Model Intercomparison

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Claudia Campetella (CIMA/UBA)   and …

SALLJEX
WCRP
CLIVAR / VAMOS-GEWEX
Field Campaign

CIMA

- Hugo Berbery: ETA model at the Univ. of Maryland
- Rene Garreaud: MM5 model at the Univ. of Chile
- Dirceu Herdies: Global model at CPTEC/INPE
- Claudio Menendez: MM5 model at CIMA (CONICET - UBA)
- Matilde Nicolini: RAMS model at Univ. of Buenos Aires
- Marcelo Seluchi: ETA model at CPTEC/INPE
- Pedro Silva Dias: RAMS model at Univ. of São Paulo

Motivation

- During the last VAMOS Panel Meeting held at Miami (23-25 April, 2003), it has been discussed the organization of a numerical experiment to assess models performance in particular events occurred during SALLJEX field campaign.

- The design of this experiment should provide insight on some of the forecast issues relevant to SALLJ scientific objectives, some of which were presented in that meeting. One key aspect is to assess the degree of dispersion between forecasts generated with identical initial and boundary conditions, and very similar domain and horizontal resolution settings.

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The 17-18 Jan. MCS ...

Not predicted by models

13 UTC,
January 18
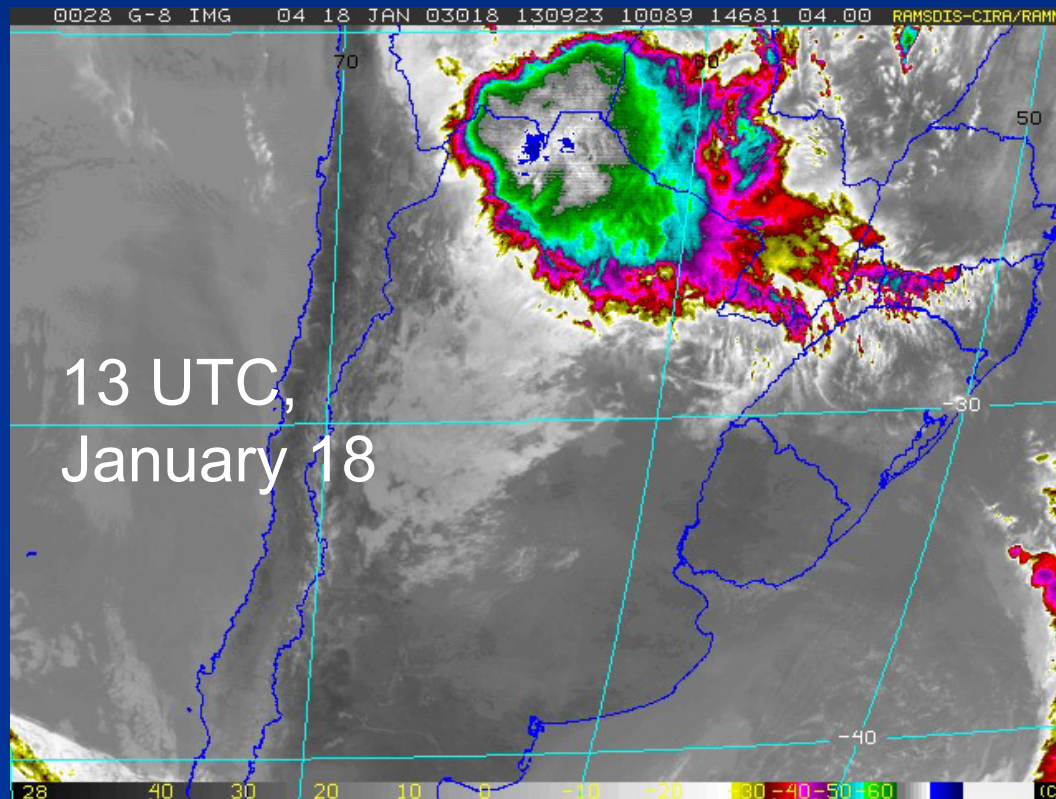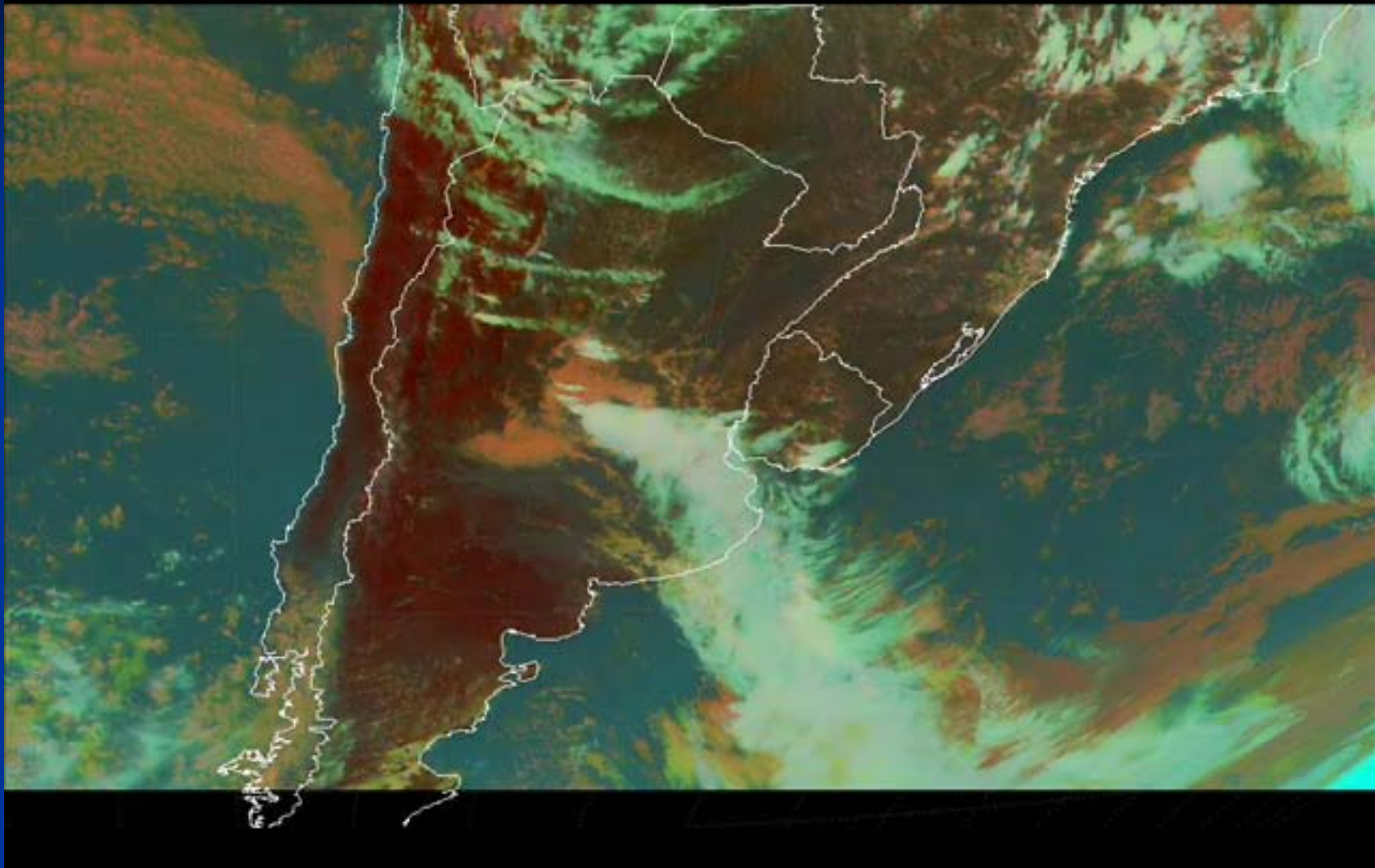
MCS evolution from January 17, 17:00 UTC
to January 18 16:00 UTC

Why models did not forecast the event ?

- Boundary data (i.e. global model providing a wrong forcing)
- Initial data quality
- Model parameterization limitations
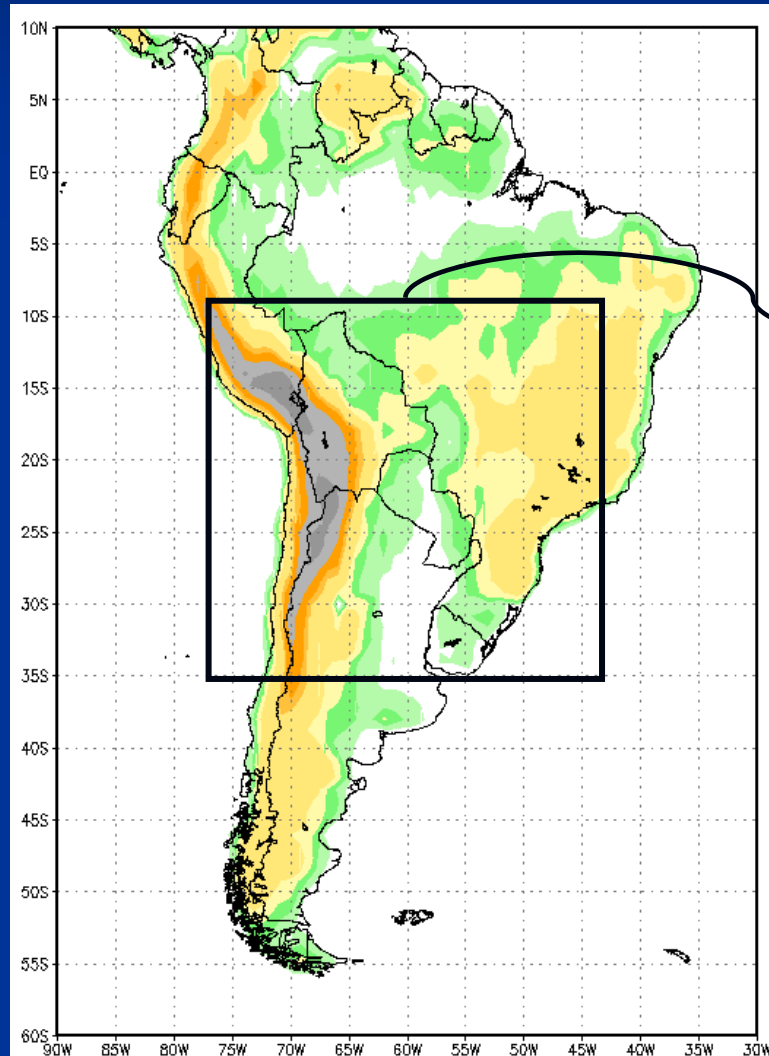- The system is unpredictable ?

