GLOBAL ETA FRAMEWORK(GEF)-
A SHORT INTRODUCTION AND RECENT RESULTS

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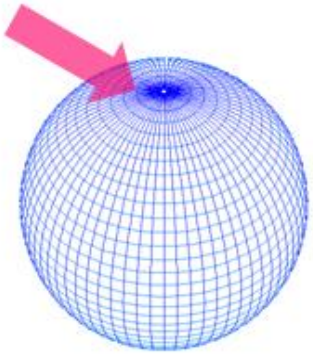
Regional? Why not a model?

Global Eta Framework (GEF)

- different grid (not lat-lon grid)



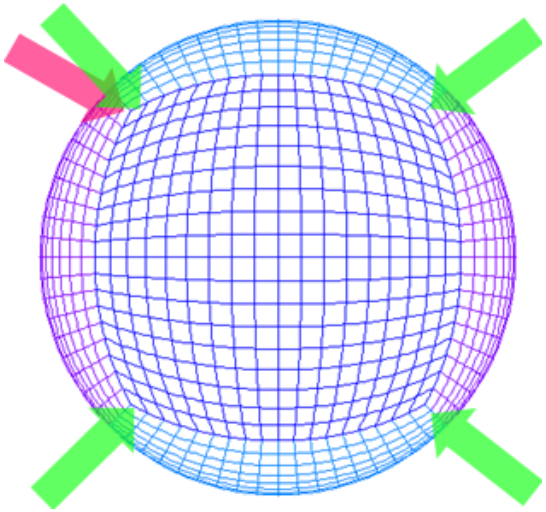
Why?

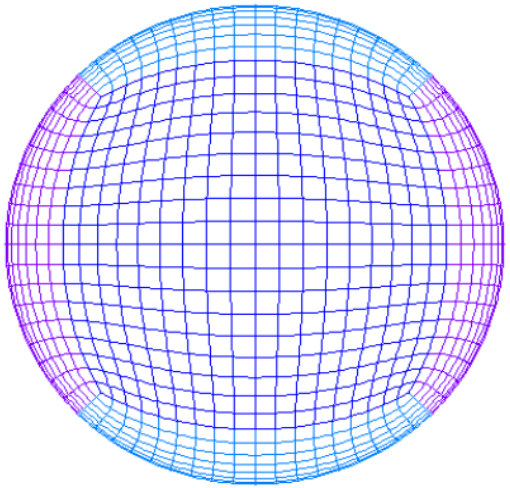
- disadvantages of lat-lon grid:
  - singularities on the poles
  - convergence of the meridians, when moving toward poles, and in that way unnecessarily over-resolving that area, and wasting computational resources
  - lat-lon grid is not uniform ⟶ different size of grid boxes

Idea?

- find another solution for the grid to avoid obvious disadvantages of lat-lon grids

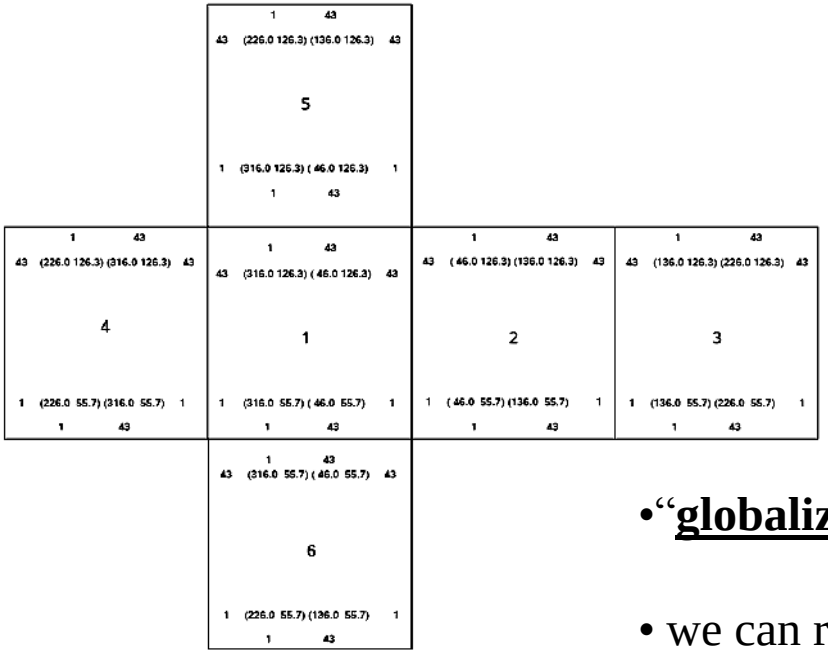
What is the solution?





