

# SALLJEX

## Modeling activities

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VPM7, Guayaquil, March 22-24 2004

# Outline

- MESA Modeling Goals
- Modeling in SALLJEX
  - Forecast activities during the field campaign
    - Operation Center at Santa Cruz de la Sierra
  - Post-field coordinated activities
    - Model intercomparison experiment
    - Data Assimilation
  - Model Development
    - Parameterization issues arising from SALLJEX experience
    - Results from ongoing research
- Concluding remarks

# Mesa Modeling Goal

## (VPM6-Miami)

- To improve seasonal and intraseasonal climate and hydrological predictions.
- Strategy is to focus on:
  - 1- Testing of hypothesis with models.
  - 2- Detecting deficiencies in the models and improving performance.
  - 3- Developing new parameterizations and model components.

# Modeling in SALLJEX

# Forecast activities during the field campaign :

## Groups from Argentina, Brazil, Chile and US issued daily weather forecasts

- NOGAPS model Analysis (USA)
- University of Utah Model Analysis (USA)
- ETA/CPTEC 40 km res., 00 and 12 UTC FC (BRAZIL)
- ETA/CPTEC 20 km res., 12 UTC FC (BRAZIL)
- ETA/UMD 80 km res., 00 UTC FC (USA)
- LAHM/CIMA 60 km res., 00 UTC FC (UBA/CIMA)
- NCEP/AVN 100 km res., 00 UTC FC (USA)
- RAMS/UBA 20 km res., 00 UTC FC (UBA/CIMA)
- RAMS/USP 25 km res., 00 and 12 UTC FC (BRAZIL)
- U of Chile MM5 30 km res., 12 UTC FC (CHILE)

# Forecast activities during the field campaign :

- Operation Center at Santa Cruz de la Sierra (VAMOS Project Office, field scientists and students)
  - Special model outputs have been prepared to assist in the forecast and in the coordination of each NOAA P-3 mission.
  - Several case studies were identified to proceed with research and collaboration among participating scientists

**<http://www.joss.ucar.edu/salljex/dm/>**

# Post-field coordinated activities

# Model intercomparison: 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.



# Coordination:

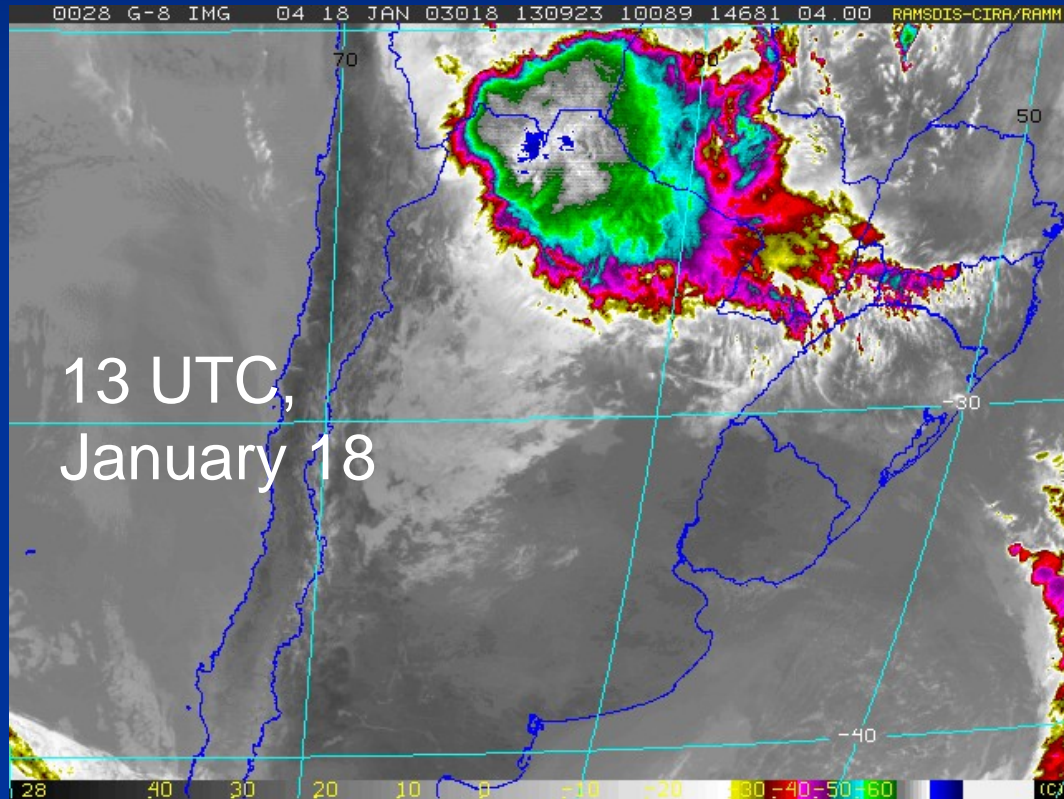
- Celeste Saulo, Univ. of Buenos Aires/CIMA
- Claudia Campetella, Univ. of Buenos Aires/CIMA

# Participants:

- 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

# The 17-18 Jan. MCS ...

## Not predicted by models



15 February 2003

Last update: 2 June 2003

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Coordinated Experiment to assess models performance

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### Motivation

Last update: 2 June 2003

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### EXPERIMENT 1

#### HIGHLIGHT OF EXPERIMENT 1

This experiment is a low resolution one, covering all of South America and focusing in the evolution of a Mesoscale Convective System over SALLJEX region. Since most of the operational models during SALLJEX campaign did not succeed in forecasting this precipitating system, while some of them produced weak precipitation, it was decided to analyze in more detail which could be the main causes of model disagreement. Emphasis will be placed in the analysis of low level circulation and precipitation.

#### TIMELINE FOR THIS EXPERIMENT

**BY AUGUST 1st:** All models outputs should be available at SALLJEX Master List

**BY SEPTEMBER 15:** First assessment of model performance and comparisons will be available to SALLJEX modelers community. Open discussion of results.

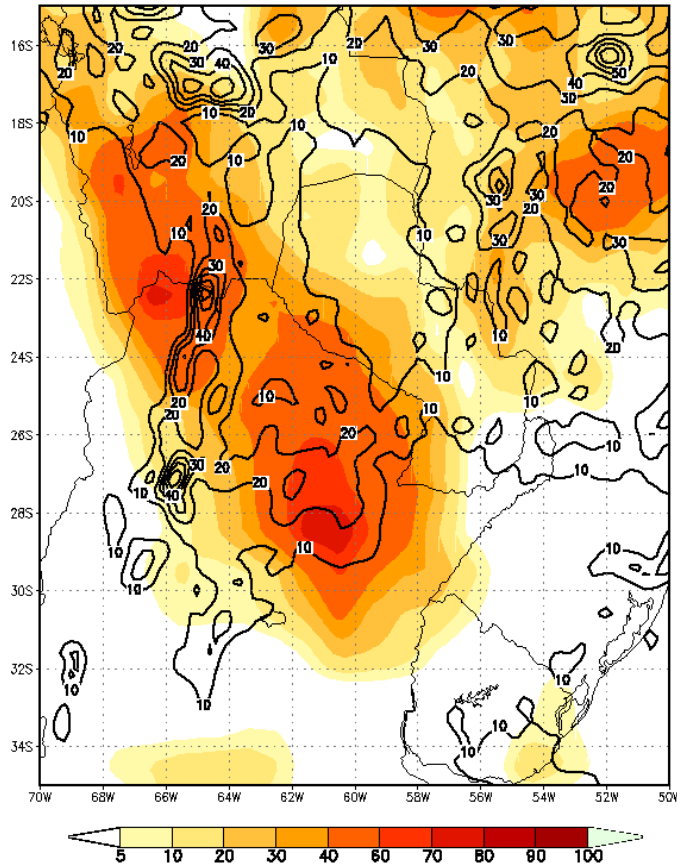
**BY NOVEMBER 1st:** Deadline to receive comments from SALLJEX modelers community. The results will be presented during the First SALLJEX workshop, to be held at Buenos Aires.