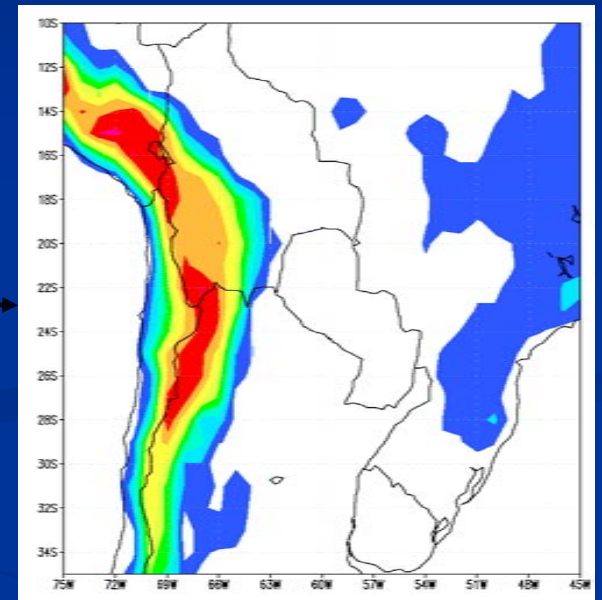# We are trying to address each of these issues

- BOUNDARIES:

  - The experiments were run with identical initial conditions and the boundaries were provided by the analysis (instead of using any global model forecast)
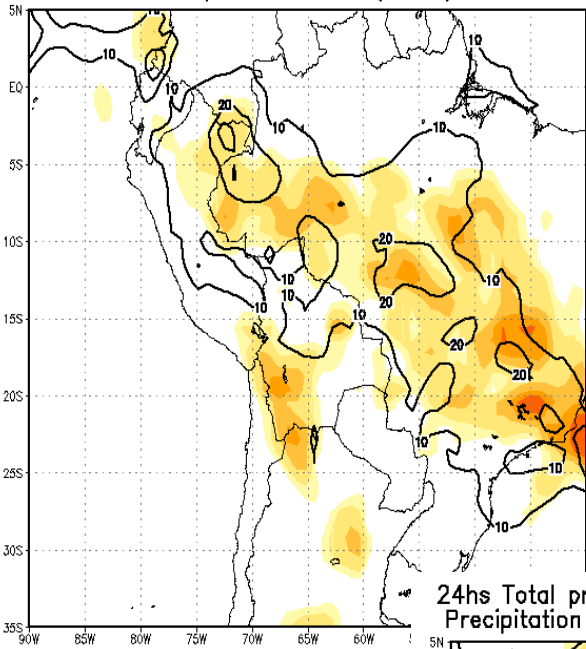
The 17-18 January MCS ...
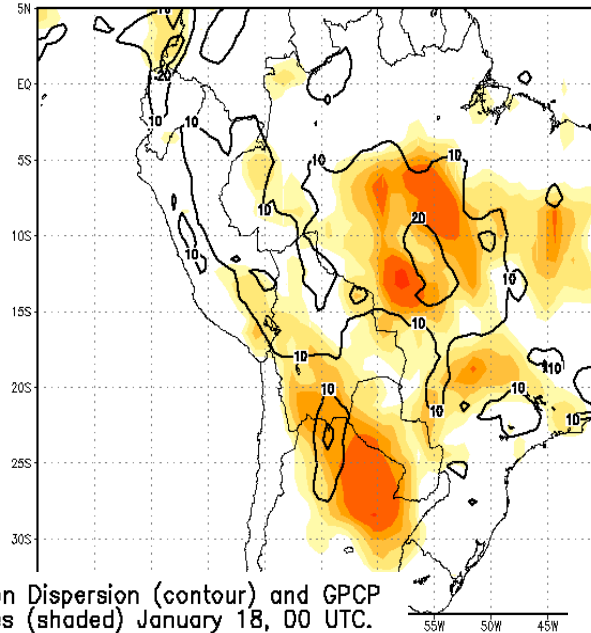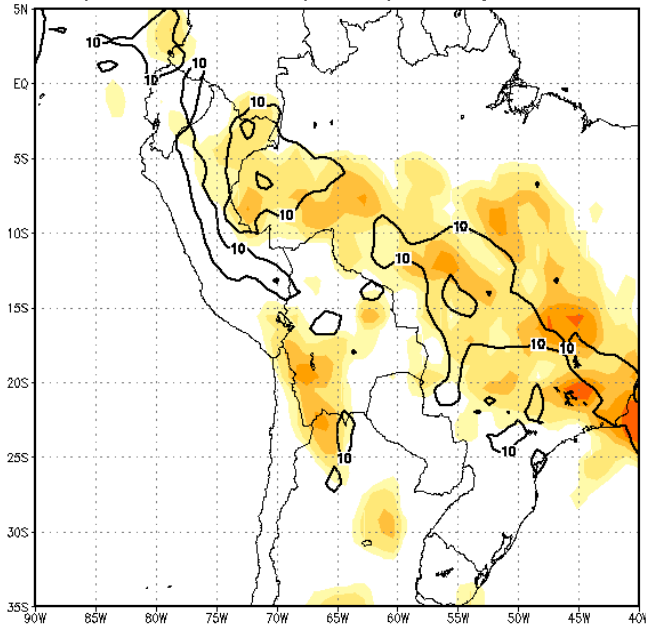
Experiment 1

Experiment 2

24 hs Mean total precipitation between
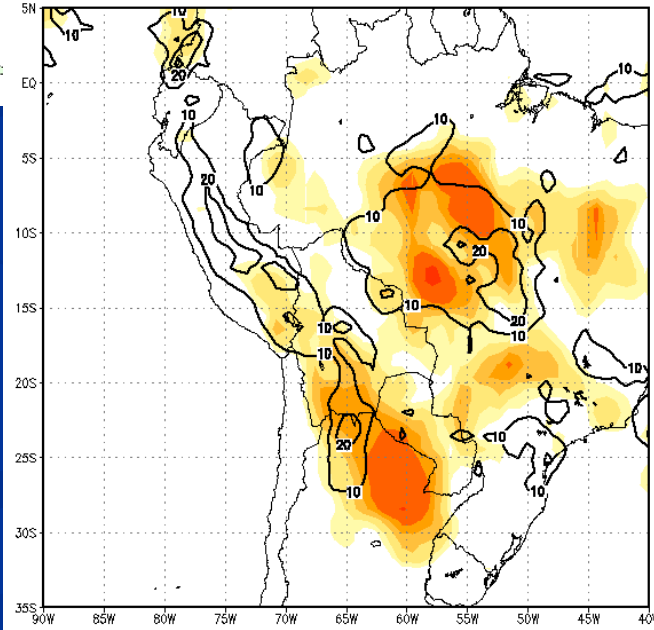17 January 00 UTC & 18 January 00 UTC (Contour) and GPCP
Precipitation Estimates (Shaded)

24 hs Mean total precipitation between
18 January 00 UTC & 19 January 00 UTC and GPCP
Precipitation Estimates (Shaded)

24hs Total precipitation Dispersion (contour) and GPCP
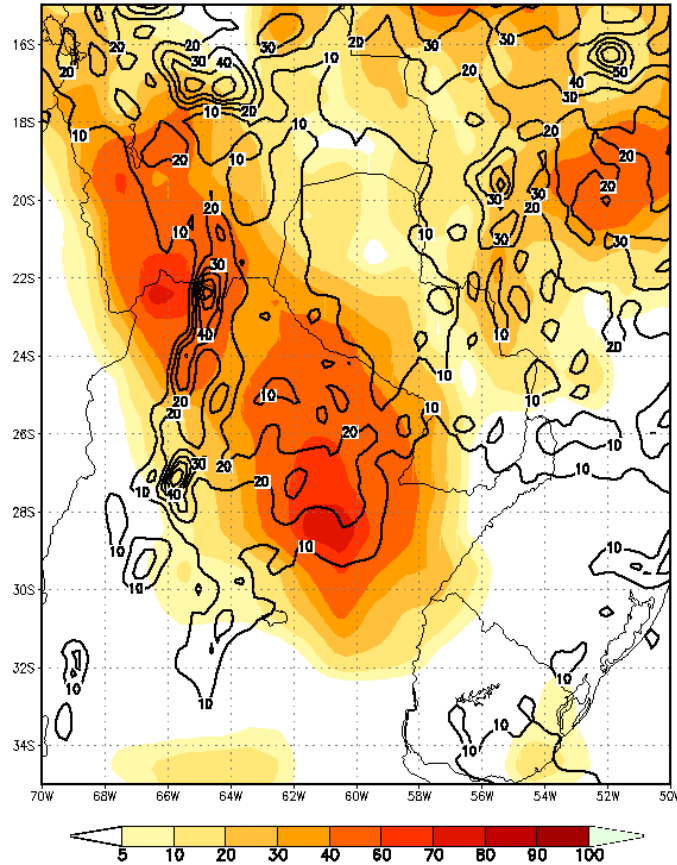Precipitation Estimates (shaded) January 18, 00 UTC.

24hs Total precipitation Dispersion (contour) and GPCP
Precipitation Estimates (shaded) January 19, 00 UTC.