Sadourny's gnomonic cube (**1972**)
(with 8 singularities and 12 singular lines)

Purser's and Rancic's
smoothed conformal cube(**1998**)
(quasi-uniform grid, "weak"
singularities)



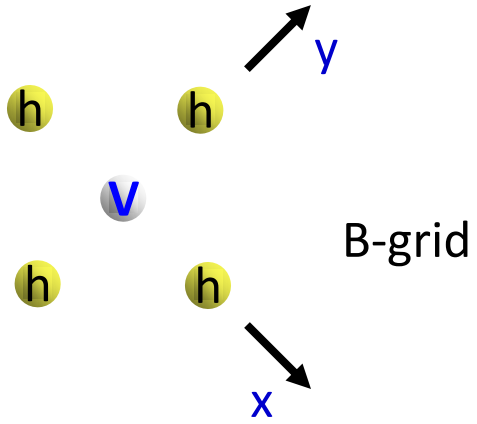
Cubic grid with 6 sides

- "**globalization" of regional atmospheric models**
- we can rather say that we have a **global framework**, not single global model
- that's why this is not Global Eta Model, then **Global Eta Framework(GEF)**
- Eta model is taken just as prototype
- Model created in 2006(Zhang, Rancic)

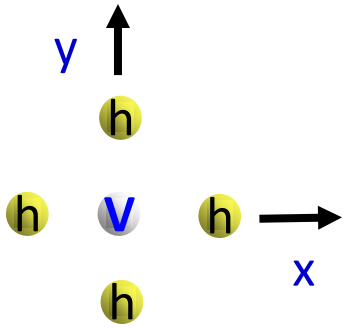
Comparison with the Regional Eta model

The same dynamics and the physics

It uses Arakawa **B grid**(Regional Eta model uses E grid)



B-grid



E-grid

Curvilinear coordinates

Lower resolution climate run

2 years ; there were 2 runs performed

Initial conditions were taken from ERA-Interim, one from randomly selected date of February 1996 and another from February 1998

Model is forced by SST from NCEP's reanalysis, with daily update

Horizontal resolution ~ 240km

These years for initial conditions were chosen in order to assess the capability of the model to simulate the conditions of one of the most extreme ENSO events, with its warm, El Niño phase from 1997 and cold, La Niña phase from 1999

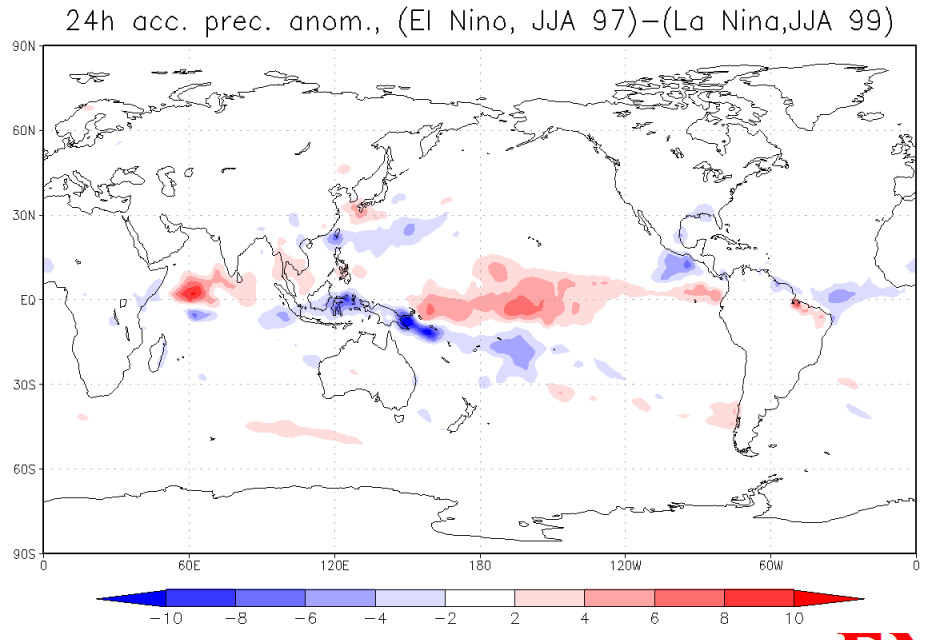
For that purpose, 24hs acc. precipitation, 850mb temperature, 850mb and 200mb wind speed fields were analysed, for summer and winter seasons(DJF and JJA)