*Exp 1: 80 km  
Covering  
South  
America*

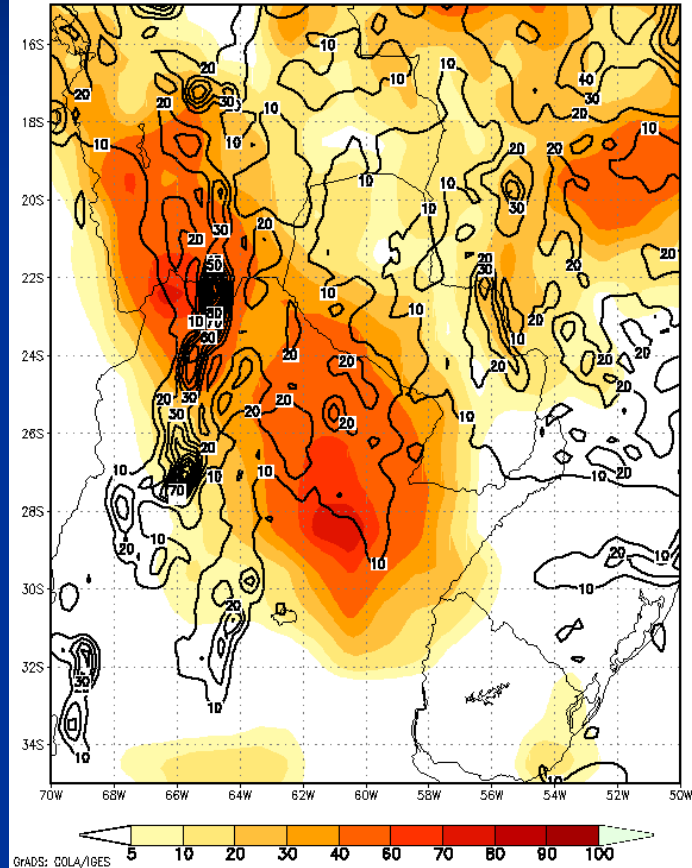
*Exp 2: 20 km  
Covering  
SALLJEX  
area*