Experiment 1

SALLJEX
WCRP
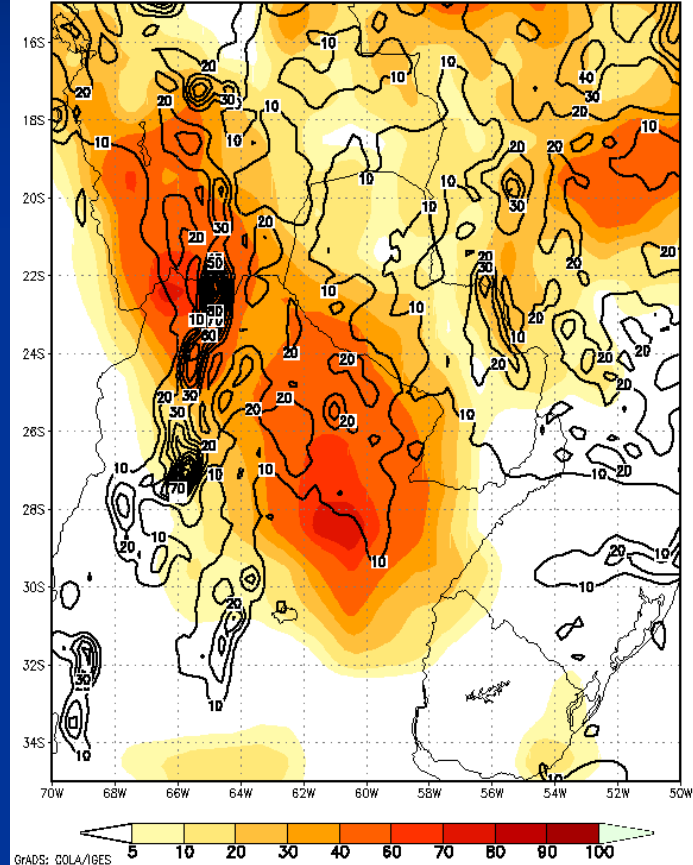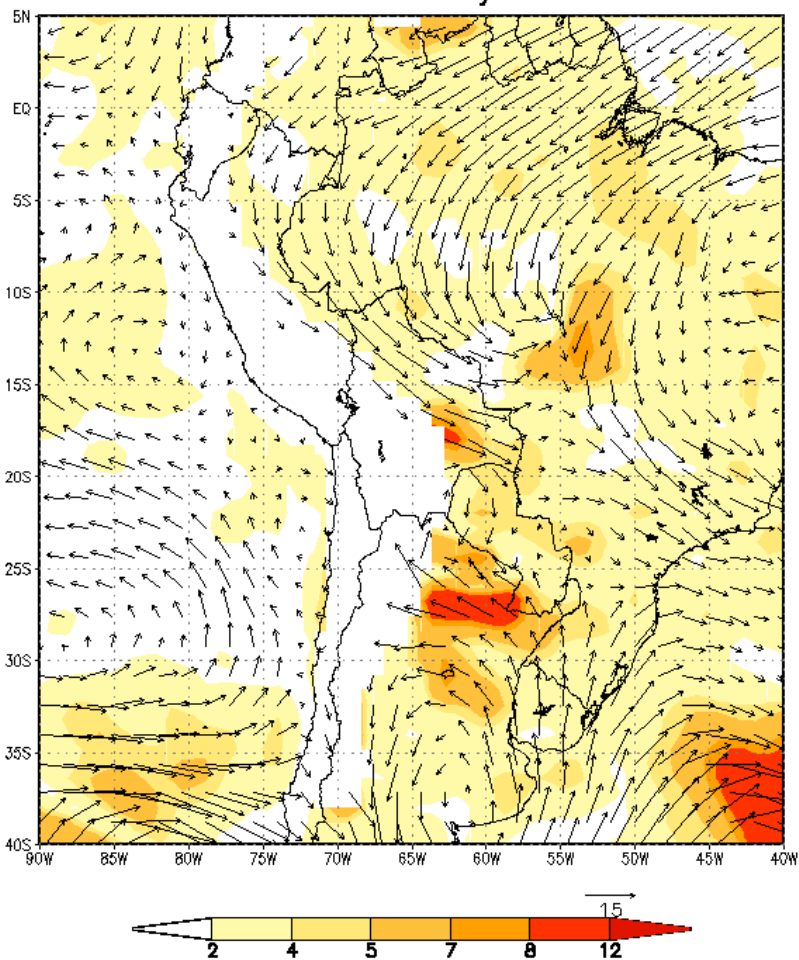CLIVAR / VAMOS-GEWEX
Field Campaign

Experiment 2

48 hs Mean total precipitation between 17 January 00 UTC & 19 January 00 UTC and GPCP Precipitation Estimates (Shaded)

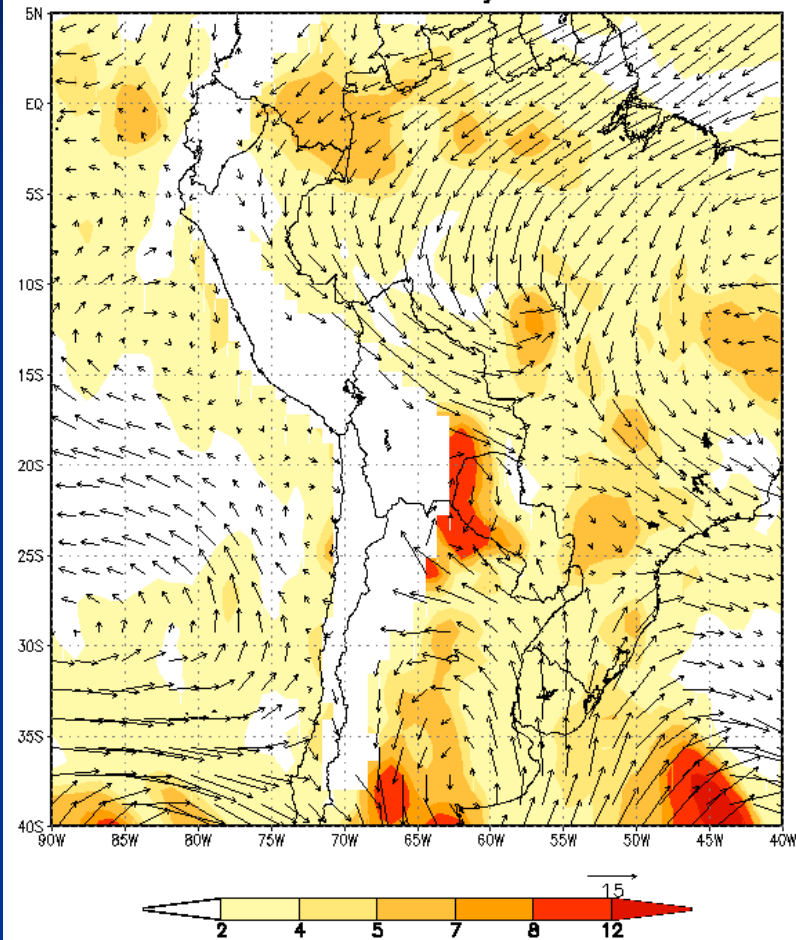48hs Total precipitation Dispersion January 19 00 UTC and GPCP Precipitation Estimates (Shaded)

Zonal wind RMS Error (shaded) & GDAS analized field 850 hPa 18 January 12 UTC.

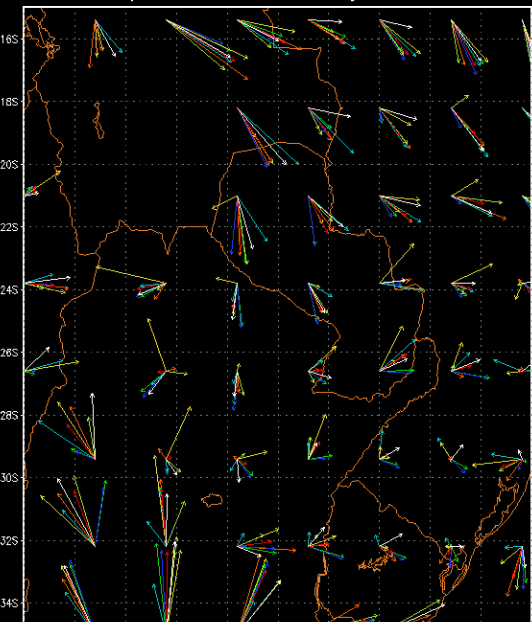Meridional wind RMS Error (shdad) & GDAS analized field 850 hPa 18 January 12 UTC.

Vector fan plot at 850 hPa. (m/s)
Experiment 2   17 January 06 UTC.
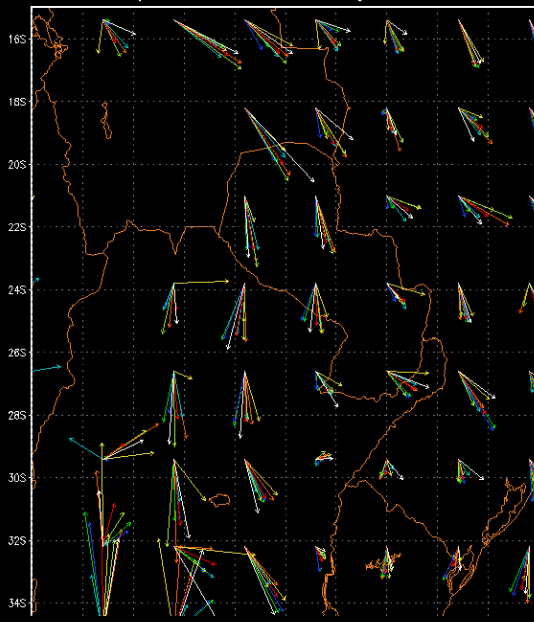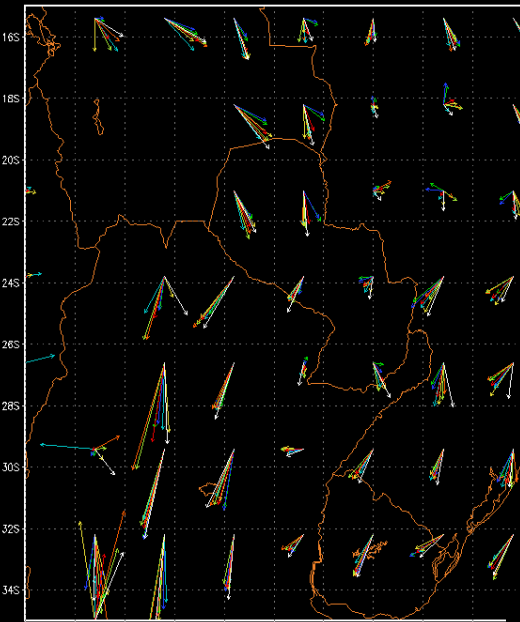
Vector fan plot at 850 hPa. (m/s)
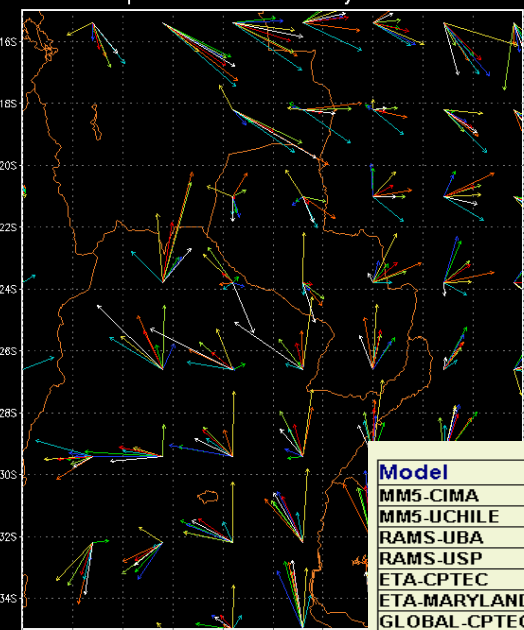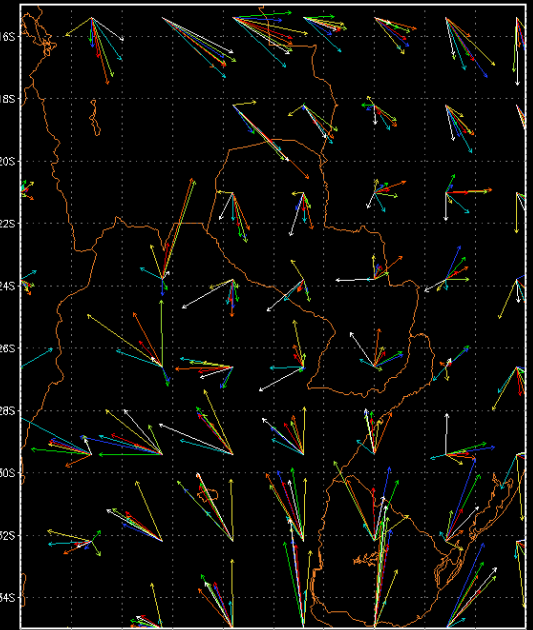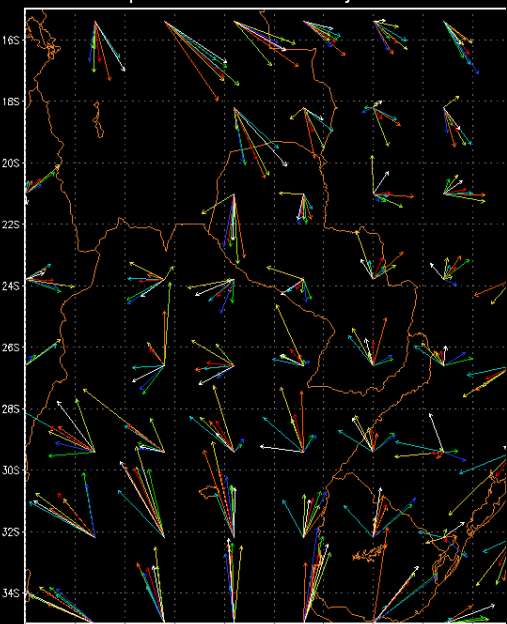Experiment 2   17 January 12 UTC.