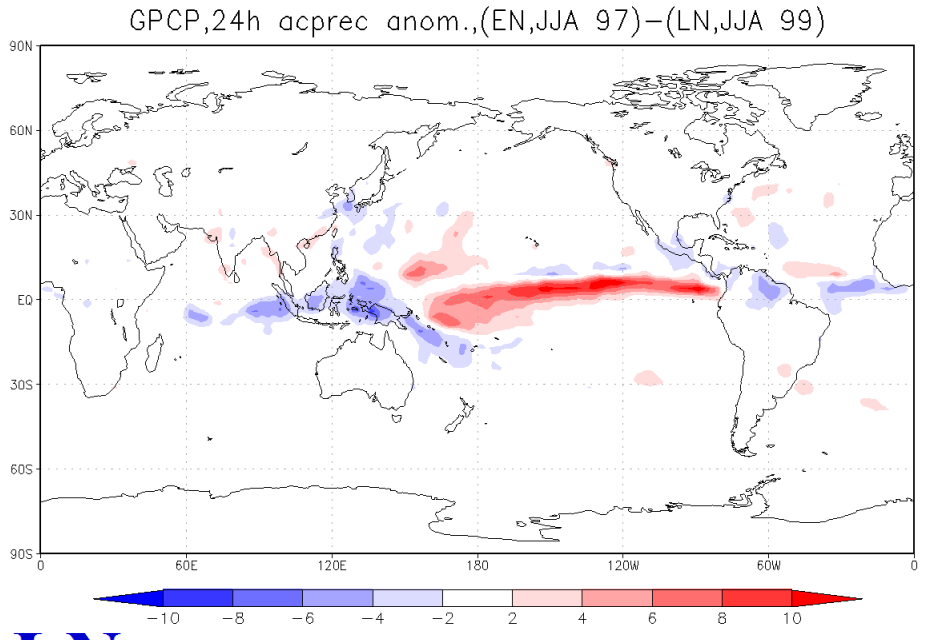
JJA ‘97	VARIABLES	SCORR
temp 850mb		0,98
wind 850mb		0,73
geopotential 500mb		0,99
wind 200mb		0,88
24h acc. precipitation		0,58

DJF ’97/98	VARIABLES	SCORR
temp 850mb		0,98
wind 850mb		0,66
geopotential 500mb		0,97
wind 200mb		0,81
24h acc. precipitation		0,69

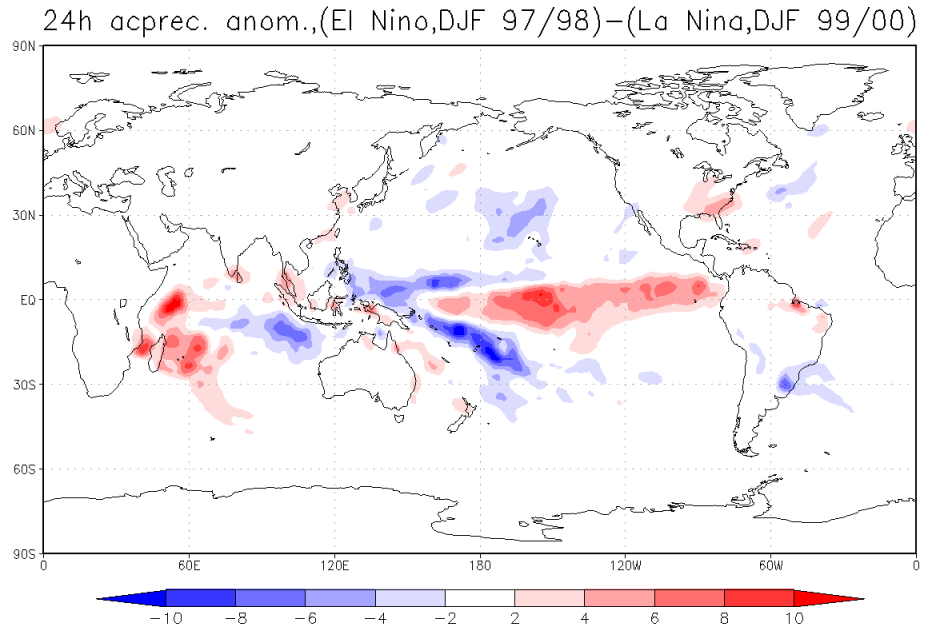
JJA ‘99	VARIABLES	SCORR
temp 850mb		0,98
wind 850mb		0,74
geopotential 500mb		0,99
wind 200mb		0,90
24h acc. precipitation		0,63

