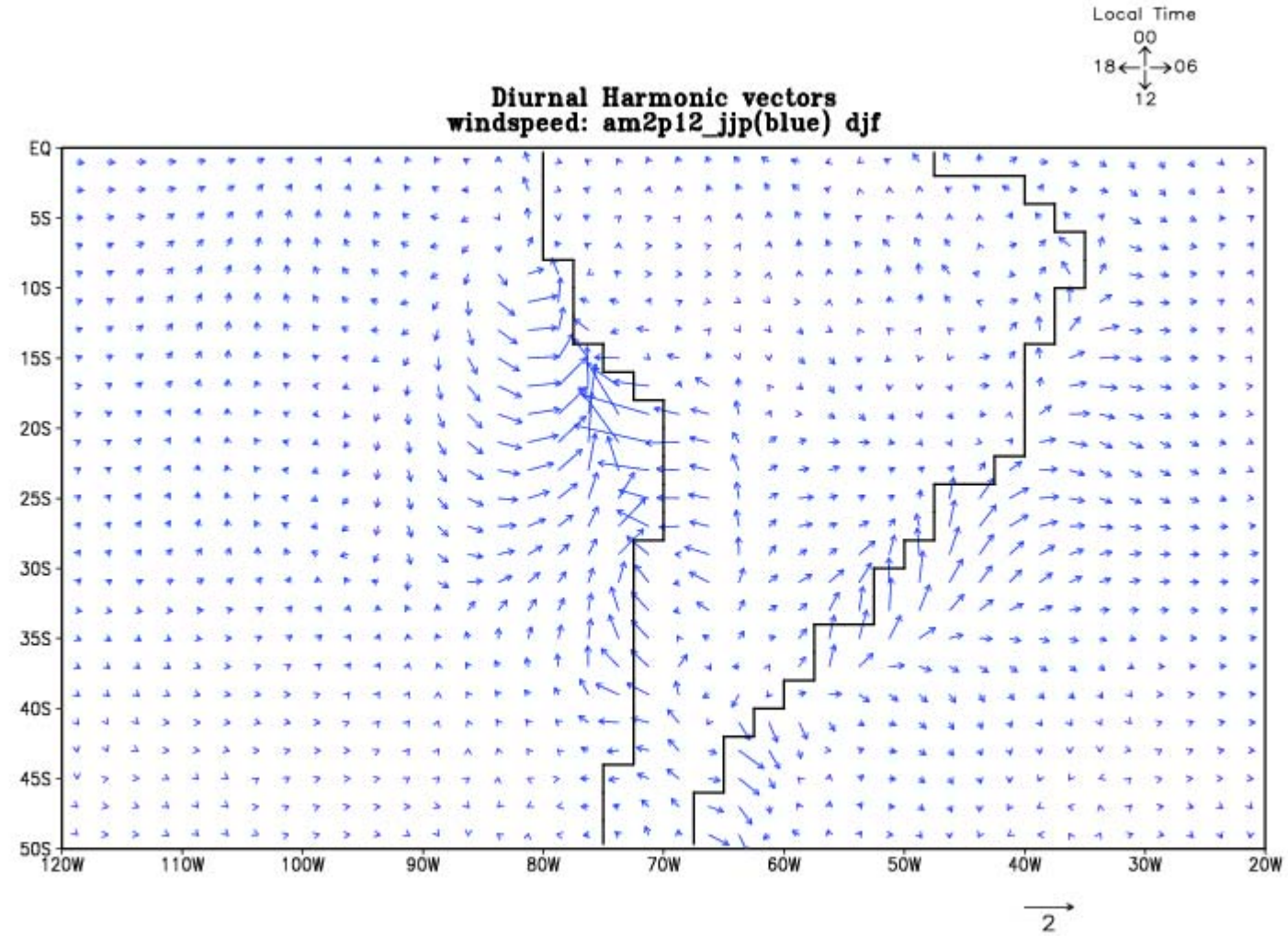