# 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)





GPCP

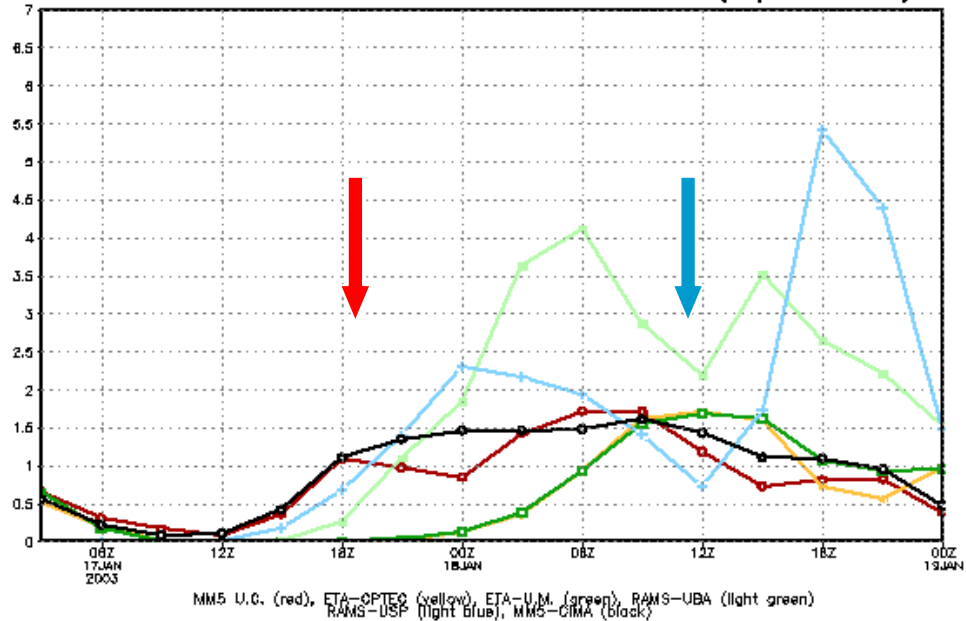


CPC

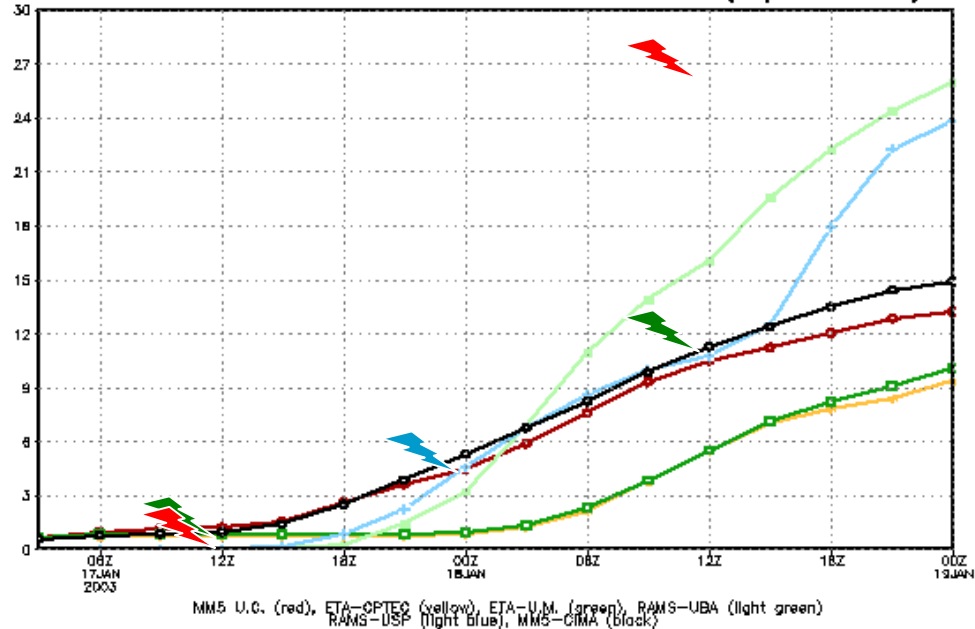


SALLJEX

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

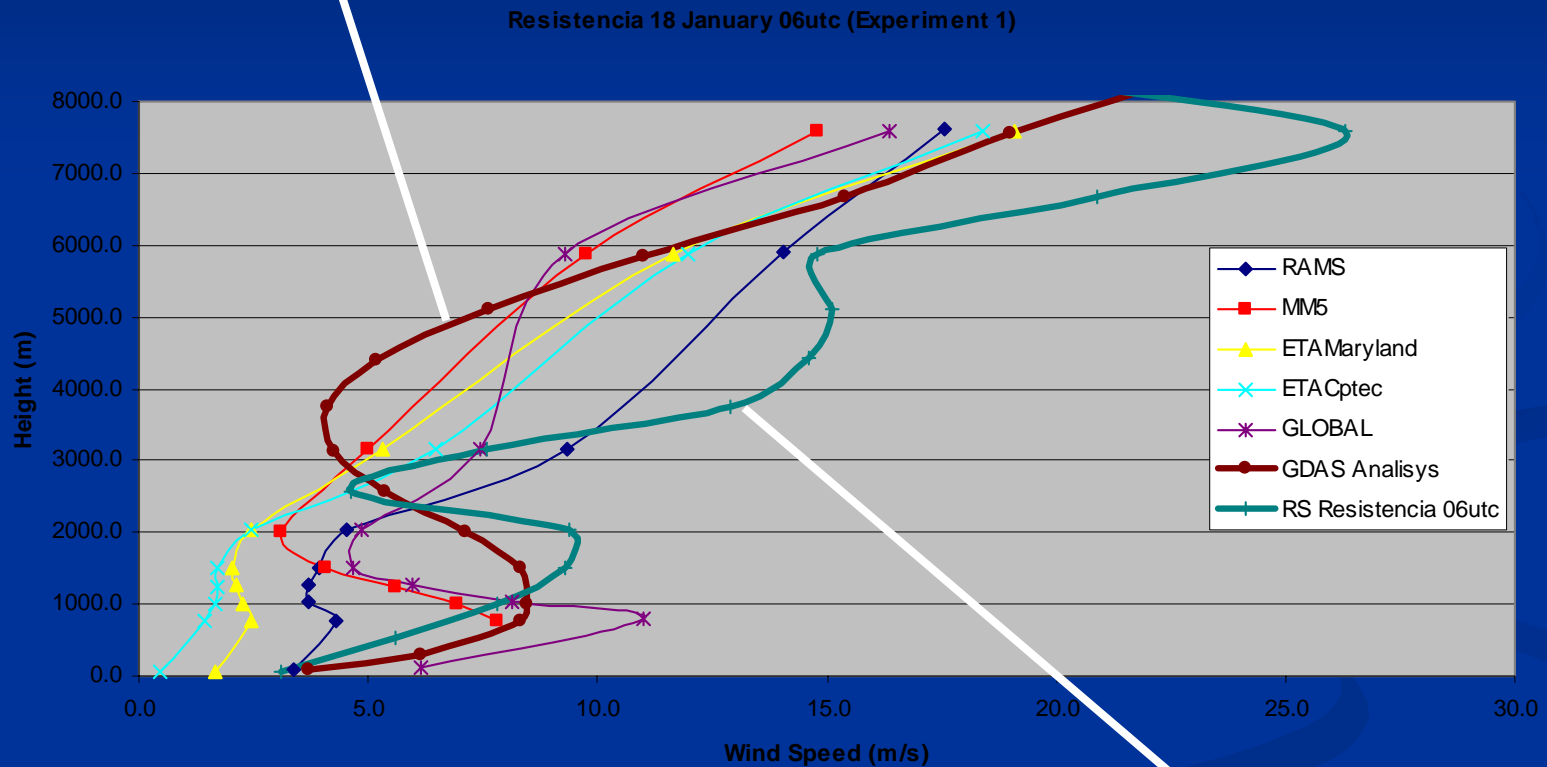


Total Accumulated Precipitation Average(Kg/sqm)  
From -30 S to -20 S and -65 W to -58 W. (Experiment 2)



# Forecast verification

GDAS



Radiosonde  
data

Why didn't models forecast this event ?  
Why did we find deficiencies in model performance close to the mountains?

- Urged us to look for answers
  - Data assimilation issue
  - Parameterization issues
  - Predictability assessment

# Data Assimilation

CPTEC – Brazil

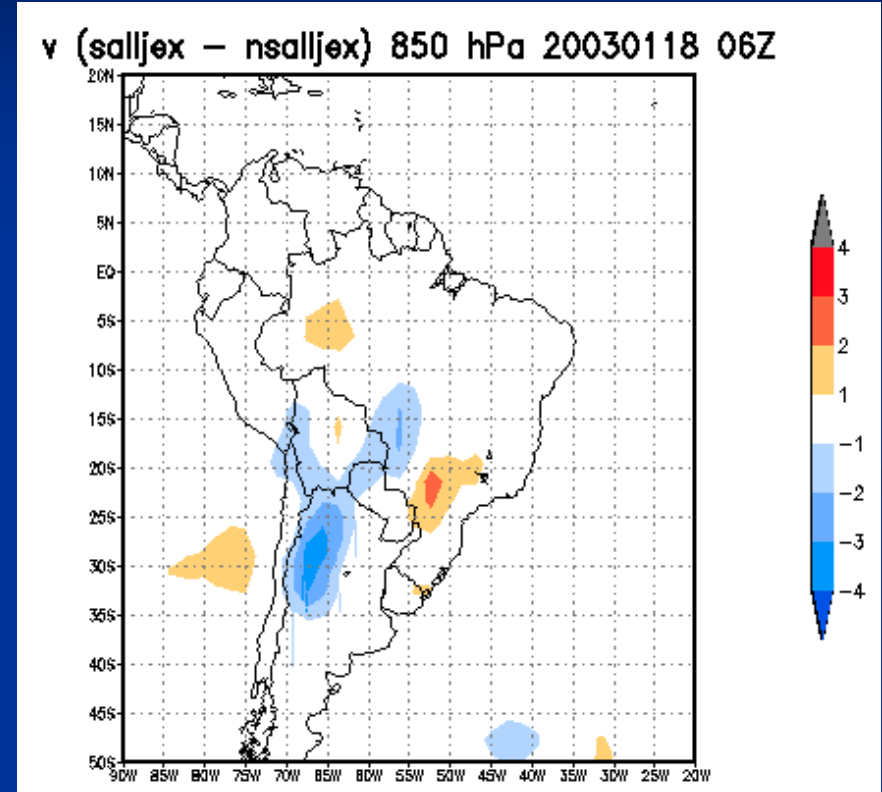
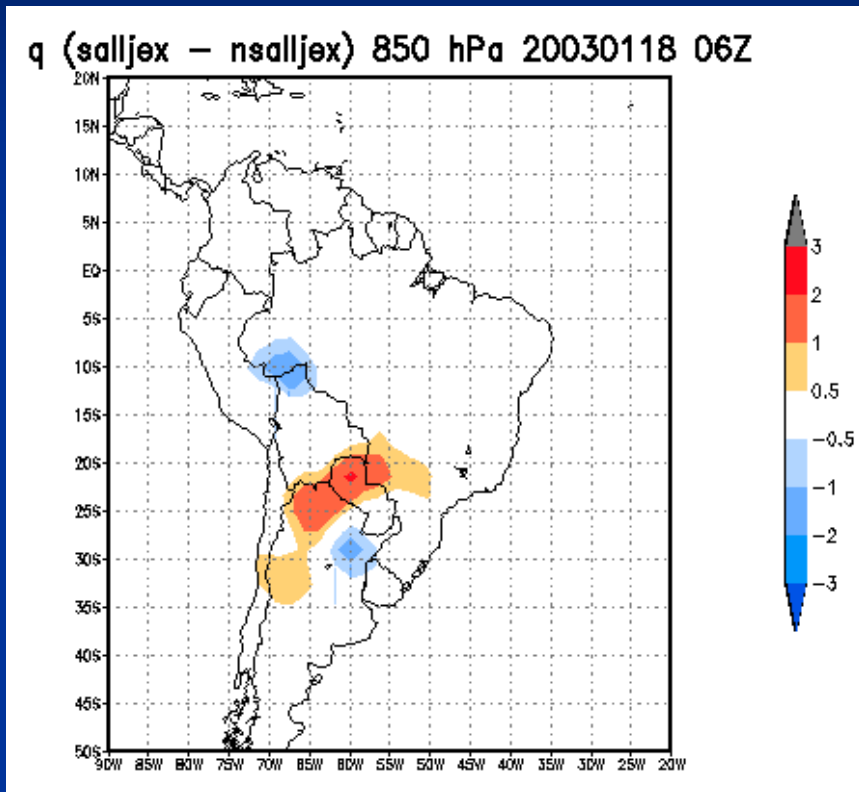
USP – Brazil