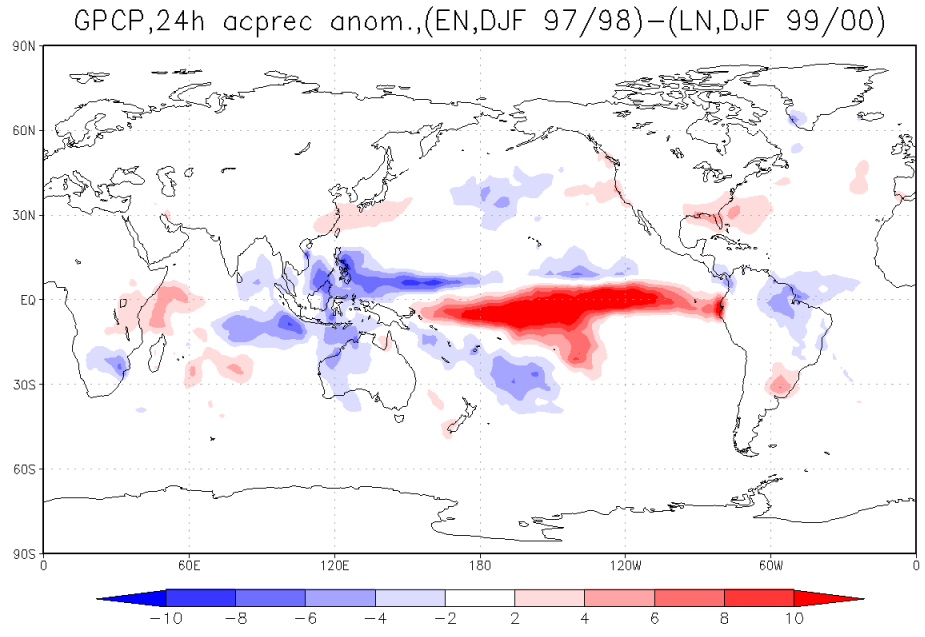
DJF ’99/00	VARIABLES	SCORR
temp 850mb		0,98
wind 850mb		0,64
geopotential 500mb		0,97
wind 200mb		0,75
24h acc. precipitation		0,70


24h acc. prec. anom., (El Nino, JJA 97)−(La Nina,JJA 99)
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
−10 −8 −6 −4 −2 2 4 6 8 10
GrADS: COLA/IGES


GPCP,24h acprec anom.,(EN,JJA 97)−(LN,JJA 99)
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
−10 −8 −6 −4 −2 2 4 6 8 10

EN-LN


24h acprec. anom.,(El Nino,DJF 97/98)−(La Nina,DJF 99/00)
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
−10 −8 −6 −4 −2 2 4 6 8 10
GrADS: COLA/IGES


GPCP,24h acprec anom.,(EN,DJF 97/98)−(LN,DJF 99/00)
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
−10 −8 −6 −4 −2 2 4 6 8 10
GrADS: COLA/IGES

Higher resolution run

90 days

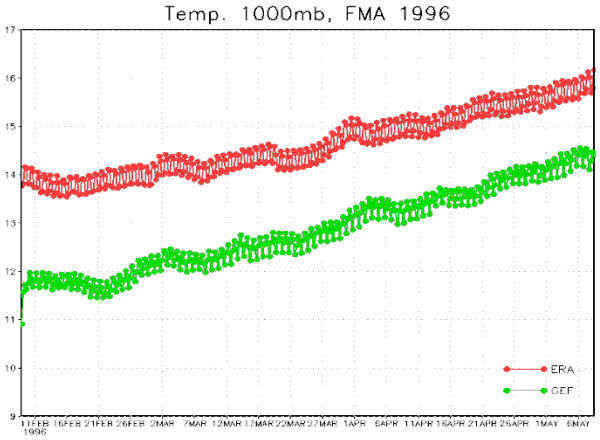
Horizontal resolution of the model ~ 25km

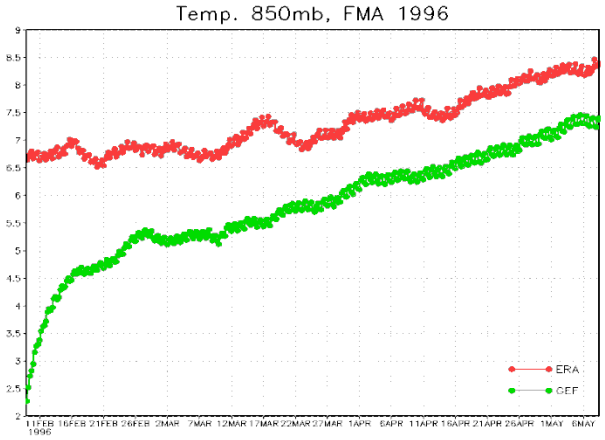
Initial conditions from ERA Interim(9th of February 1996)

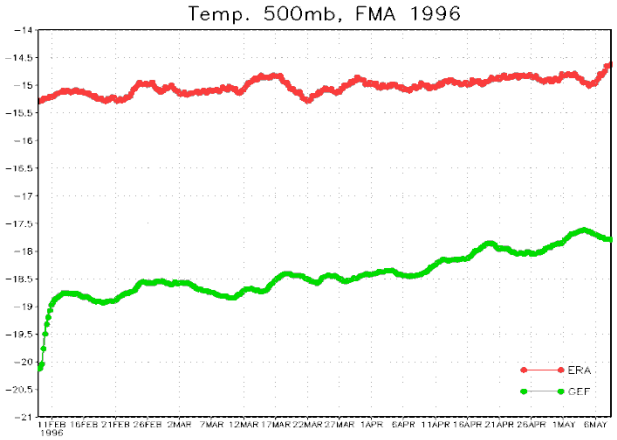
Model is forced by SST from NCEP's reanalysis, with daily update