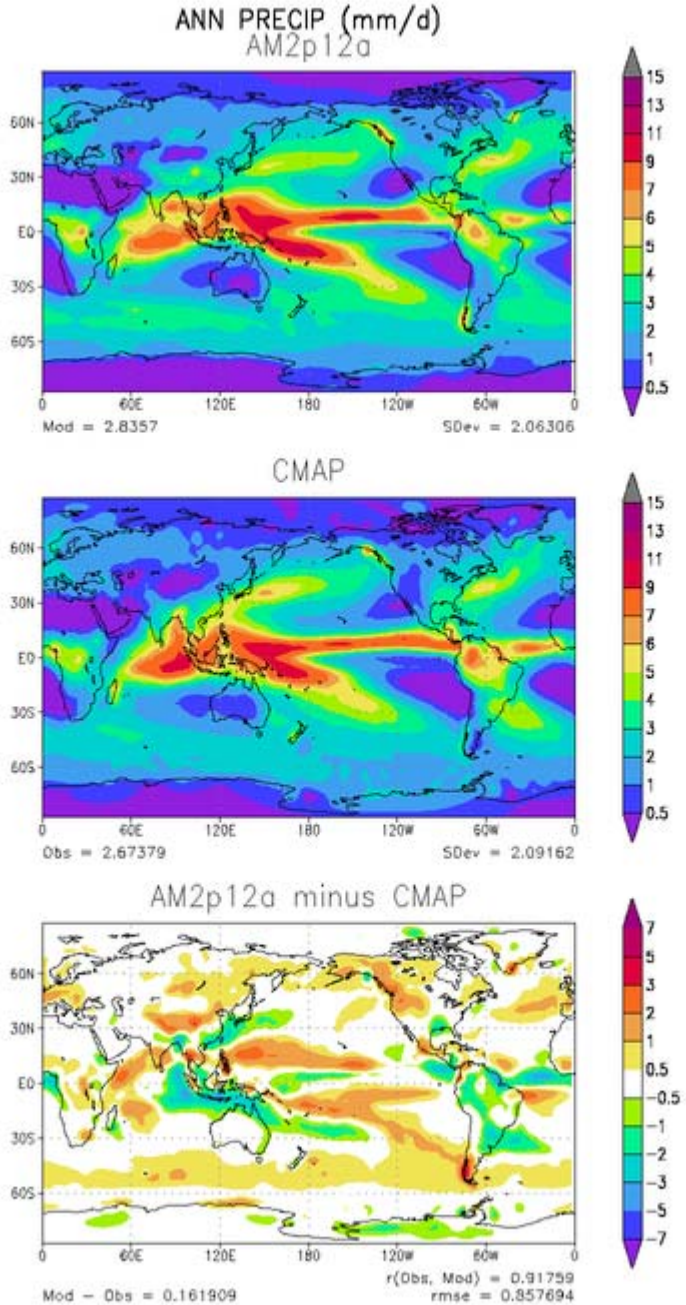
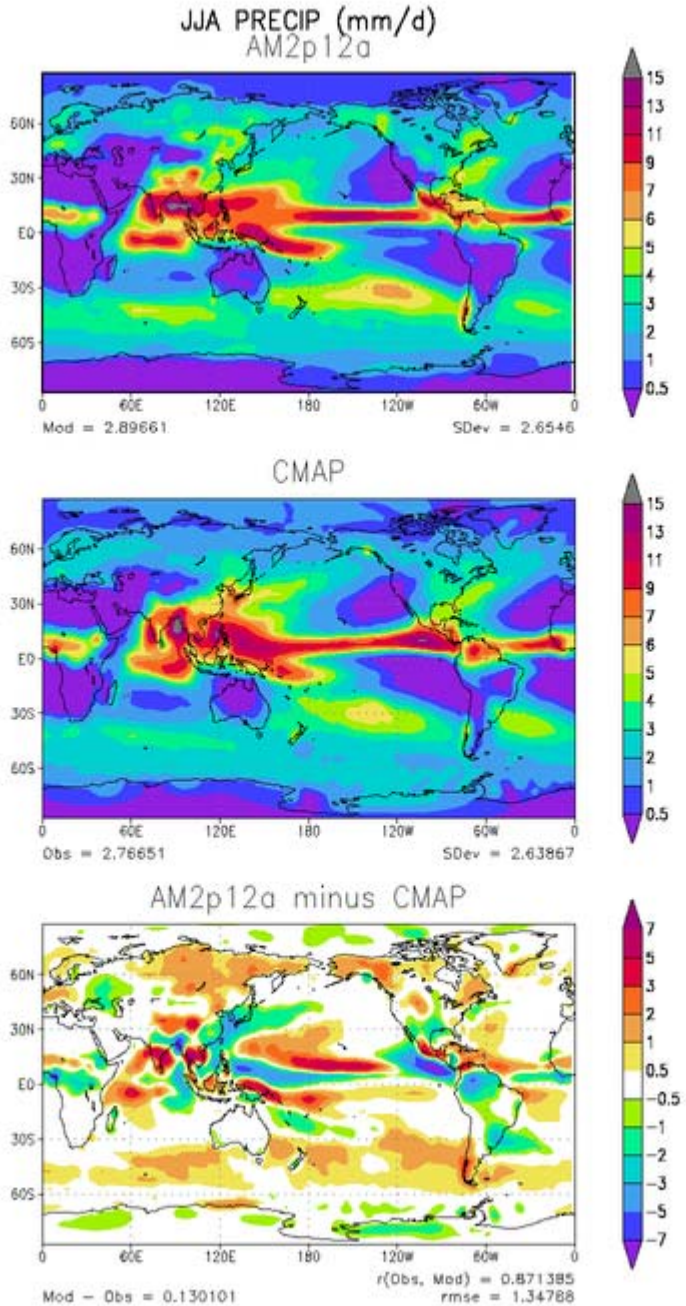