UBA – Argentina



# Experiments with the SALLJEX dataset using CPTEC Global Model

Dirceu L.Herdies, I. Cavalcanti, J.A. Aravéquia, J. Marengo,  
and R. Cintra



Results from experiments using SALLJEX data assimilated for q and v (differences). For January 18 2003 the assimilation resulted on an increase of moisture at 850 hPa and on the meridional component of the wind over the region. Experiments were made using the CPTEC GCM T062L28 (~200kmX200km).

# Model development

USP – Brazil

ATMET and Duke University - USA

# RAMS advancements and SALLJEX: Impact of 'shaved' ETA vertical coordinates in RAMS Simulations of the Andes low level jets and of effect of cumulus parameterizations

Pedro L. Silva Dias

## *Problems with Terrain-Following ( $\sigma$ ) Coordinate Systems*

## *Surface data rejection in the assimilation module near mountains*

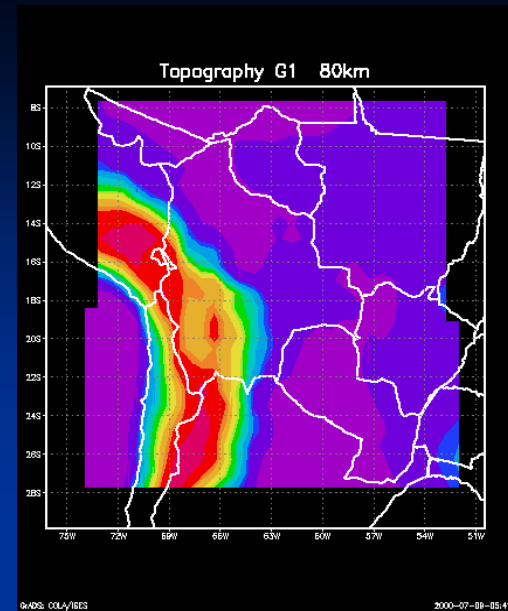
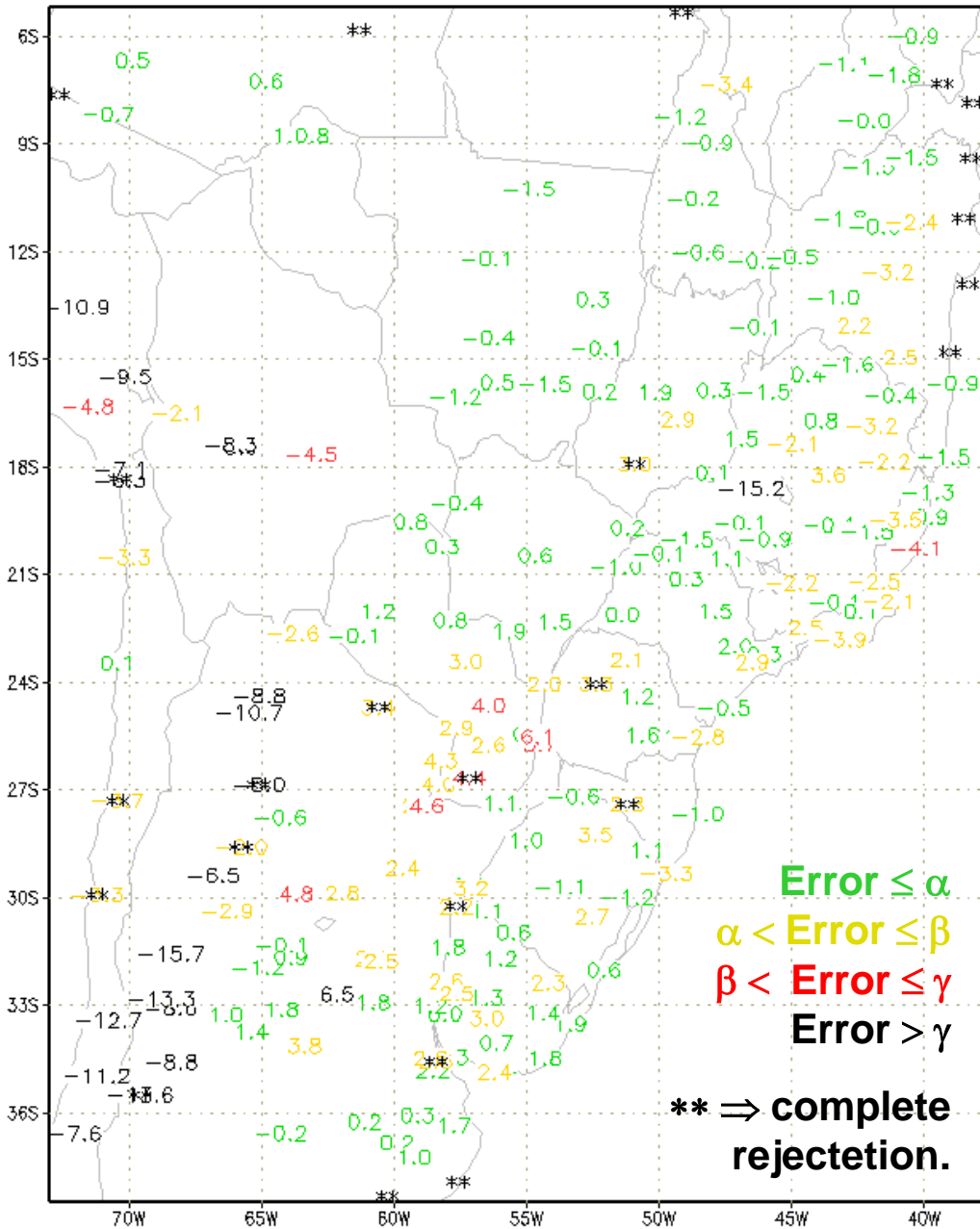
Adaptative vertical coordinate (shaved eta) – RAMS

Developed by Dr. Craig Tremback\* and Dr. Robert Walko\*\*

\*ATMET      \*\*Duke University

(currently under operational testing and debugging at MASTER/IAG-USP)

Erro em T (fst - obs)