Vector fan plot at 850 hPa. (m/s)
Experiment 2   17 January 18 UTC.

Vector fan plot at 850 hPa. (m/s)
Experiment 2   18 January 00 UTC.

Vector fan plot at 850 hPa. (m/s)
Experiment 2   18 January 06 UTC.

Vector fan plot at 850 hPa. (m/s)
Experiment 2   18 January 12 UTC.

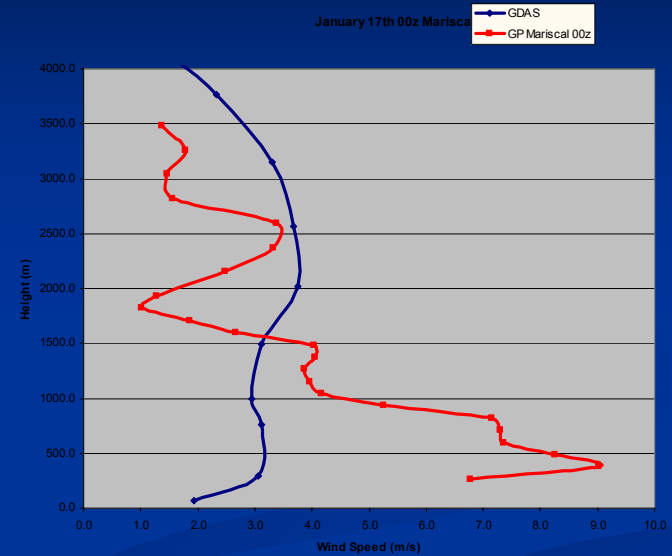| Model	Color
MM5-CIMA	
MM5-UCHILE	
RAMS-UBA	
RAMS-USP	
ETA-CPTEC	
ETA-MARYLAND	
GLOBAL-CPTEC	
GDAS-ANALISYS	
MEAN	

Why models did not forecast the event ?

- Boundary data (i.e. global model providing a wrong forcing)

- **Initial data quality**

- Model parameterization limitations
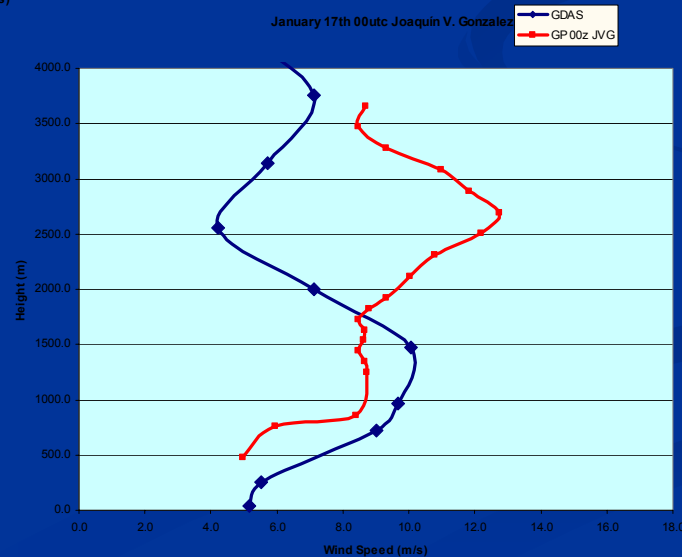
- The system is unpredictable

Initialization: discrepancies between SALLJEX data and GDAS Analysis
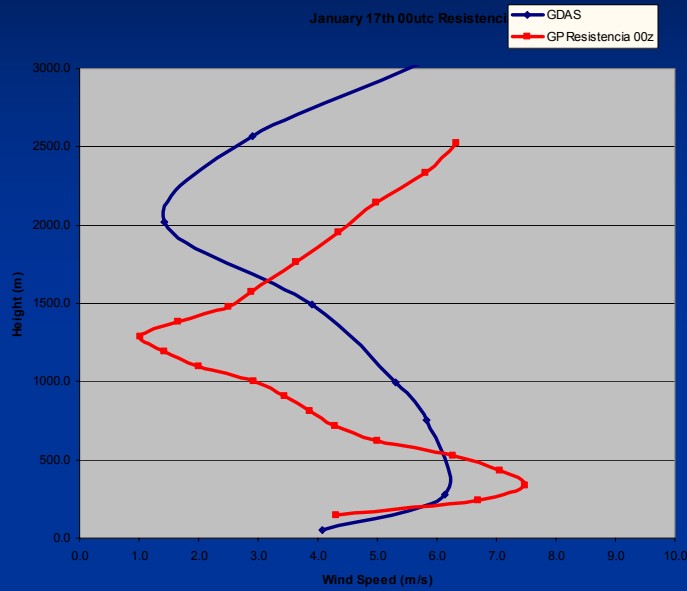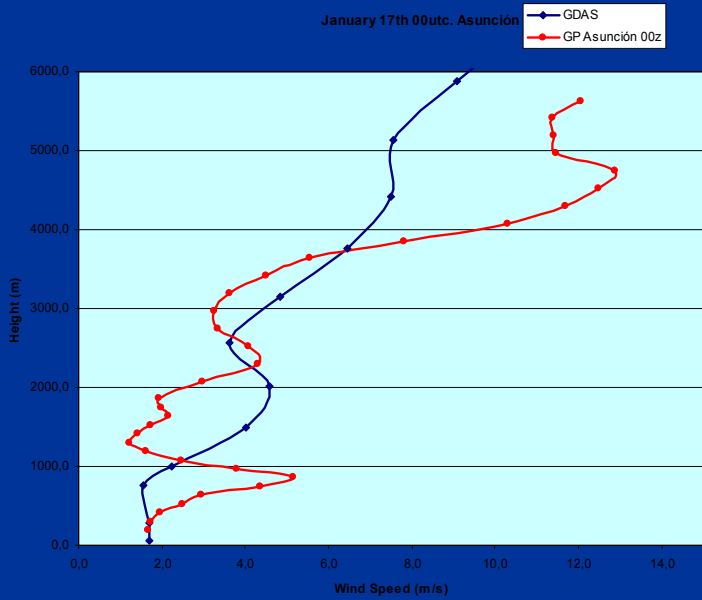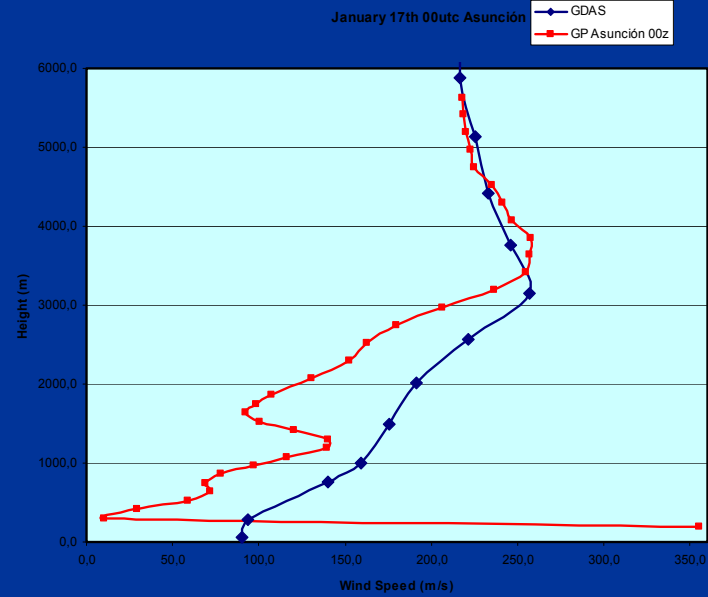

Resistencia

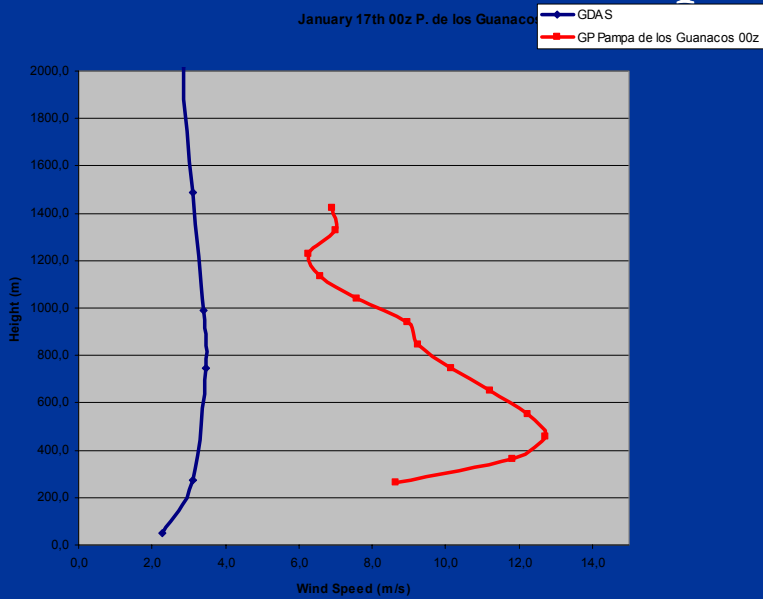Mariscal Estig.