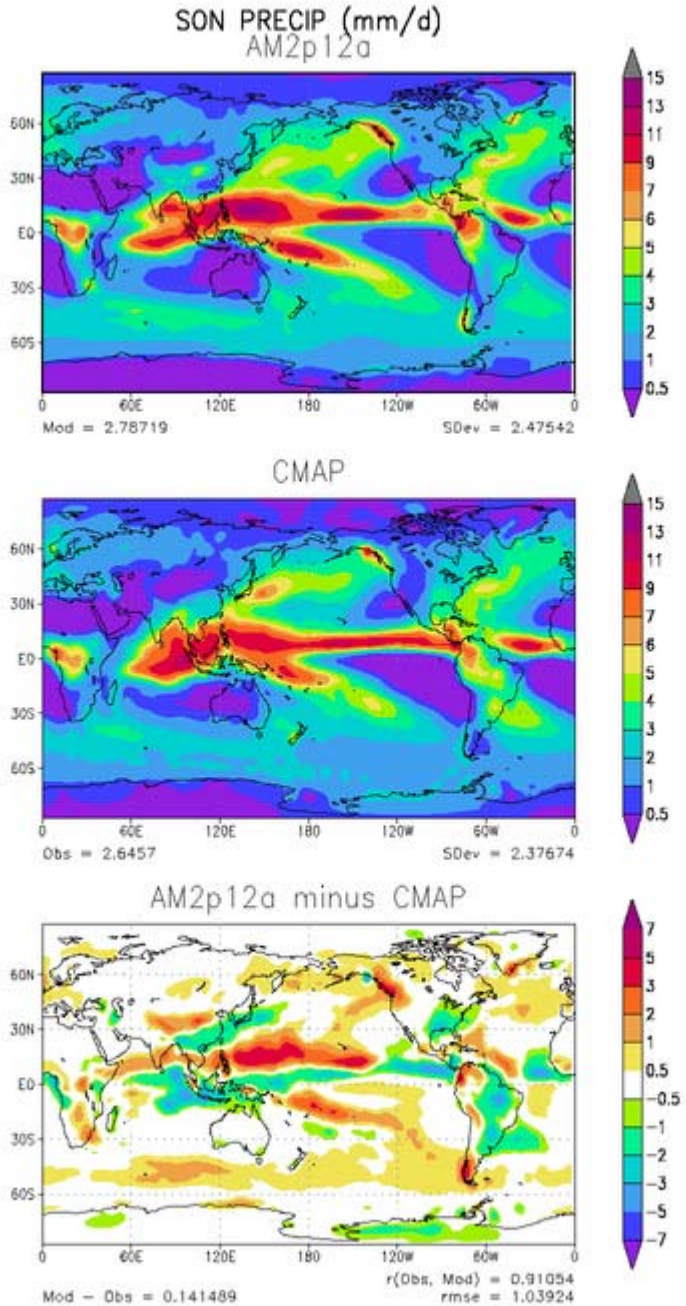