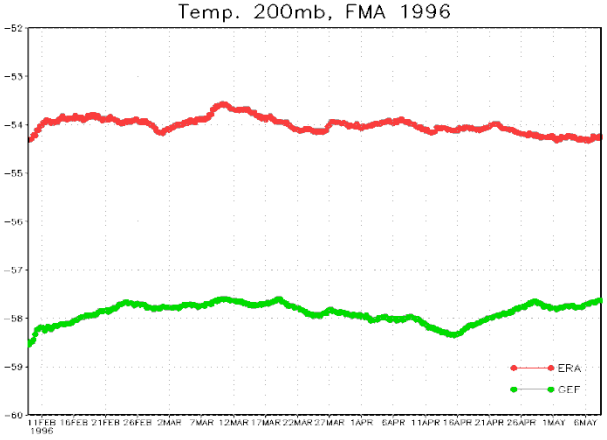
dt = 40s ; LM = 38; PT = 25mb

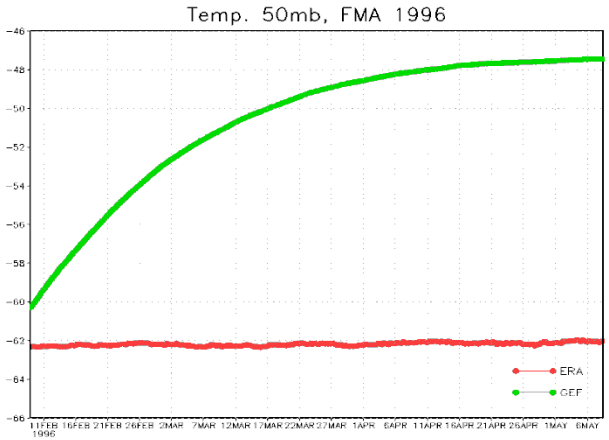
The "equal area" grid


Temp. 1000mb, FMA 1996
ERA
GEF

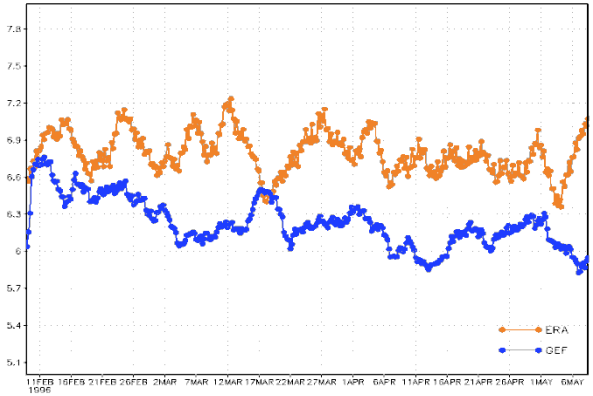

Temp. 850mb, FMA 1996
ERA
GEF


Temp. 500mb, FMA 1996
ERA
GEF

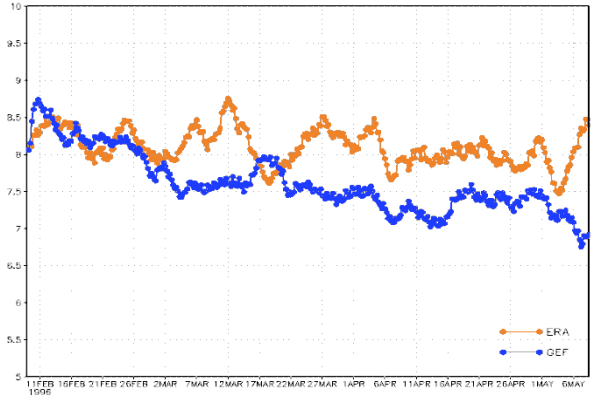