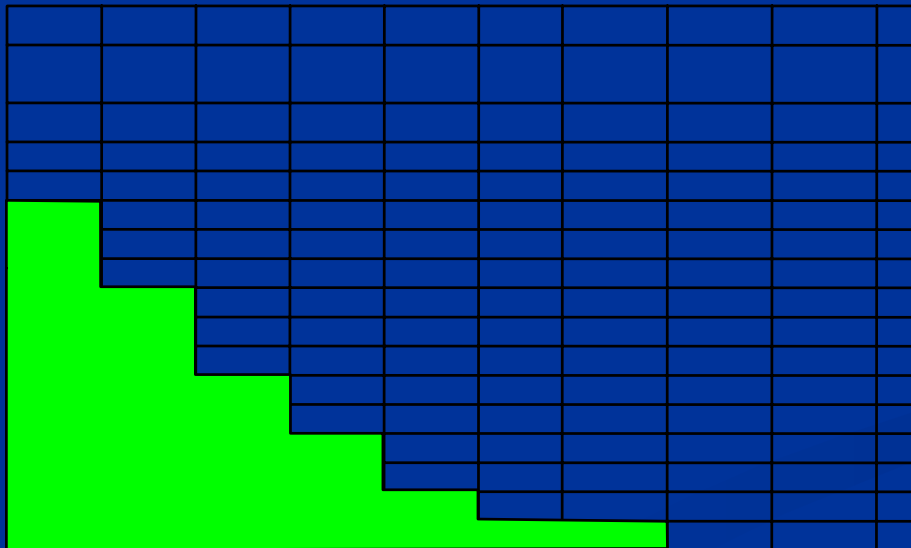


Difference between first guess (BRAMS-20km) and the observed temperature (METAR+SYNOP) on Jan 10,2002 00UTC.

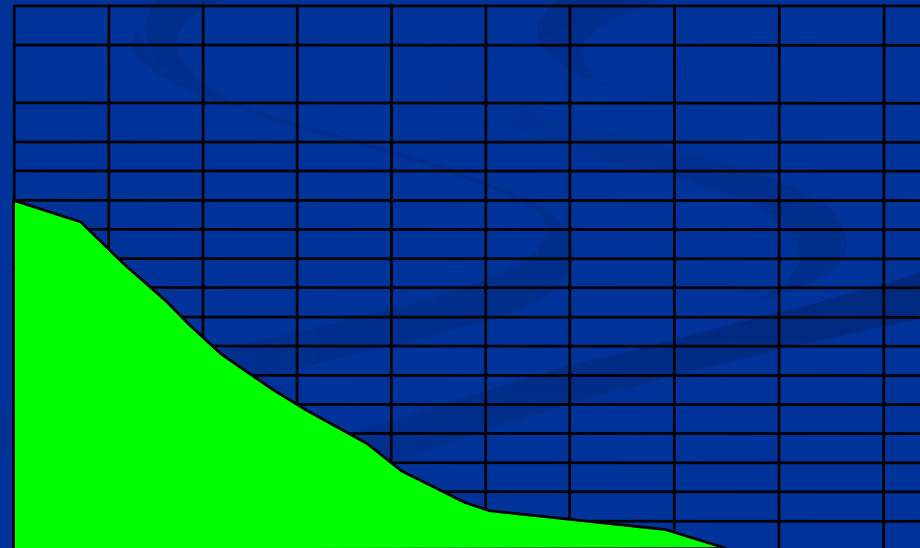
# *Toward a Robust Solution...*

- ADAP (ADaptive APerture) coordinate
- Mostly following work of Adcroft, *et al* for oceanographic model
- “Shaved” ETA-type coordinate