JVG

Asuncion

January 17th 00utc. Asunción

Legend: GDAS, GP Asunción 00z

X-axis: Wind Speed (m/s), Y-axis: Height (m)

January 17th 00utc Asunción

Legend: GDAS, GP Asunción 00z

X-axis: Wind Speed (m/s), Y-axis: Height (m)

Pampa de los Guanacos

January 17th 00z P. de los Guanacos

Legend: GDAS, GP Pampa de los Guanacos 00z

X-axis: Wind Speed (m/s), Y-axis: Height (m)

January 17th 00z P. de los Guanacos

Legend: GDAS, GP P Guanacos 00z

X-axis: Wind Direction (°), Y-axis: Height (m)
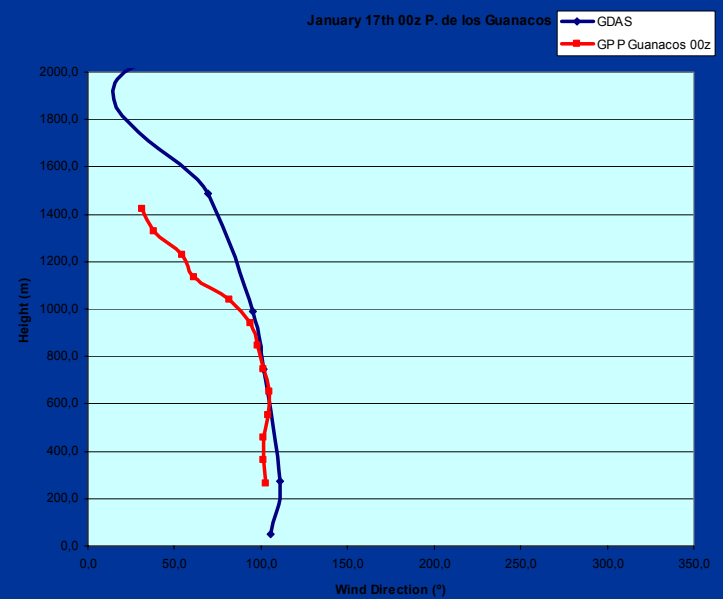
The availability of extra observational data does not only show the uncertainty in the initial condition but also contributes with another "truth" in forecast verification
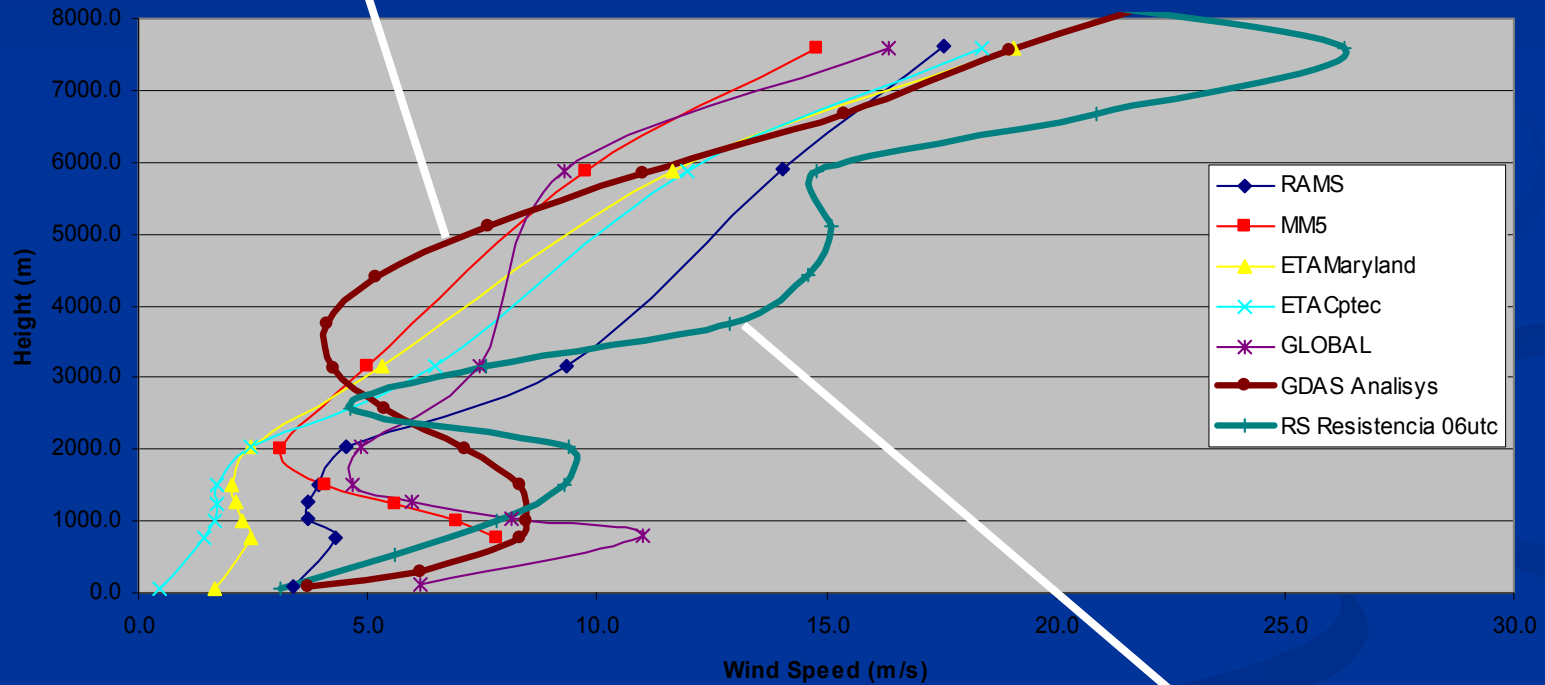
Forecast verification
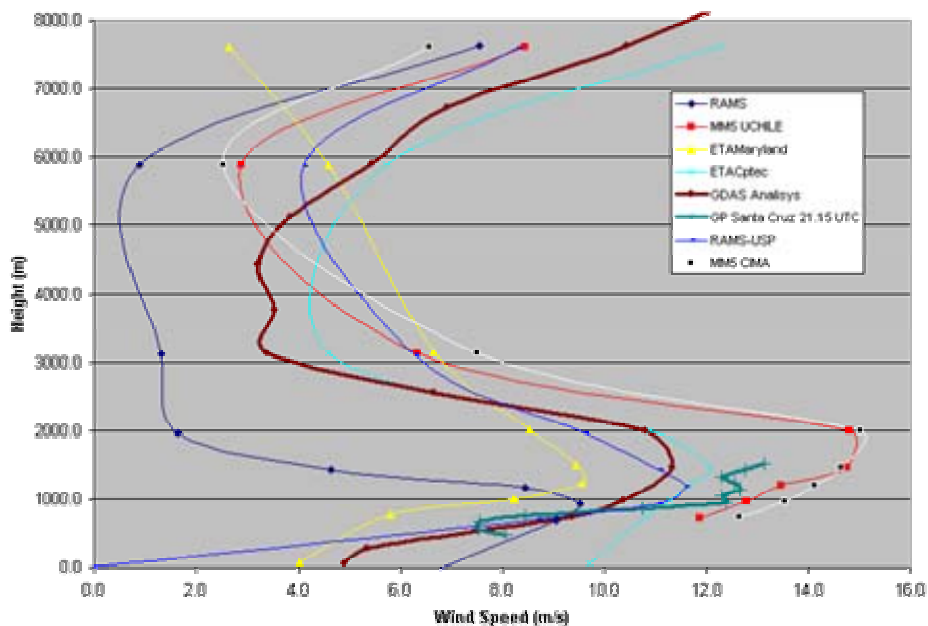# Detecting deficiencies in the models: first step toward improvement

GDAS

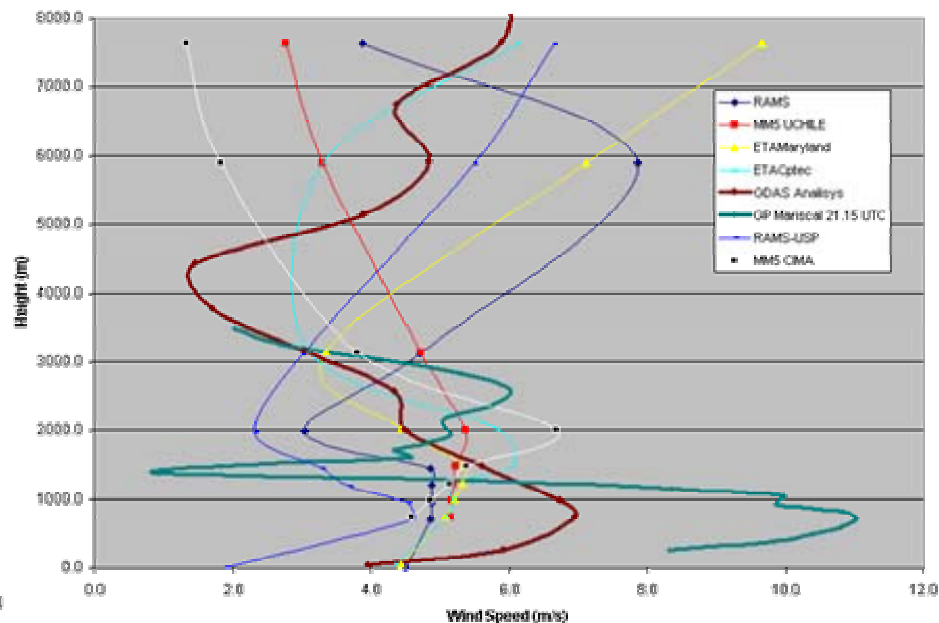Radiosonde data

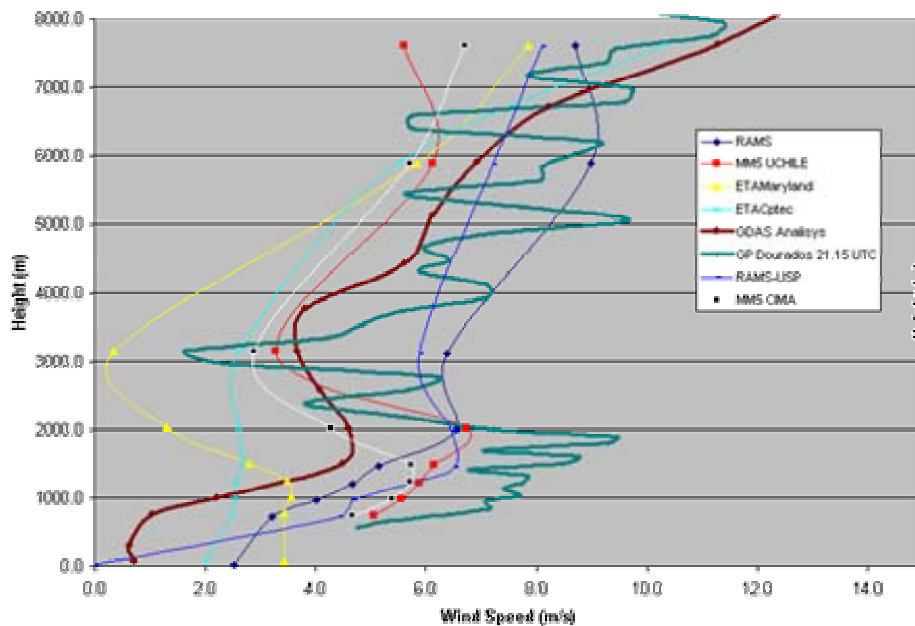Resistencia 18 January 06utc (Experiment 1)