Wind Speed (18S,63W) Jan 17–31, 2000
690
720
750
780
810
840
870
900
930
960
990
17JAN
2000
19JAN
21JAN
23JAN
25JAN
27JAN
29JAN

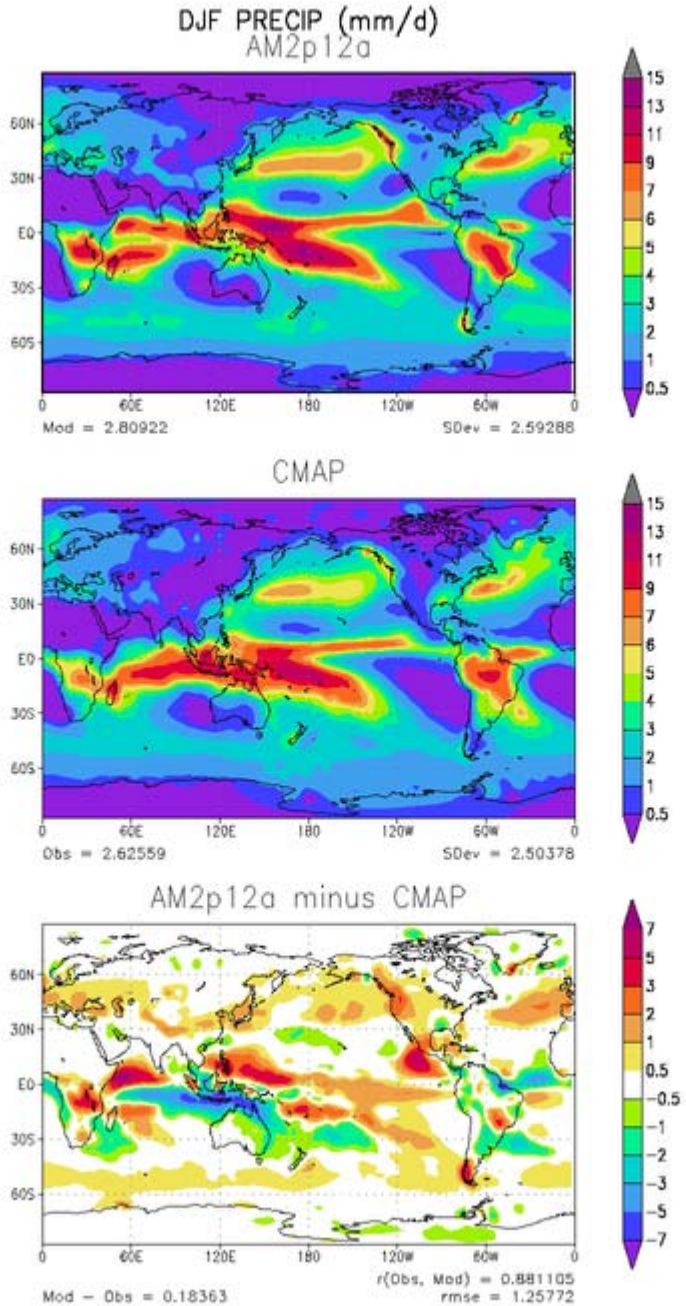

6
10

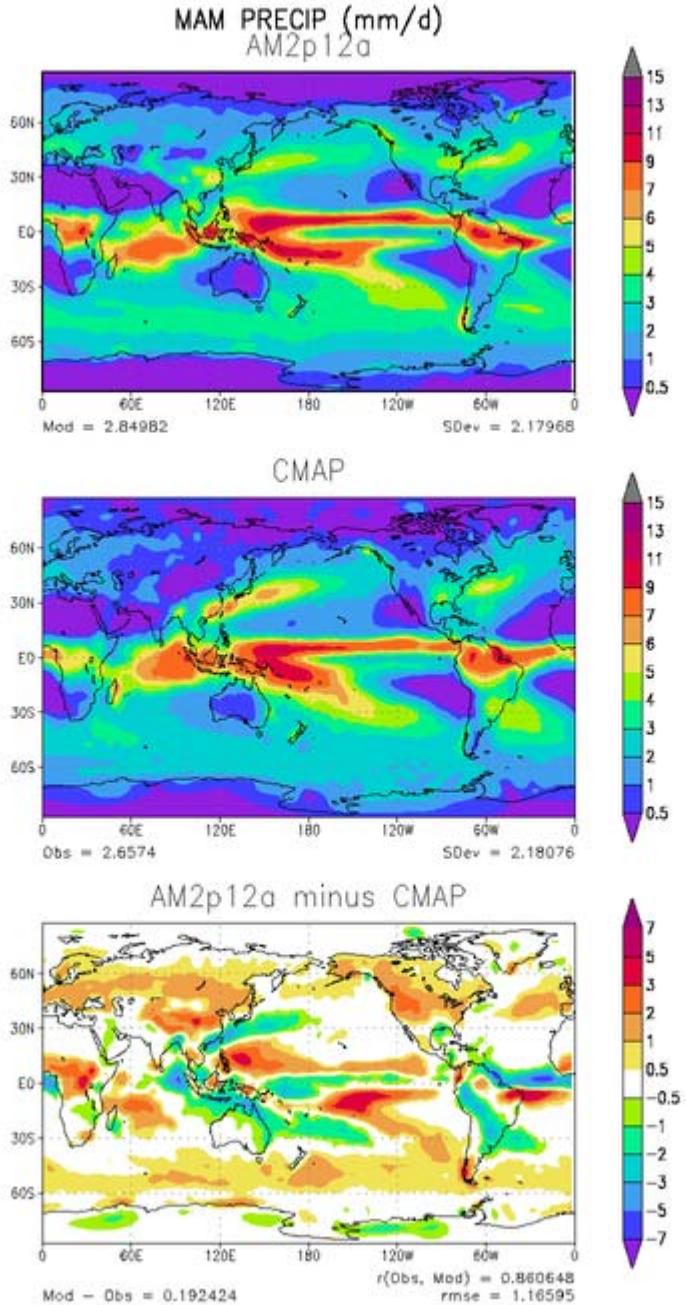

Local Time
00
18
06
12
Diurnal Harmonic vectors
windspeed: am2p12_jjp(blue) djf
EQ
5S
10S
15S
20S
25S
30S
35S
40S
45S
50S
120W
110W
100W
90W
80W
70W
60W
50W
40W
30W
20W
2
GrADS: COLA/IGES
2003-12-04-10:08


ANN PRECIP (mm/d)
AM2p12a
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
Mod = 2.8357
SDev = 2.06306
15
13
11
9
7
6
5
4
3
2
1
0.5
CMAP
Obs = 2.67379
SDev = 2.09162
AM2p12a minus CMAP
Mod − Obs = 0.161909
r(Obs, Mod) = 0.91759
rmse = 0.857694
7
5
3
2
1
0.5
−0.5
−1
−2
−3
−5
−7