*Standard ETA coordinate*

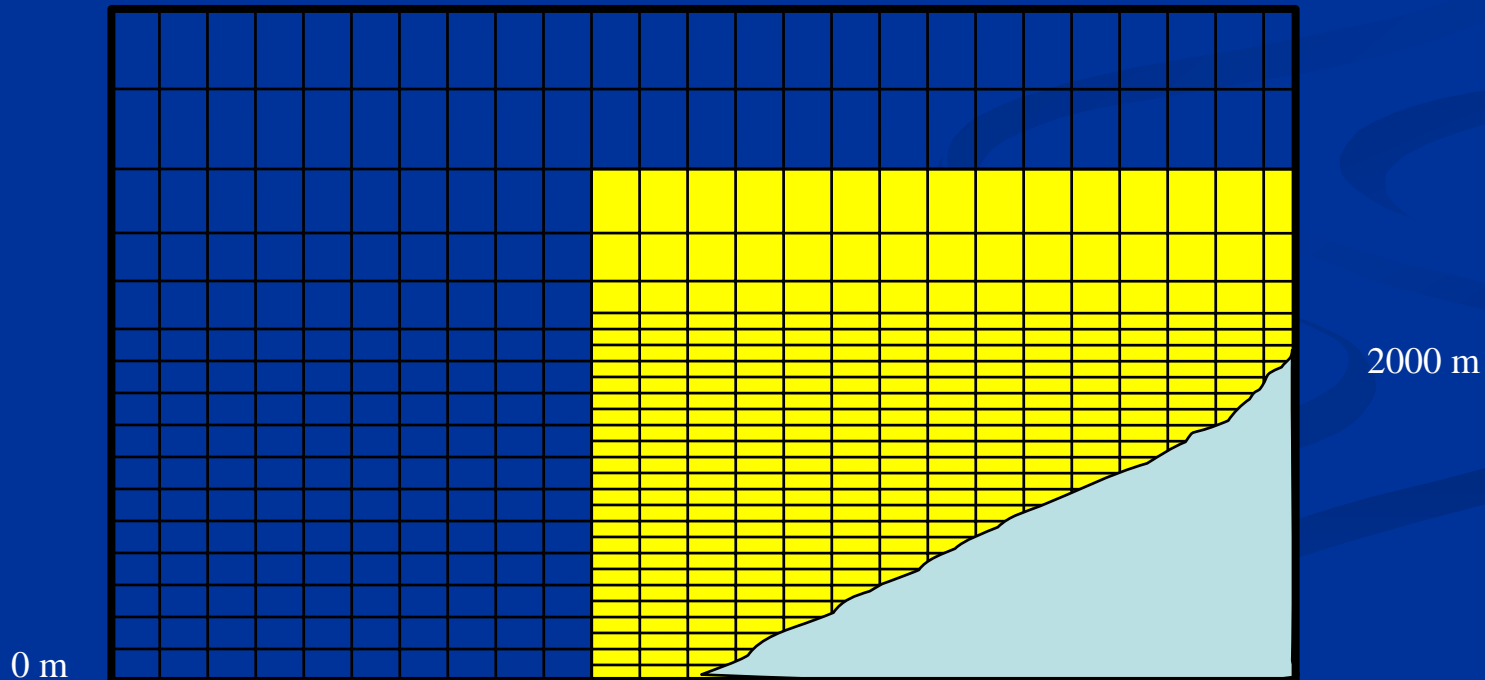


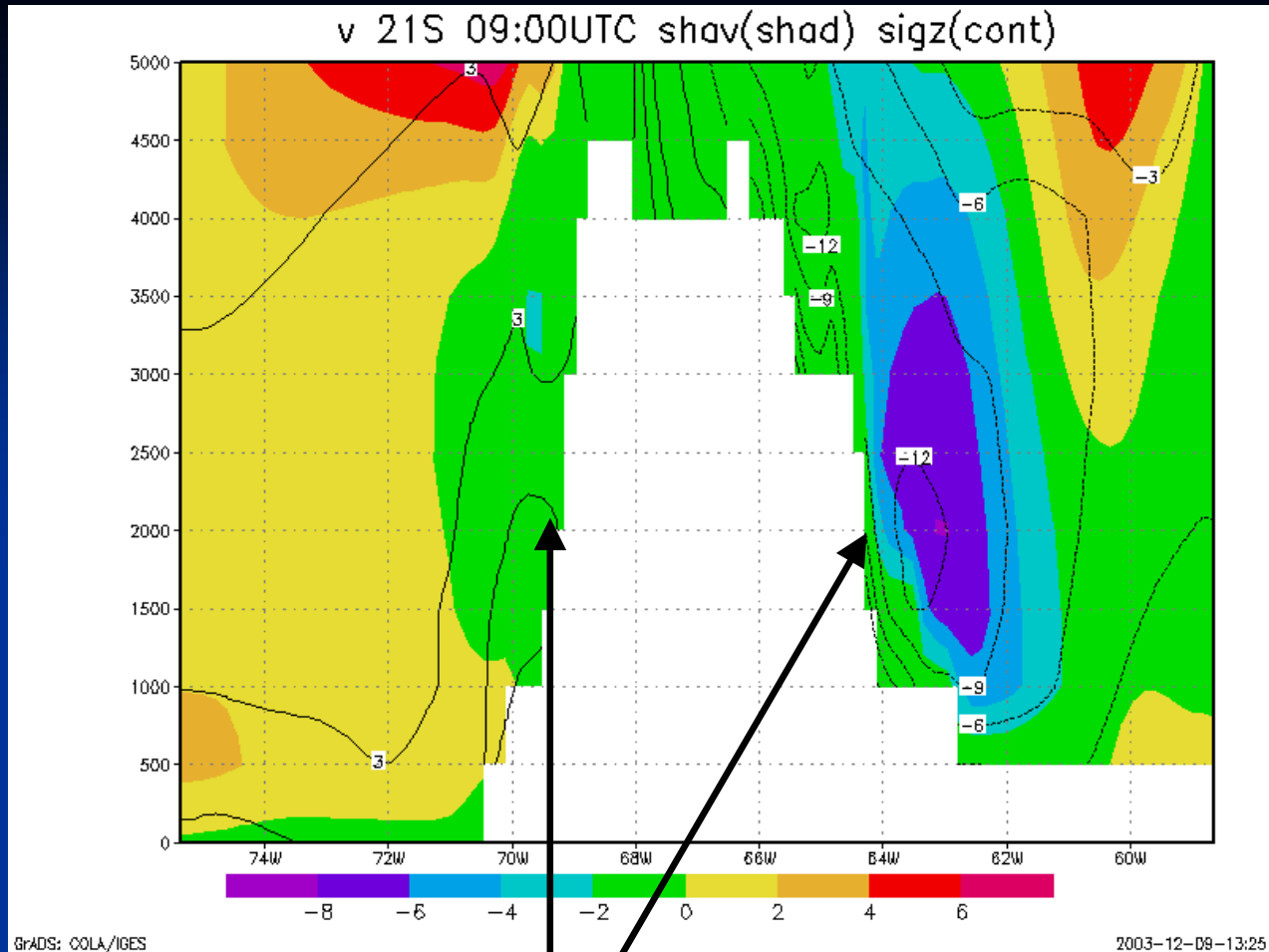
*ADAP coordinate*



# *RAMS Vertical Nesting*

- Can add vertically-nested grid along slope
- Nest can have same horizontal resolution as “coarse” grid
- Nest is not required to extend to model top
- Not ideal solution (e.g. second order approx), but can help...





Shaved\_eta allows steep orography simulations with reduction of computational effort and much smaller truncation error along sloping surfaces.

Significant reduction in data rejection in mountain regions in surface data assimilation procedure with 20 km resolution.

# Testing different parameterizations of convection

USP – Brazil

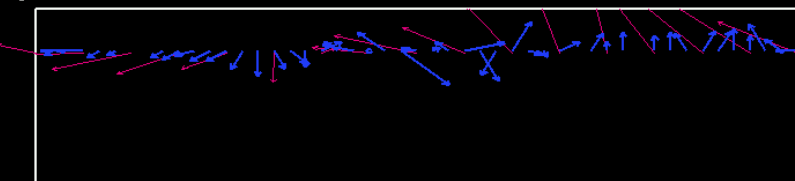
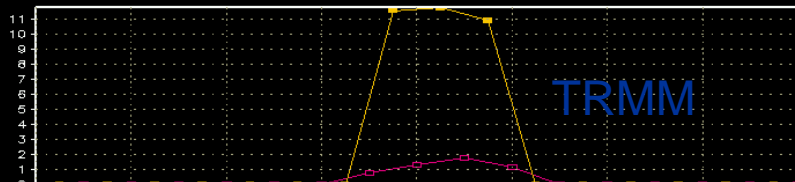
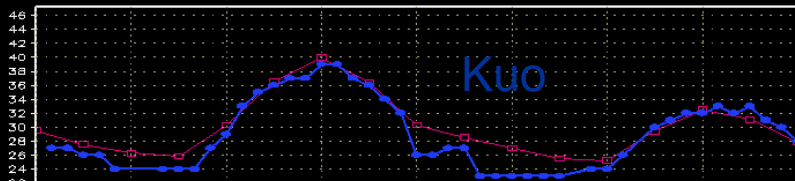
CPTEC – Brazil

GFDL - USA



# Different Cu-Parameterization Schemes – Case Jan 18 – Resistencia

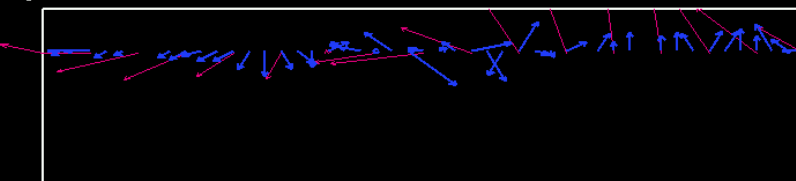
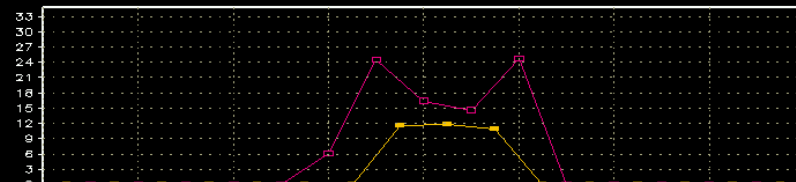
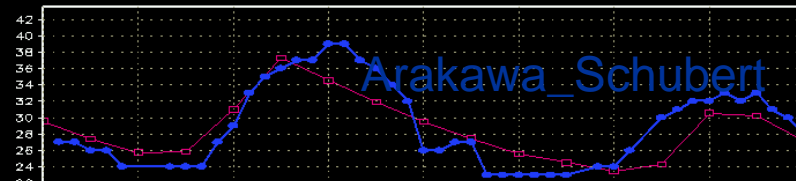
COMPARACAO ENTRE METAR(—●—), RAMS(—□—), TRMM(—◇—)