Temp. 200mb, FMA 1996
ERA
GEF


Temp. 50mb, FMA 1996
ERA
GEF

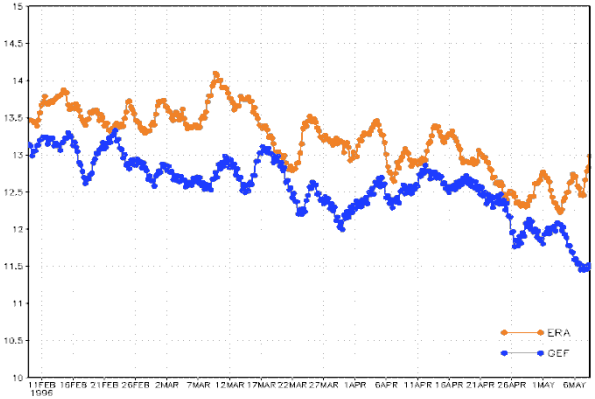
Wind 1000mb, FMA 1996



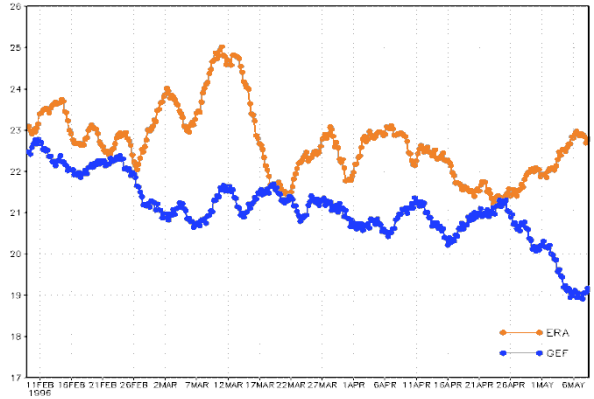
Wind 850mb, FMA 1996



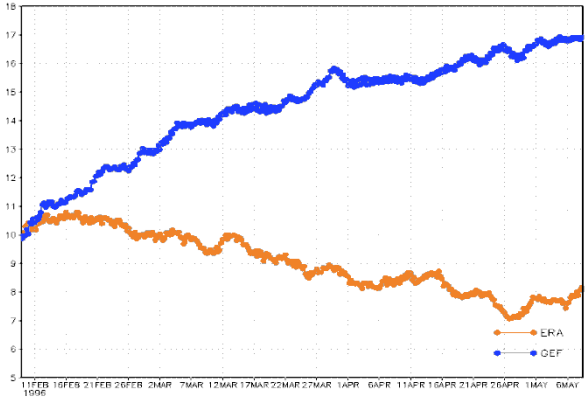
Wind 500mb, FMA 1996

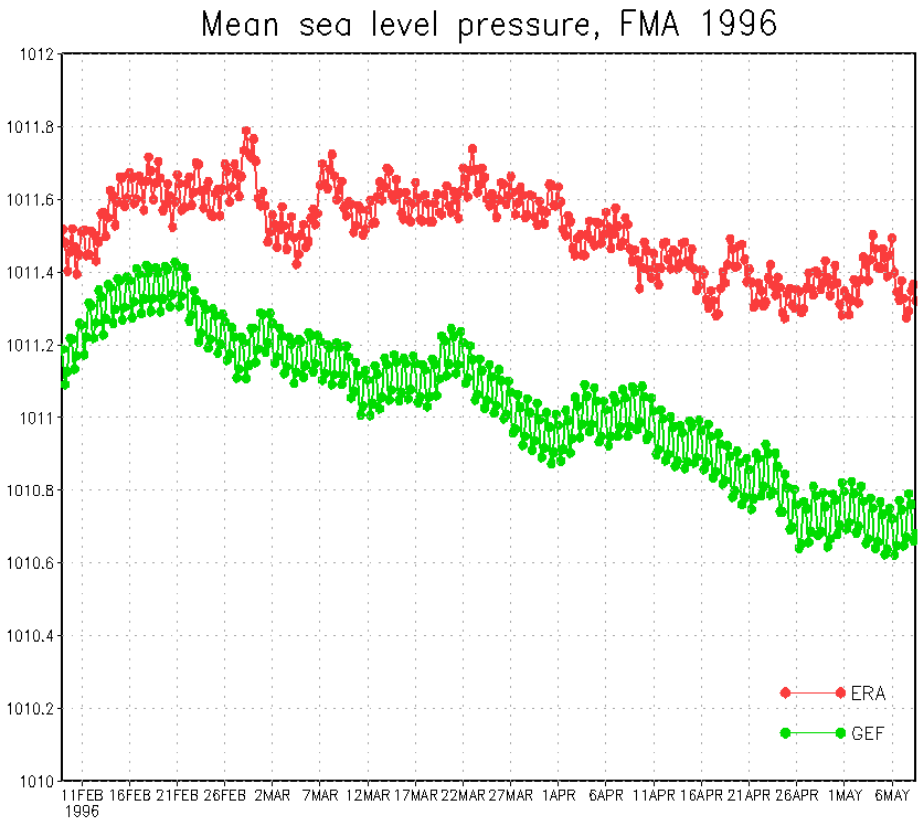


Wind 200mb, FMA 1996