JJA PRECIP (mm/d)
AM2p12a
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
Mod = 2.89661
SDev = 2.6546
15
13
11
9
7
6
5
4
3
2
1
0.5
CMAP
Obs = 2.76651
SDev = 2.63867
AM2p12a minus CMAP
7
5
3
2
1
0.5
-0.5
-1
-2
-3
-5
-7
Mod - Obs = 0.130101
r(Obs, Mod) = 0.871385
rmse = 1.34788

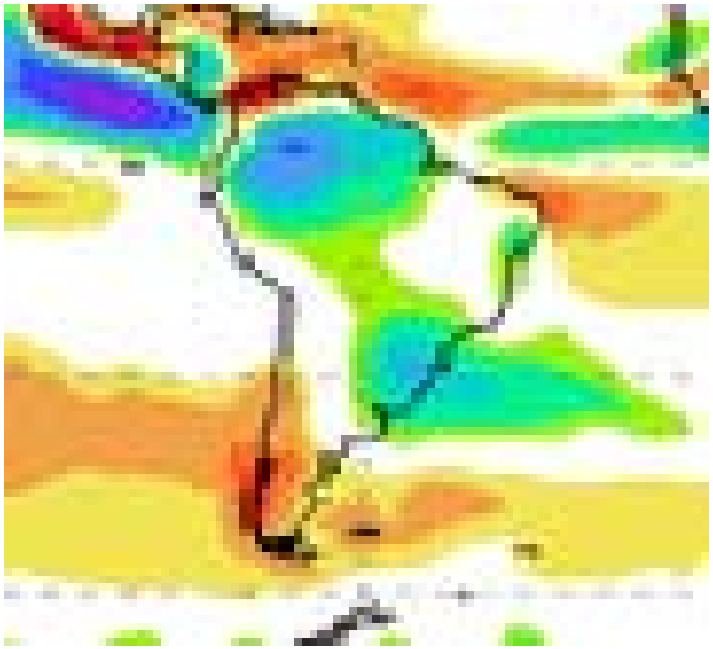

SON PRECIP (mm/d)
AM2p12a
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
Mod = 2.78719
SDev = 2.47542
15
13
11
9
7
6
5
4
3
2
1
0.5
CMAP
Obs = 2.6457
SDev = 2.37674
AM2p12a minus CMAP
Mod − Obs = 0.141489
r(Obs, Mod) = 0.91054
rmse = 1.03924
7
5
3
2
1
0.5
−0.5
−1
−2
−3
−5
−7


DJF PRECIP (mm/d)
AM2p12a
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
Mod = 2.80922
SDev = 2.59288
15
13
11
9
7
6
5
4
3
2
1
0.5
CMAP
Obs = 2.62559
SDev = 2.50378
AM2p12a minus CMAP
7
5
3
2
1
0.5
-0.5
-1
-2
-3
-5
-7
Mod - Obs = 0.18363
r(Obs, Mod) = 0.881105
rmse = 1.25772