Legend:
- RAMS
- MM5
- ETAMaryland
- ETACptec
- GLOBAL
- GDAS Analisys
- RS Resistencia 06utc

Santa Cruz 21utc 17th January (Experiment 2)

Legend:
- RAMS
- MM5 UCHILE
- ETAMaryland
- ETACptec
- GDAS Analisys
- GP Santa Cruz 21.15 UTC
- RAMS-USP
- MM5 CIMA

Mariscal 21utc 17th January (Experiment 2)

Legend:
- RAMS
- MM5 UCHILE
- ETAMaryland
- ETACptec
- GDAS Analisys
- GP Mariscal 21.15 UTC
- RAMS-USP
- MM5 CIMA

Dourados 21utc 17th January (Experiment 2)

Legend:
- RAMS
- MM5 UCHILE
- ETAMaryland
- ETACptec
- GDAS Analisys
- GP Dourados 21.15 UTC
- RAMS-USP
- MM5 CIMA

Joaquin V. Gonzalez 21utc 17th January (Experiment 2)

Legend:
- GDAS
- GP JVG 21.15 z
- RAMS
- MM5 UCHILE
- ETA Maryland
- ETA-OPTEC
- RAMS-USP
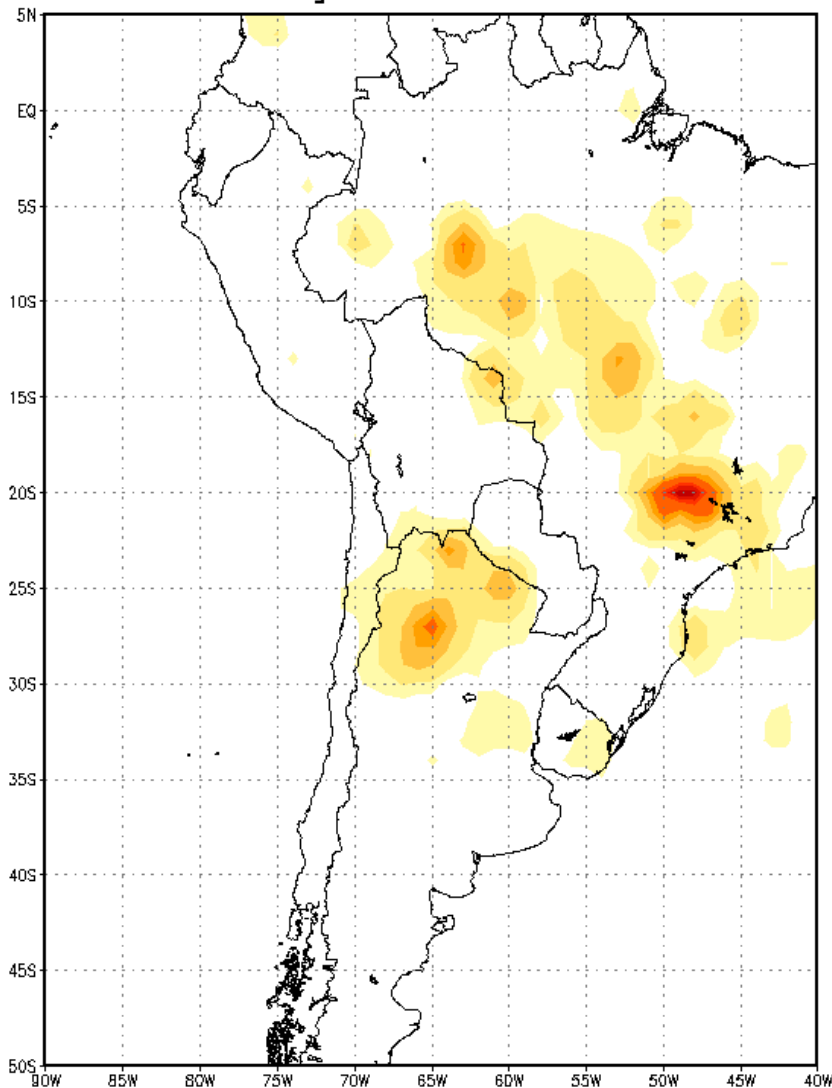- MM5 CIMA
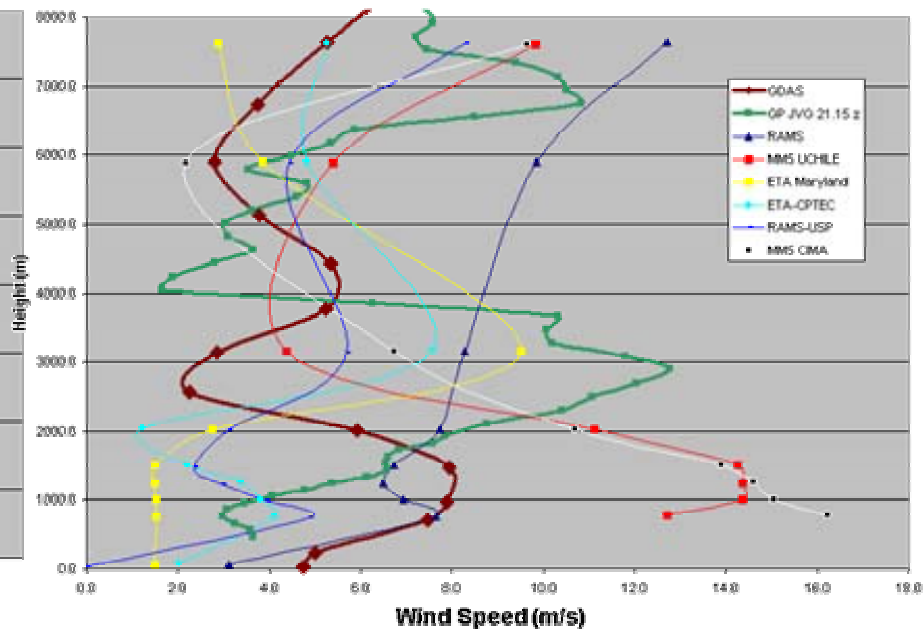
Total acumulated precipitation between 12 UTC 17 Jan 2003 and 12 UTC 18 Jan 2003

SALLJEX Raingauge Network Raw Data.
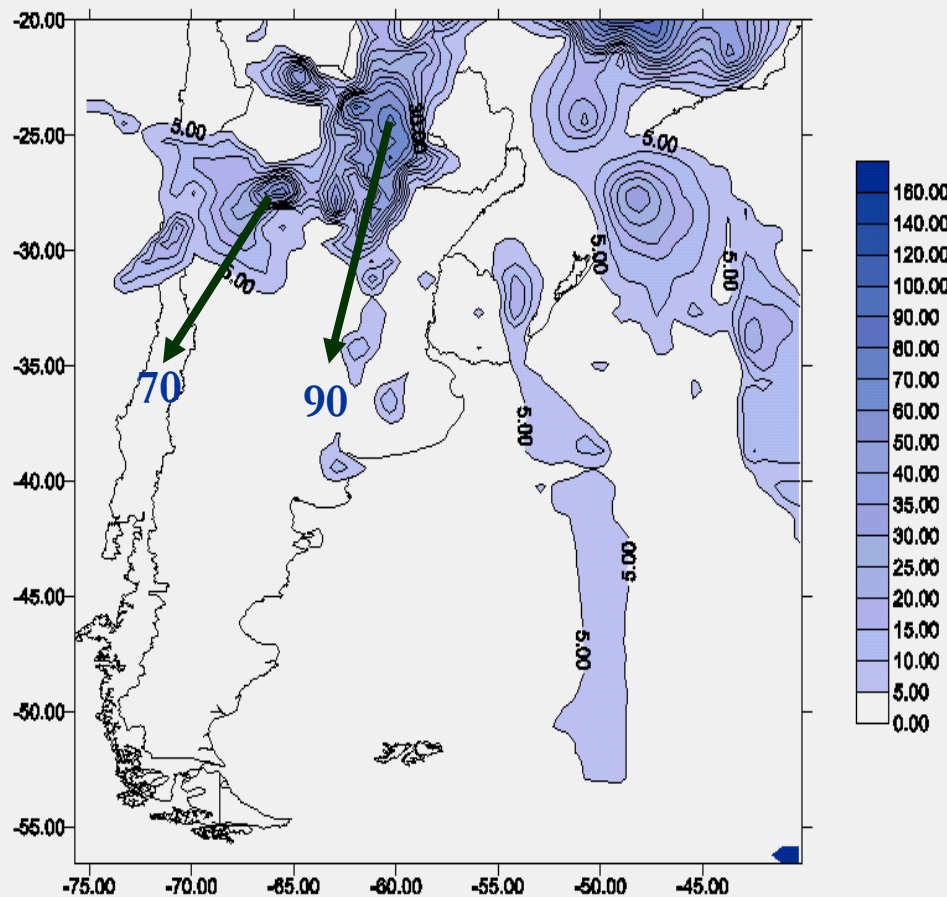
CPC Daily Precipitation Restrospective Analysis
1x1 degree 12z 18 Jan 2003

Why models did not forecast the event ?