00Z 17 JAN 2003 06Z 12Z 18Z 00Z 18 JAN 06Z 12Z 18Z 00Z 19 JAN

topo [SARE]=> 52. 2 m/s

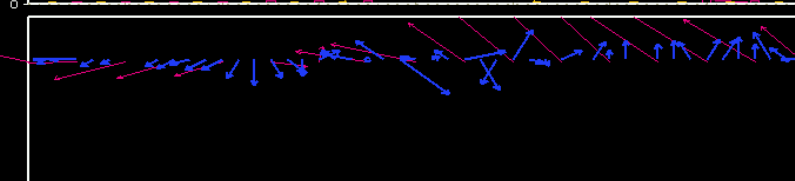
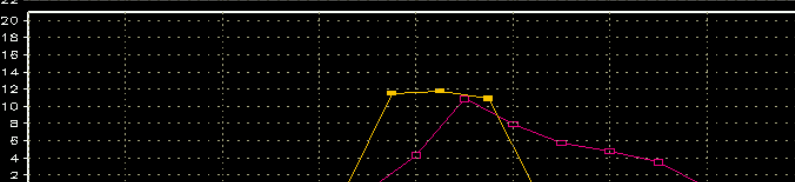
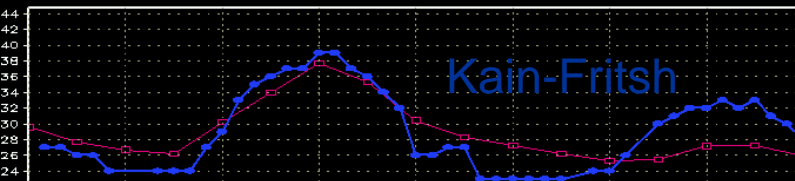
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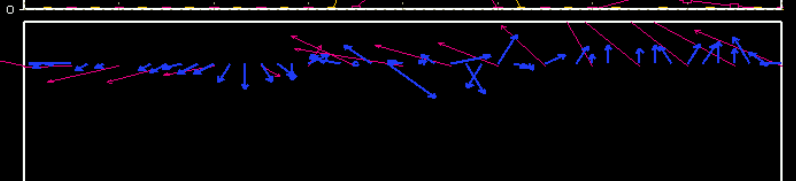
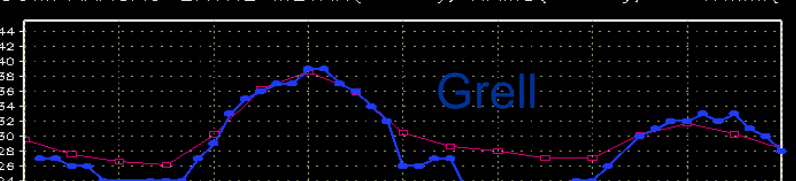
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COMPARACAO ENTRE METAR(—●—), RAMS(—□—), TRMM(—◇—)



00Z 17 JAN 2003 06Z 12Z 18Z 00Z 18 JAN 06Z 12Z 18Z 00Z 19 JAN

topo [SARE]=> 52. 2 m/s

# Preliminary results

- Intensity distribution of precipitation events depends on cumulus parameterization
- This has been particularly observed for January 17-18, 2003.