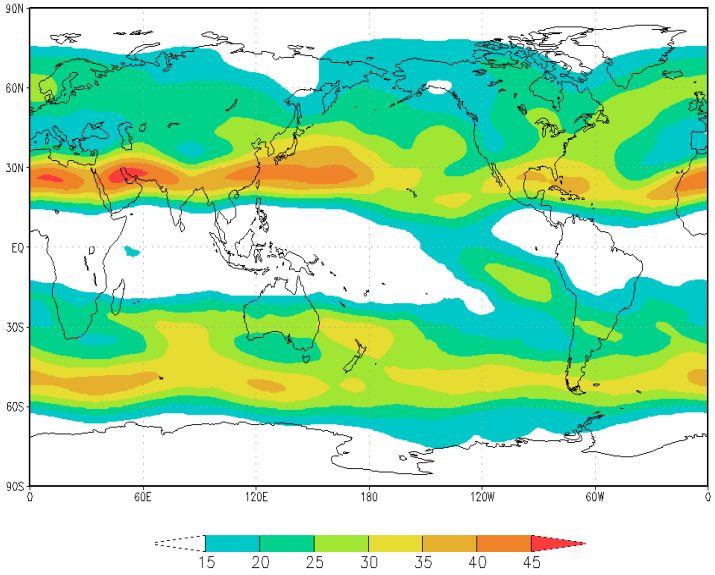


Wind 50mb, FMA 1996

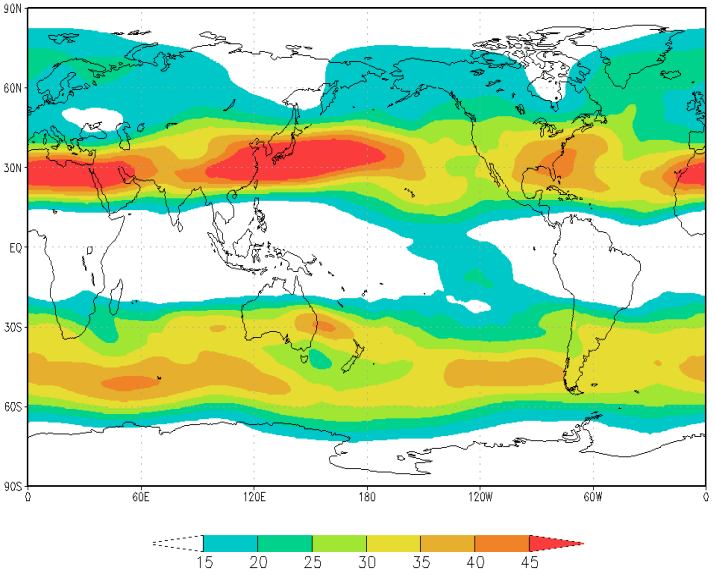



Mean sea level pressure, FMA 1996
1012
1011.8
1011.6
1011.4
1011.2
1011
1010.8
1010.6
1010.4
1010.2
1010
11FEB 1996
16FEB
21FEB
26FEB
2MAR
7MAR
12MAR
17MAR
22MAR
27MAR
1APR
6APR
11APR
16APR
21APR
26APR
1MAY
6MAY
ERA
GEF