- Boundary data (i.e. global model providing a wrong forcing)

- Initial data quality

- **Model parameterization limitations**

  - (e.g. convective parameterization: Grell, Kuo, Bets-Miller, Kain-Fritsch and/or Full Microphysics)
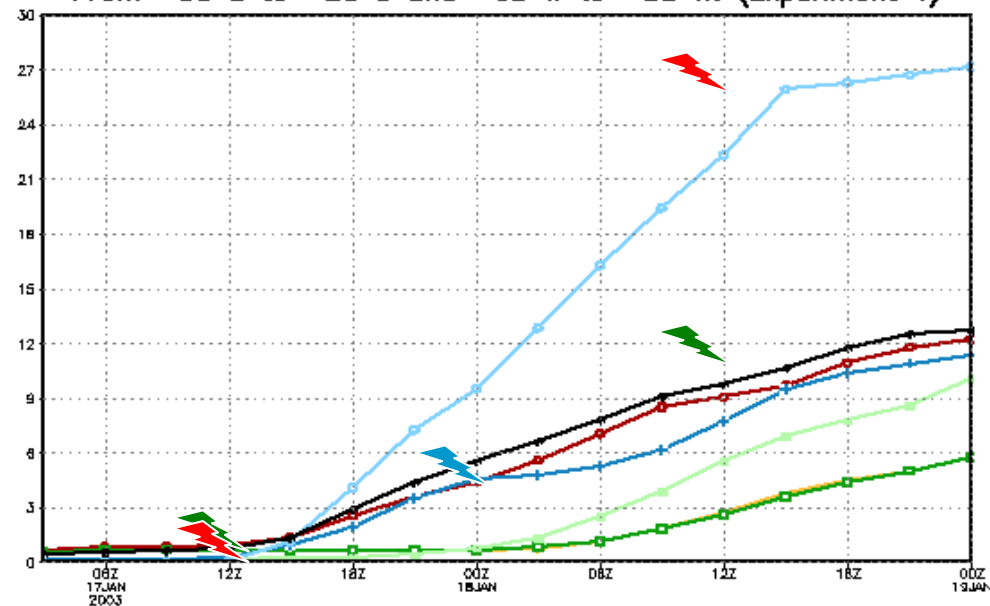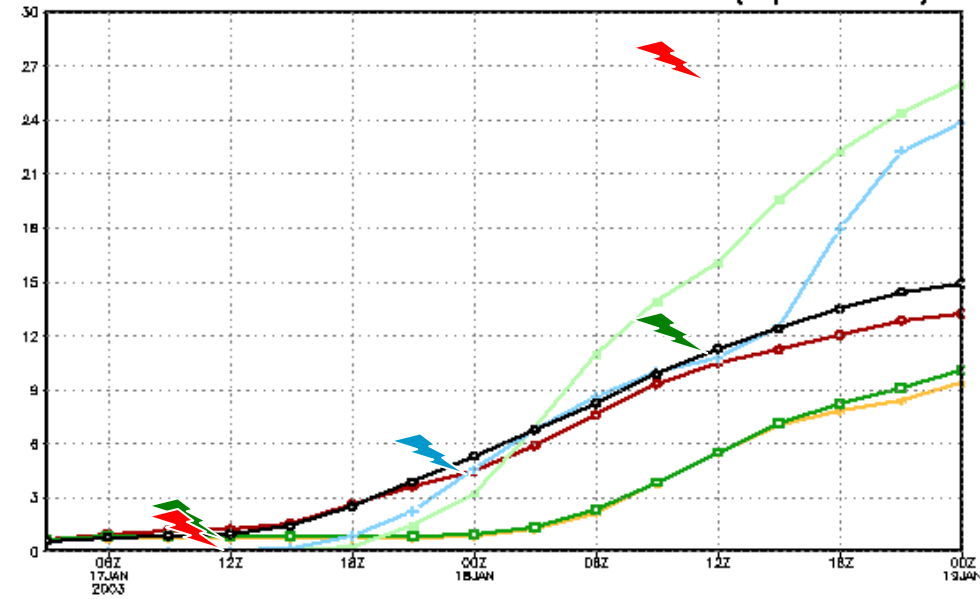
- The system is unpredictable

GPCP

CPC

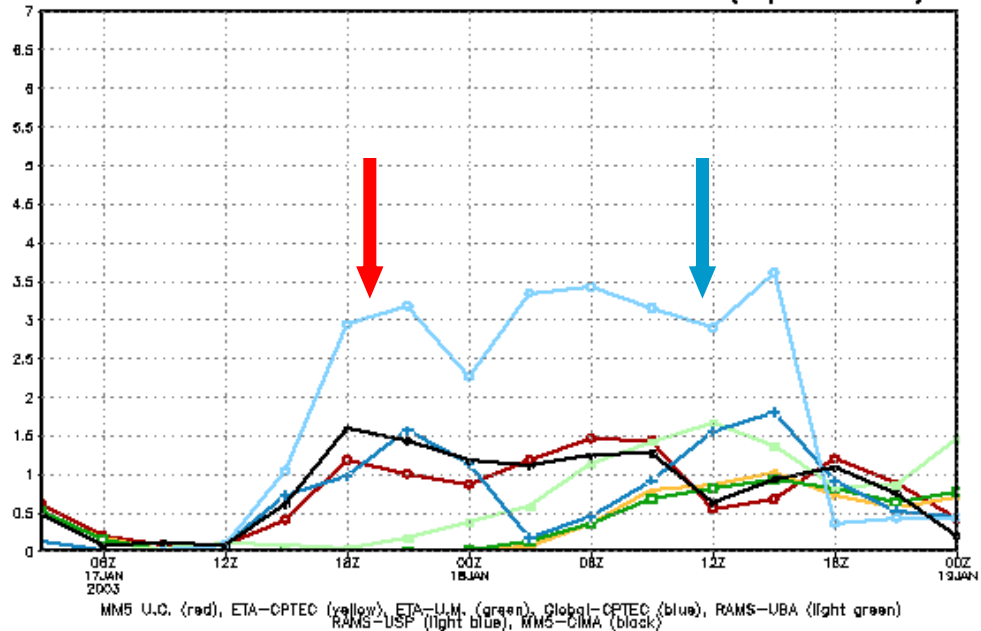**SALLJEX**

Convective parameterization…

- Instability is reasonably well reproduced by all the models

- Moisture convergence is not so coherent between runs, and some models may have been affected by underprediction of this quantity

- To correctly simulate nocturnal convection, the convective parameterizations should correctly handle nocturnal inversion

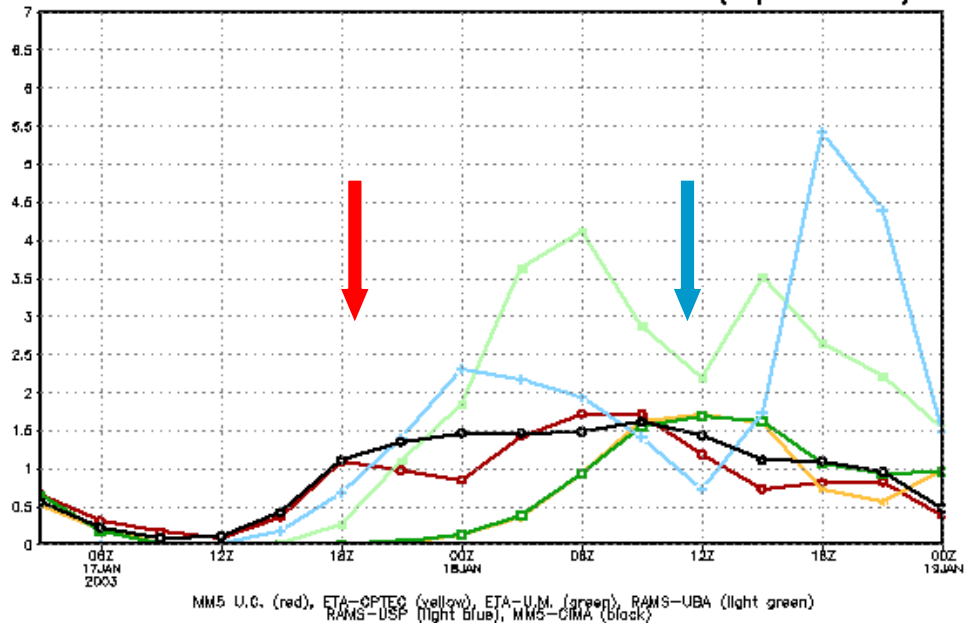## … are triggering mechanisms working properly ??

With additional data parameterization performance can be better assessed. Particularly, the role of the diurnal cycle upon different fields may be analyzed and parameterizations adjusted consequently

3hs Accumulated Precipitation Average(Kg/sqm)
From −30 S to −20 S and −65 W to −58 W. (Experiment 1)

MM5 U.C. (red), ETA−CPTEC (yellow), ETA−U.M. (green), Global−CPTEC (blue), RAMS−UBA (light green)
RAMS−USP (light blue), MM5−CIMA (black)

3 hs Accumulated Precipitation Average(Kg/sqm)
From −30 S to −20 S and −65 W to −58 W. (Experiment 2)

MM5 U.C. (red), ETA−CPTEC (yellow), ETA−U.M. (green), RAMS−UBA (light green)
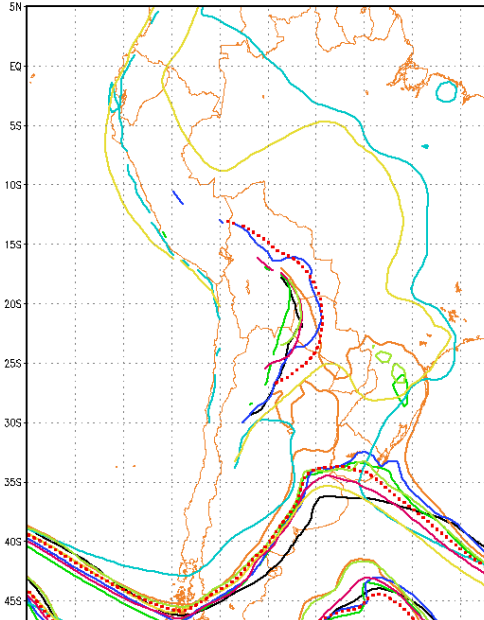RAMS−USP (light blue), MM5−CIMA (black)