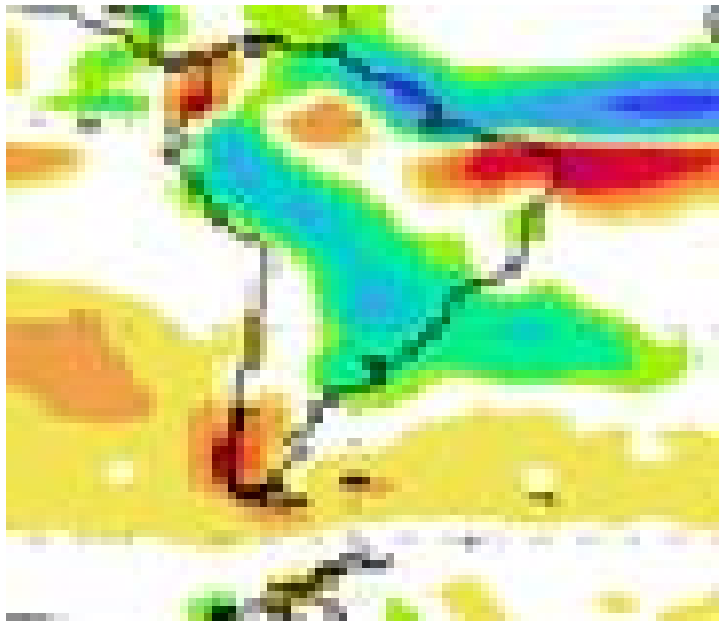

MAM PRECIP (mm/d)
AM2p12a
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
Mod = 2.84982
SDev = 2.17968
15
13
11
9
7
6
5
4
3
2
1
0.5
CMAP
Obs = 2.6574
SDev = 2.18076
AM2p12a minus CMAP
7
5
3
2
1
0.5
-0.5
-1
-2
-3
-5
-7
Mod - Obs = 0.192424
r(Obs, Mod) = 0.860648
rmse = 1.16595

AM2p12a Precipitation Errors (mm/day)

JJA



SON



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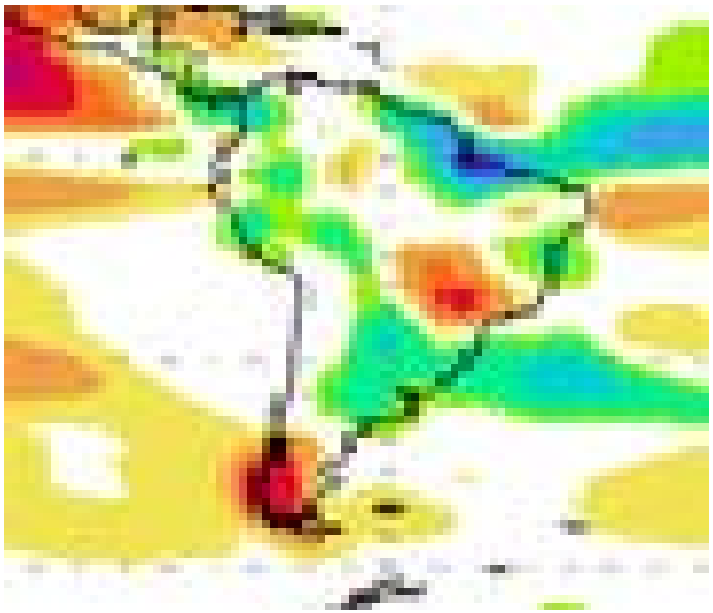
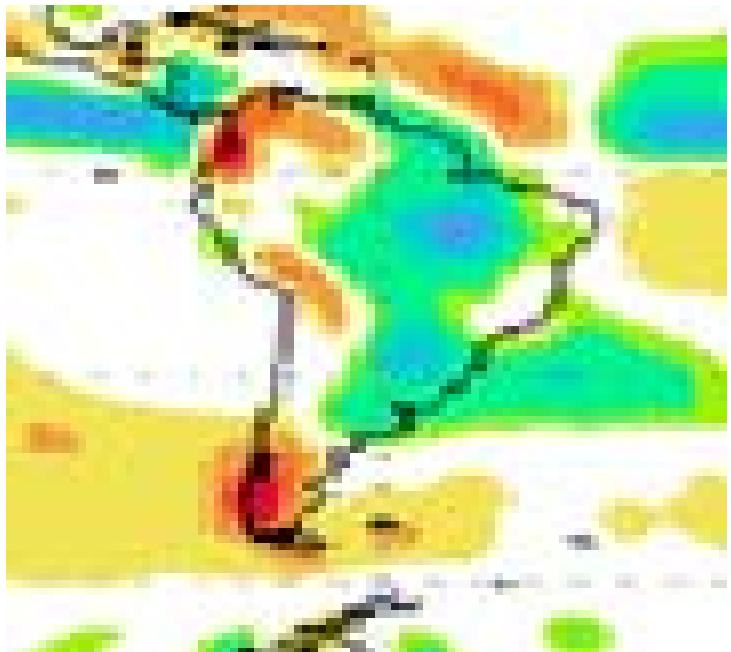
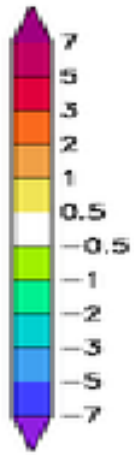