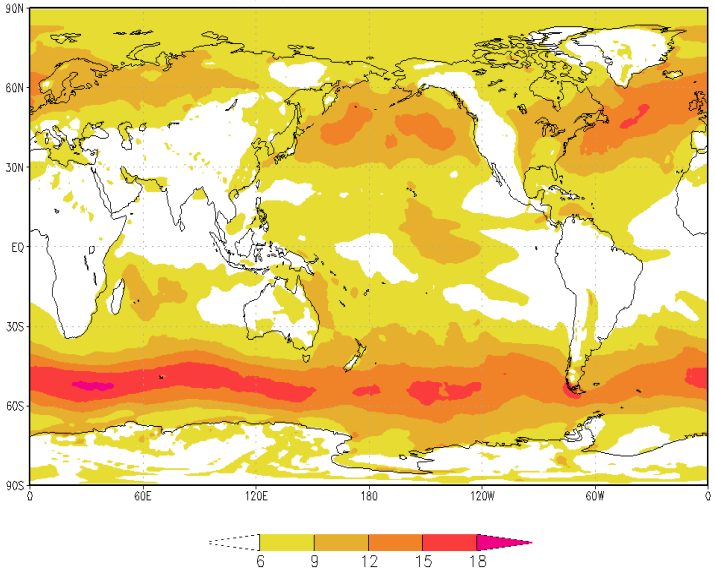
Wind 200mb, FMA 1996, GEF



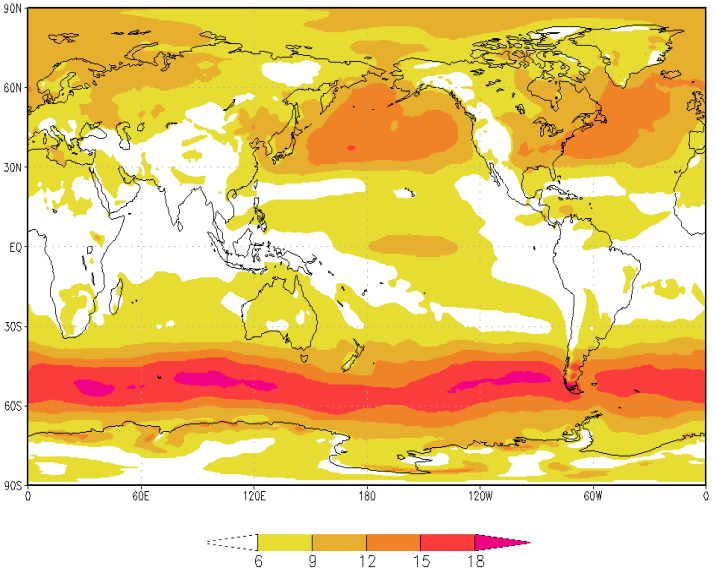
Wind 200mb, FMA 1996, ERA

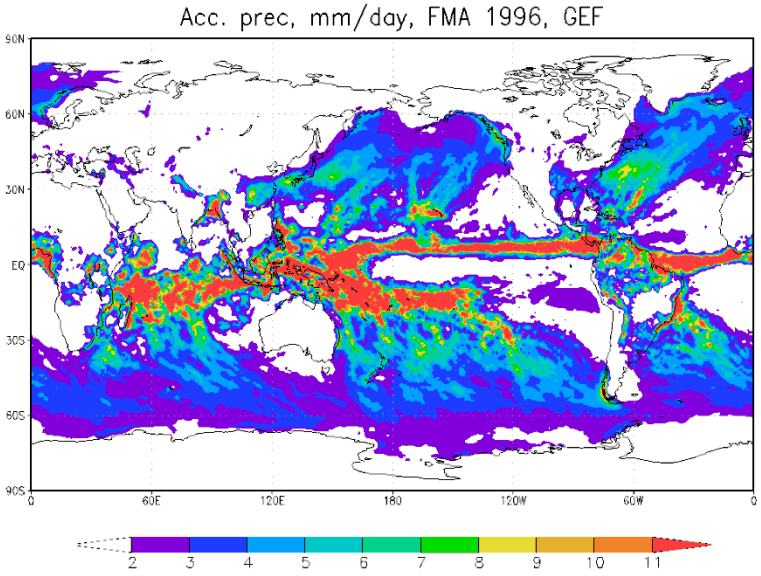


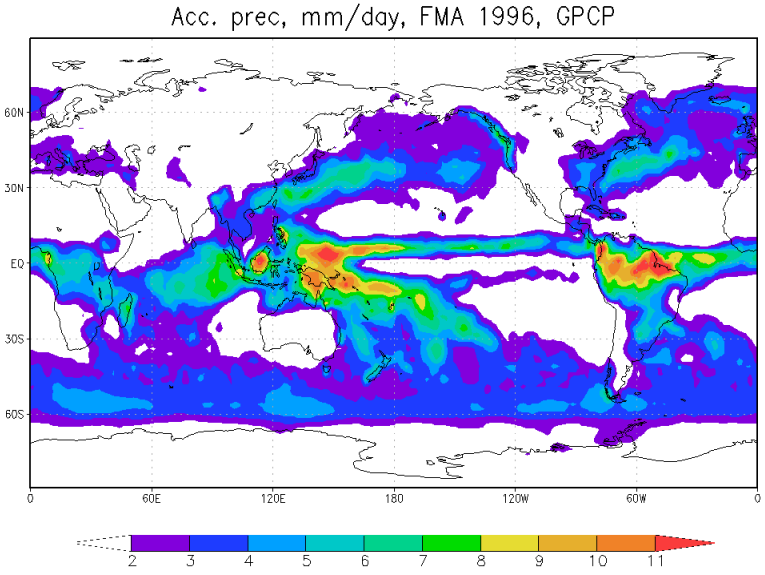
Wind(m/s) 850mb, FMA 1996, GEF



Wind(m/s) 850mb, FMA 1996, ERA




Acc. prec, mm/day, FMA 1996, GEF
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
2
3
4
5
6
7
8
9
10
11


Acc. prec, mm/day, FMA 1996, GPCP
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
2
3
4
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6
7
8
9
10
11

resolution ~25km => 20min to make a 1 day forecast

600 processors, LM= 38, PT = 25mb

resolution ~25km => 28min to make a 1 day forecast

600 processors, LM= 60, PT = 10mb

Future work

Include non-hydrostatic part of the code(*in progress*)

Increase the horizontal resolution up to ~8km

Evaluate the impact of non-hydrostatic processes on development of tropical convection in the Amazon region

Conclusions

- GEF is efficient in terms of use of computational resources and stable in longer runs
- capable of simulating extreme climate events
- capable of running in high resolution(*hopefully non-hydrostatic and with horizontal resolution below 10km in very near future*)
- based on Regional Eta model

- a good candidate to be future global model of CPTEC

Thank you!

CAPES

CNPq
Conselho Nacional de Desenvolvimento Científico e Tecnológico