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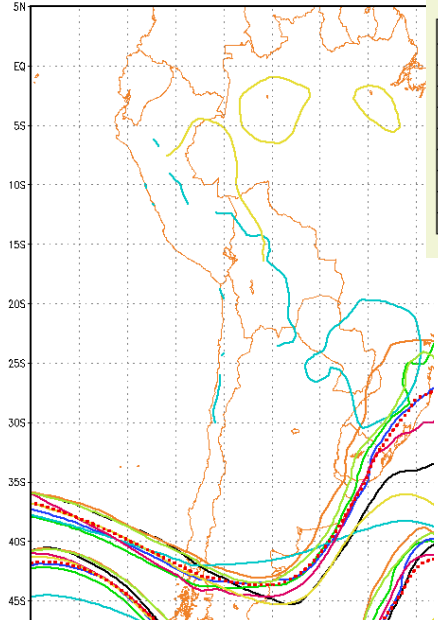- Model parameterization limitations
- **The system is unpredictable ?**

850 hPa. geopotential height spaghetti.
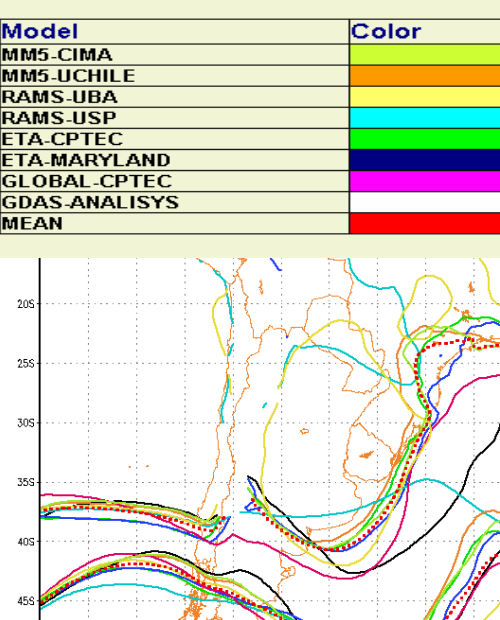Heights: 1480 and 1380 17 January 06
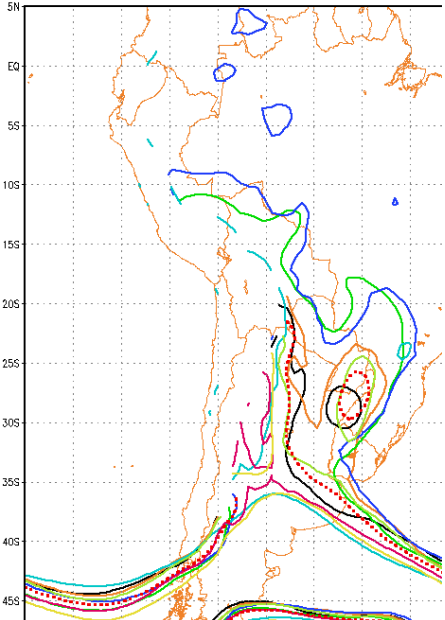
850 hPa. geopotential height spaghetti.
Heights: 1480 and 1380 17 January 18 UTC.

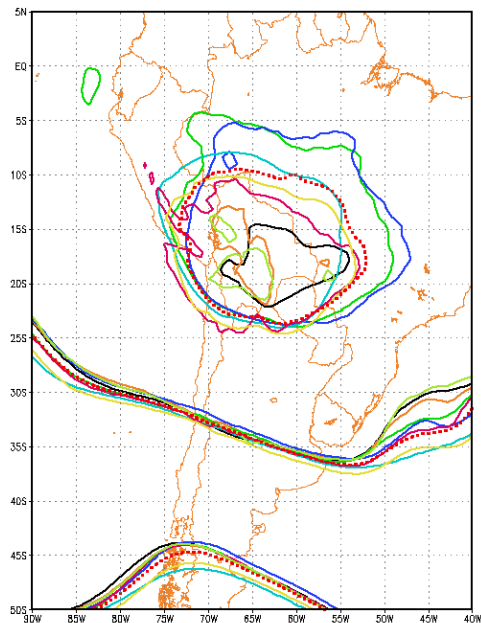850 hPa. geopotential height spaghe
Heights: 1480 and 1380 18 January 06

850 hPa. geopotential height spaghetti.
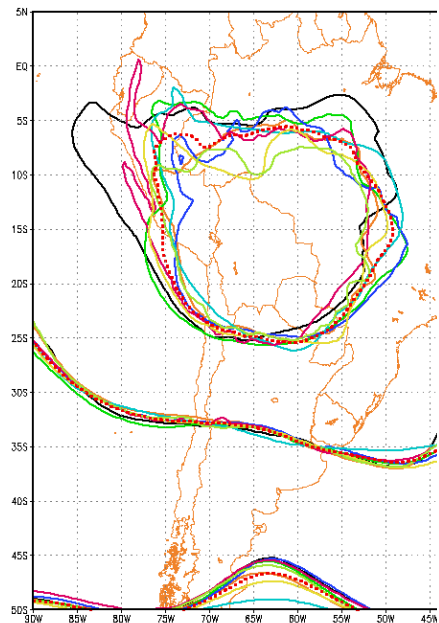Heights: 1480 and 1380 18 January 18 UTC.

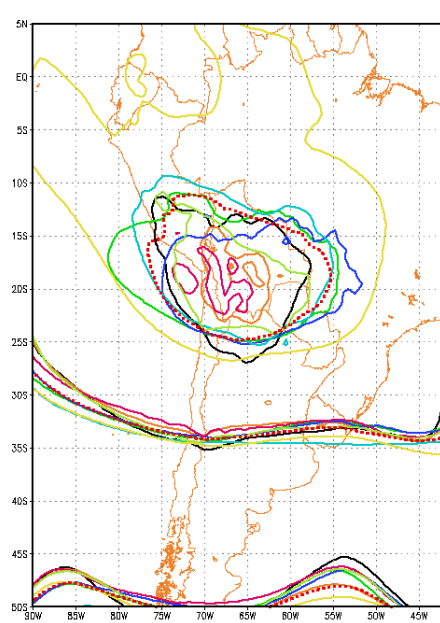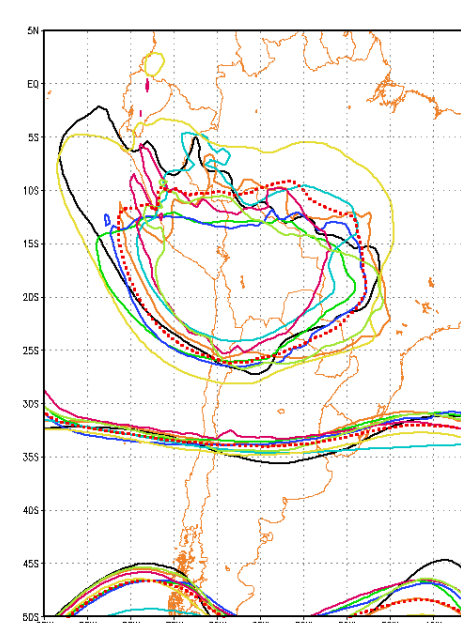| Model	Color
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MM5-UCHILE	
RAMS-UBA	
RAMS-USP	
ETA-CPTEC	
ETA-MARYLAND	
GLOBAL-CPTEC	
GDAS-ANALISYS	
MEAN	

250 hPa. geopotential height spaghetti.
Heights: 11000 and 10800 & 10200 17 January 06

250 hPa. geopotential height spaghe
Heights: 11000 and 10800 & 10200 17 Janu
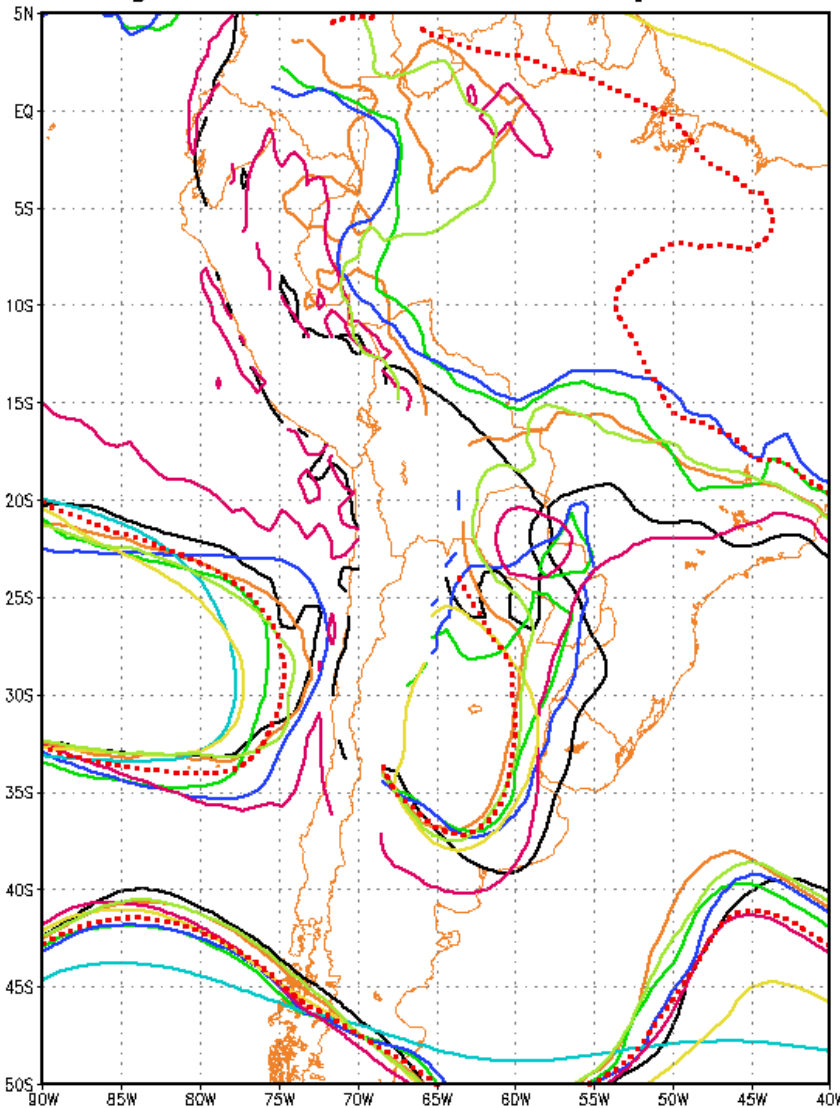
250 hPa. geopotential height spaghe
Heights: 11000 and 10800 & 10200 18 Jan

250 hPa. geopotential height spaghetti.
Heights: 11000 and 10800 & 10200 18 January

850 hPa. geopotential height spaghetti.
Heights: 1520 and 1380 18 January 12 UTC.

Model	Color
MM5-CIMA	
MM5-UCHILE	
RAMS-UBA	
RAMS-USP	
ETA-CPTEC	
ETA-MARYLAND	
GLOBAL-CPTEC	
GDAS-ANALISYS	
MEAN	