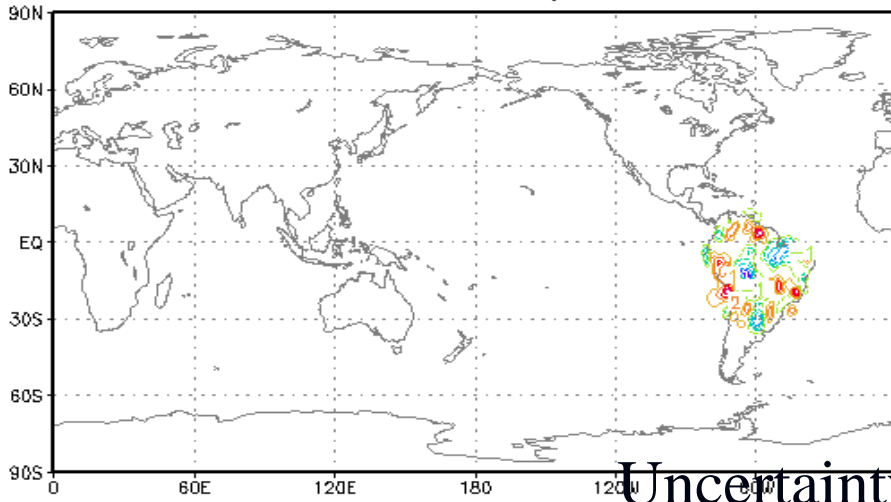
# Predictability issues

U. of Utah – USA

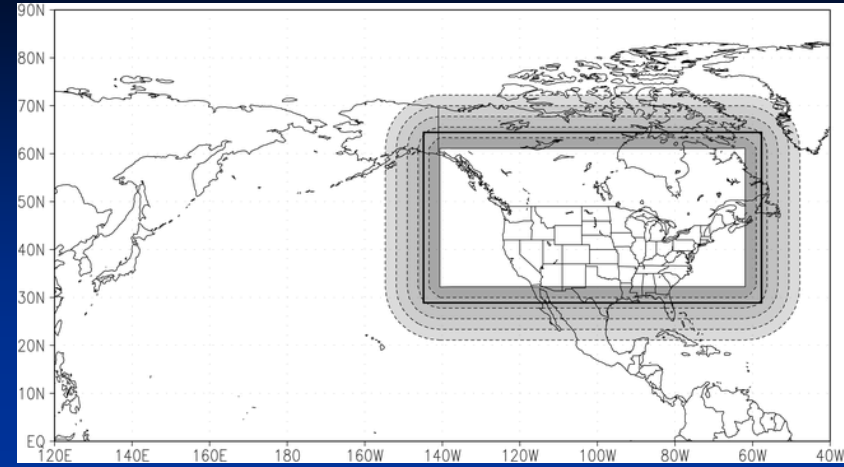
UBA/CIMA – Argentina

U. of Maryland - USA

00 Hr v-wnd 17 January 2003  
 .875 REAN-REAN w/GDAS SA

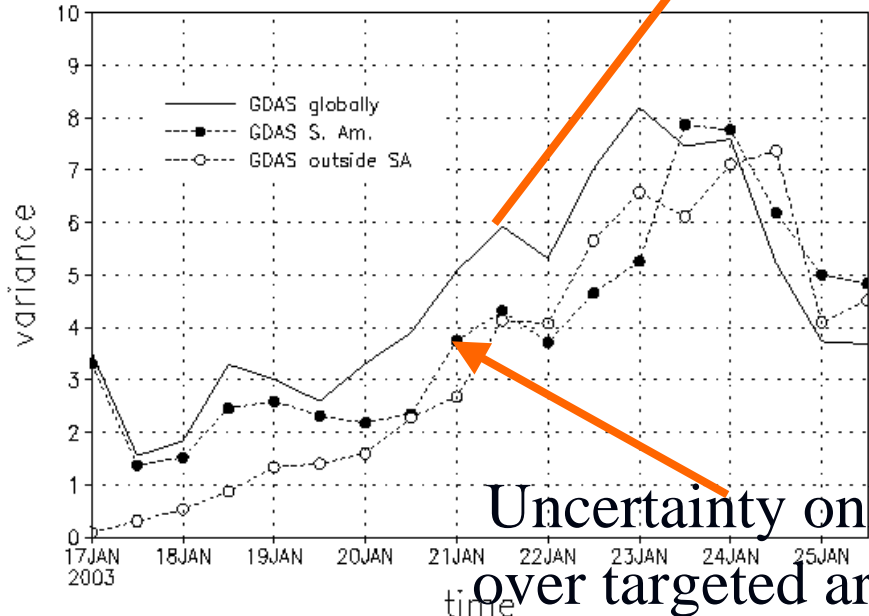


Uncertainty over the whole globe

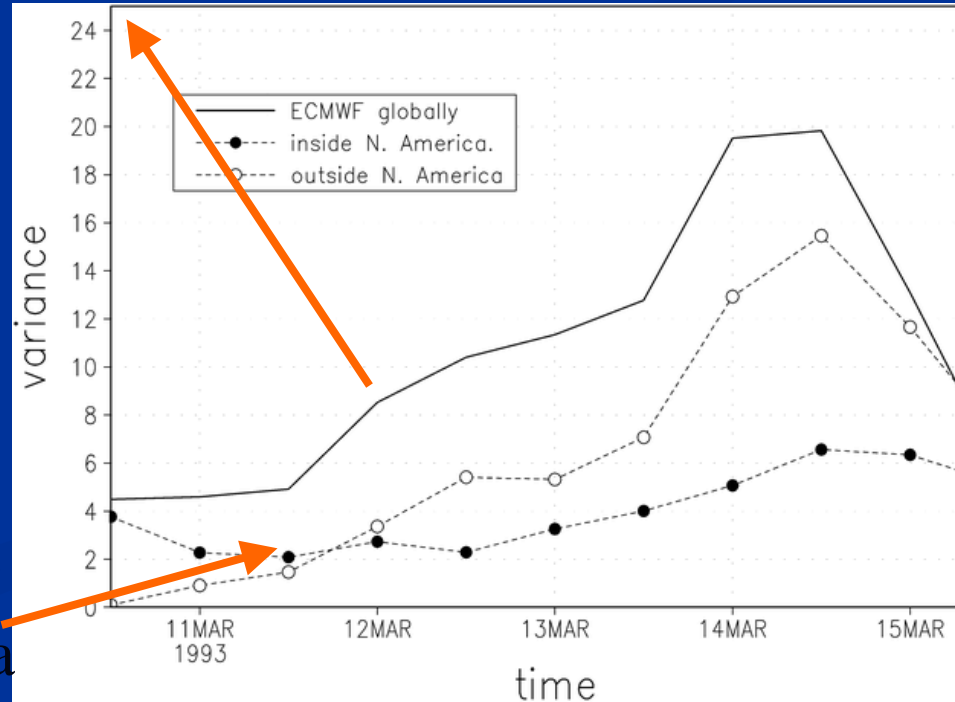


Miguez-Macho & Paegle, 2001

SALLJEX-area Targeted  $\nu = 0.875$



Uncertainty only over targeted area



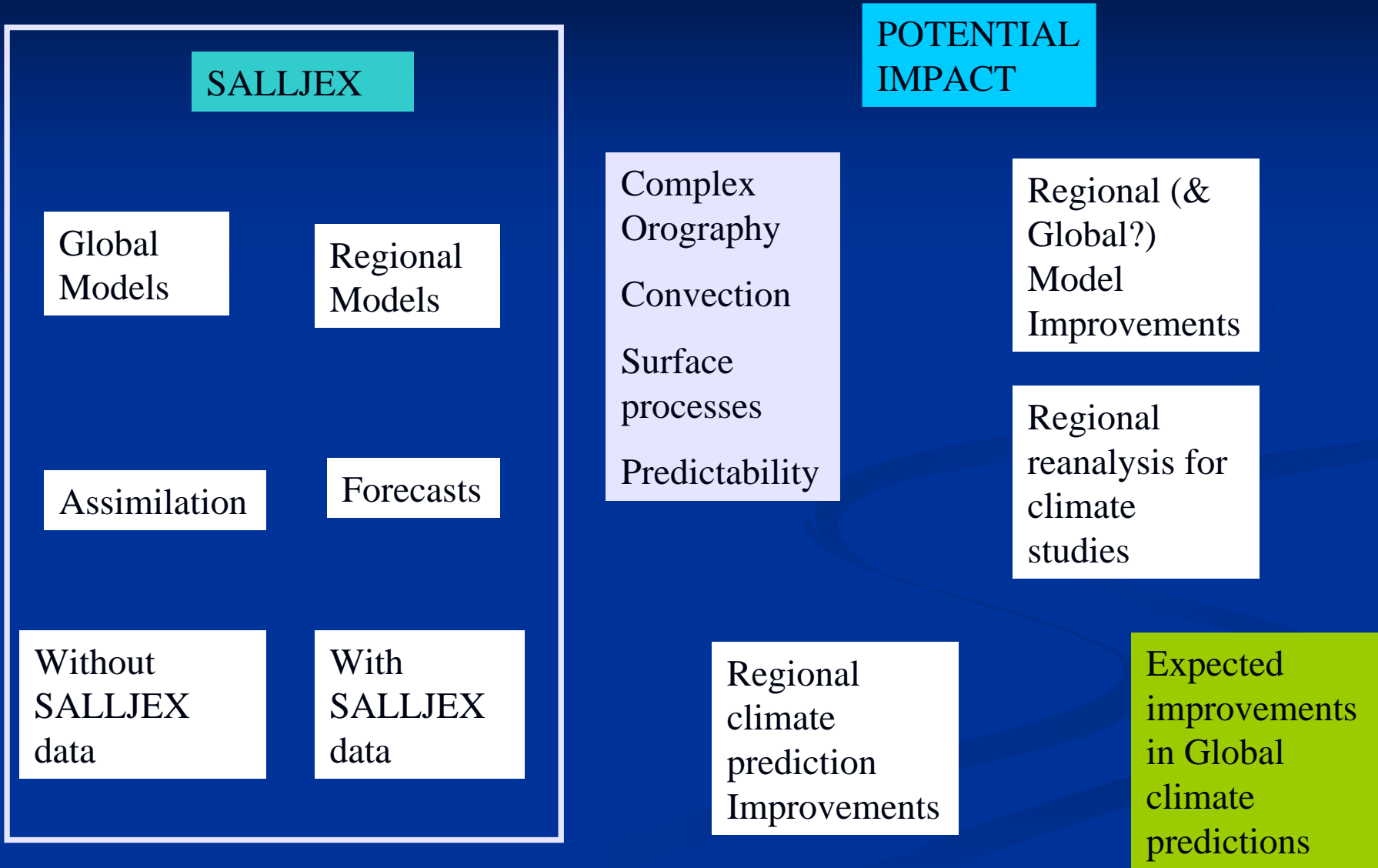
Uncertainty over the whole globe

Uncertainty only over targeted area

# Concluding remarks

- To improve seasonal and intraseasonal climate and hydrological predictions.
- Strategy is to focus on:
  - Testing of hypothesis with models.
  - Detecting deficiencies in the models and improving performance.
  - Developing new parameterizations and model components.
- Data assimilation issue
- Parameterization issues
- Predictability assessment

# How is SALLJEX contributing to MESA modeling?



**Thank you**