MMA





AM2p12a South American Precipitation Errors

- All-seasons negative bias around Rio de la
- Plata
- Negative bias in lee of Andes, especially in spring
- Negative bias over northeast, migrates with season
- Bias shifting negative to positive from JJA to MAM northwest of equator
- All-seasons positive bias over southern tip

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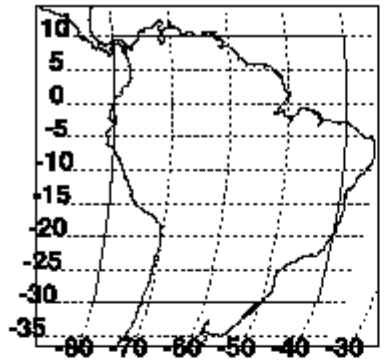
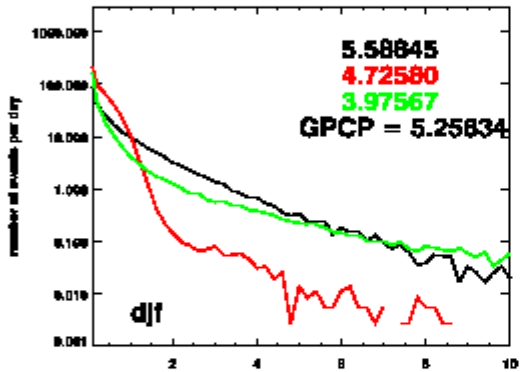
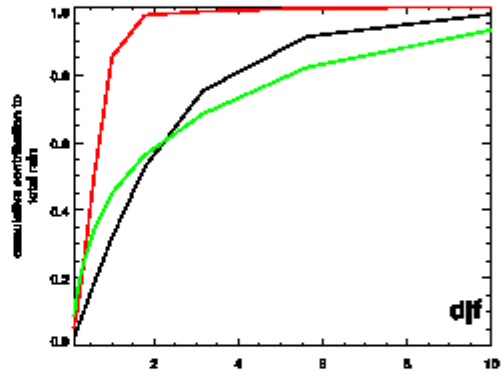
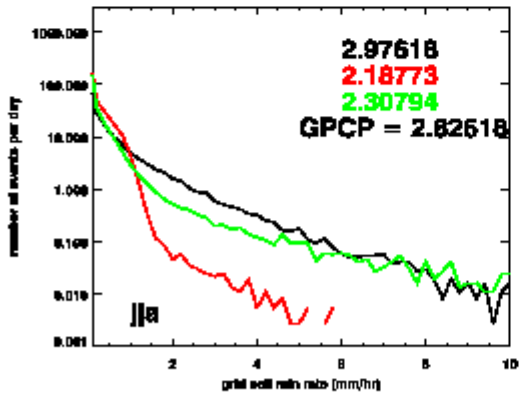
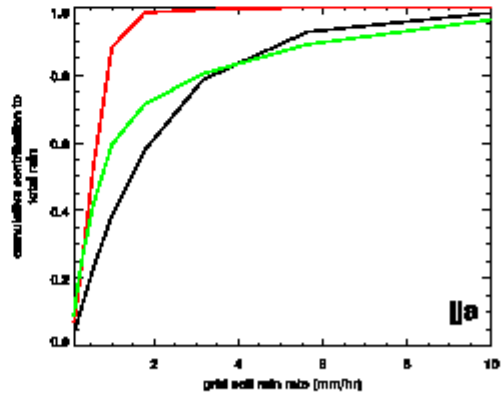
Distribution of Precipitation Intensities











SSM/I

Donner

RAS

Summary

- South American low-level jet evident in GFDL AM2p9
- Climatological precipitation biases coincide with jet location
- Intensity distribution of precipitation events depends on cumulus parameterization

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