SALLJEX
Modeling activities

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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 where 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:

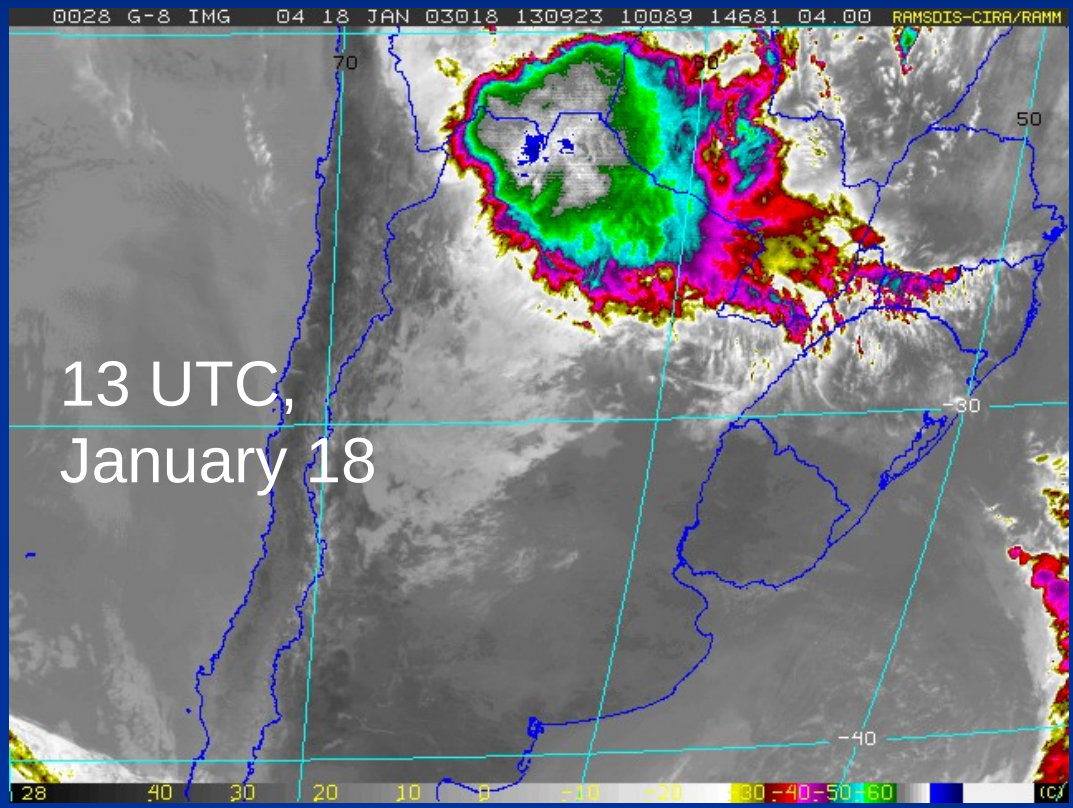
- Celeste Saulo, Univ. of Buenos Aires/CIMA
- Claudia Campetella, Univ. of Buenos Aires/CIMA

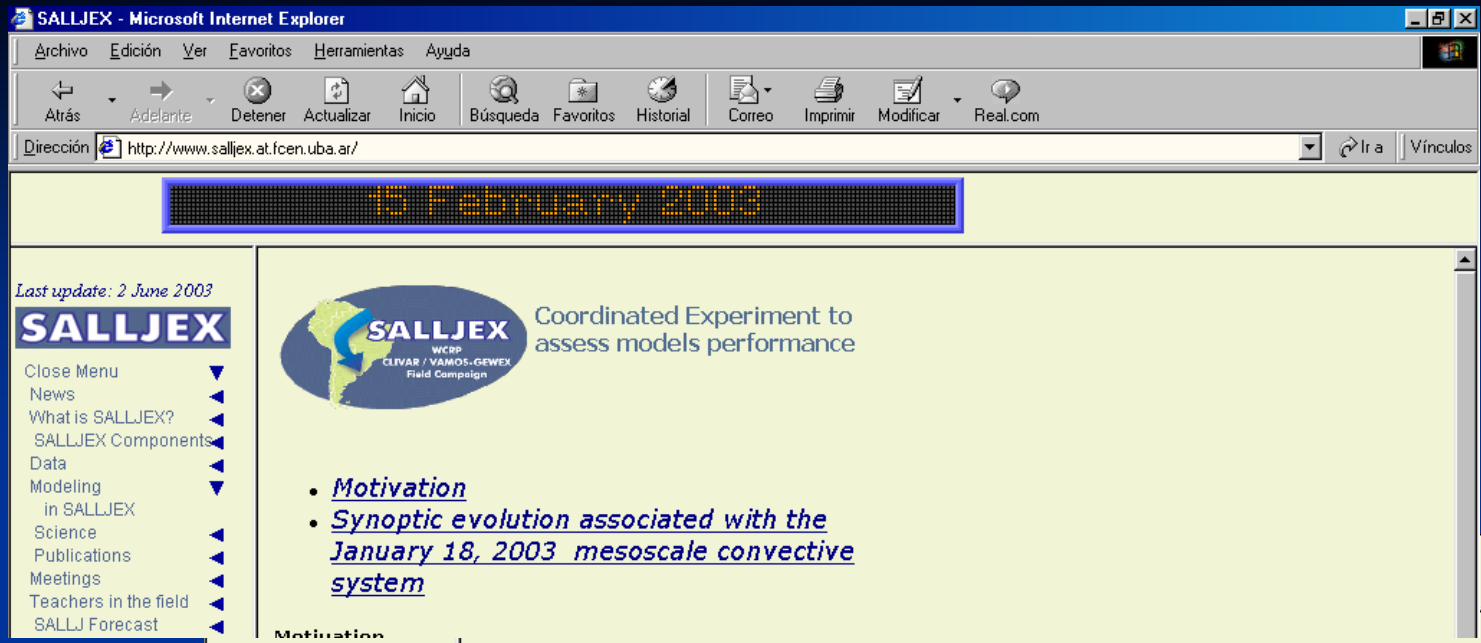
Participants:

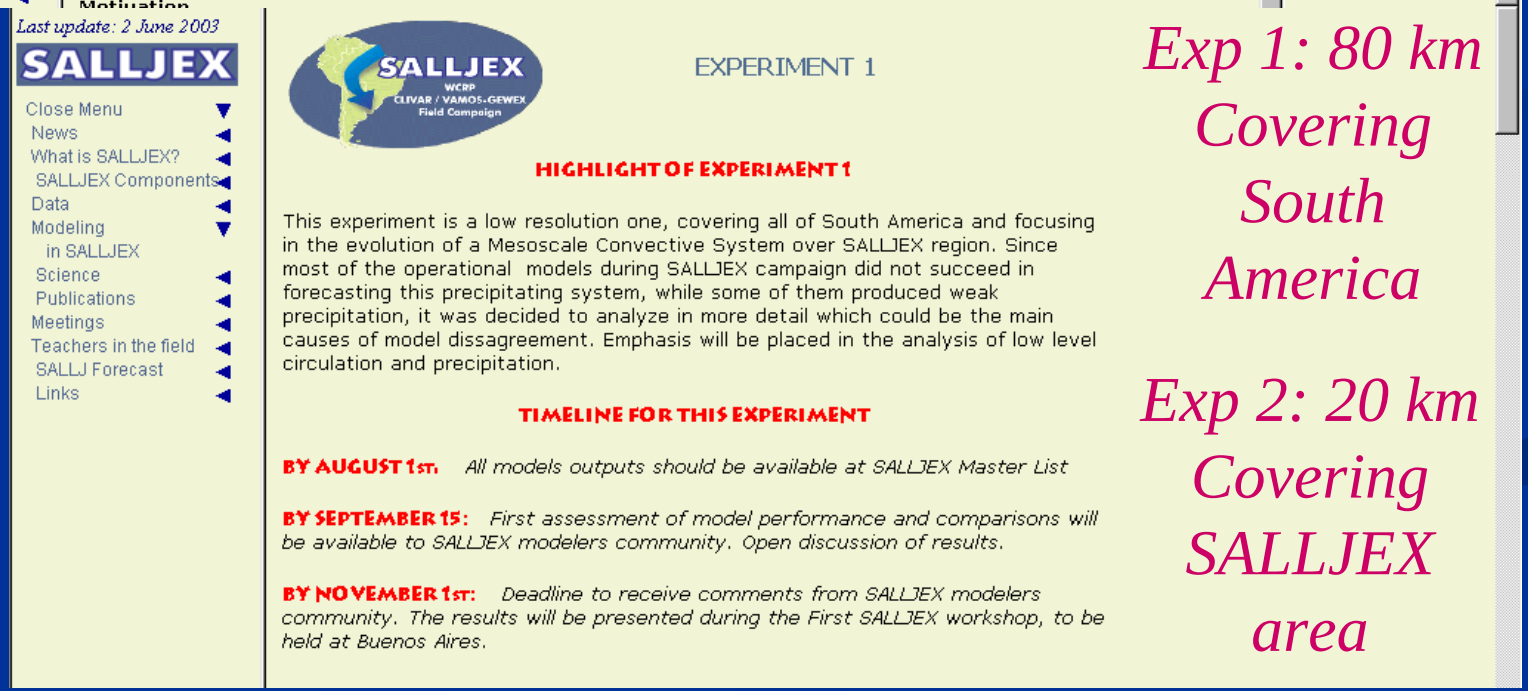
- Hugo Berbery: ETA model at the Univ. of Maryland
- Rene Garreaud: MM5 model at the Univ. of Chile
- Dirceu Herdies: Global model at CPTEC/INPE
- Claudio Menendez: MM5 model at CIMA (CONICET - UBA)
- Matilde Nicolini: RAMS model at Univ. of Buenos Aires
- Marcelo Seluchi: ETA model at CPTEC/INPE
- Pedro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

The 17-18 Jan. MCS ...

Not predicted by models



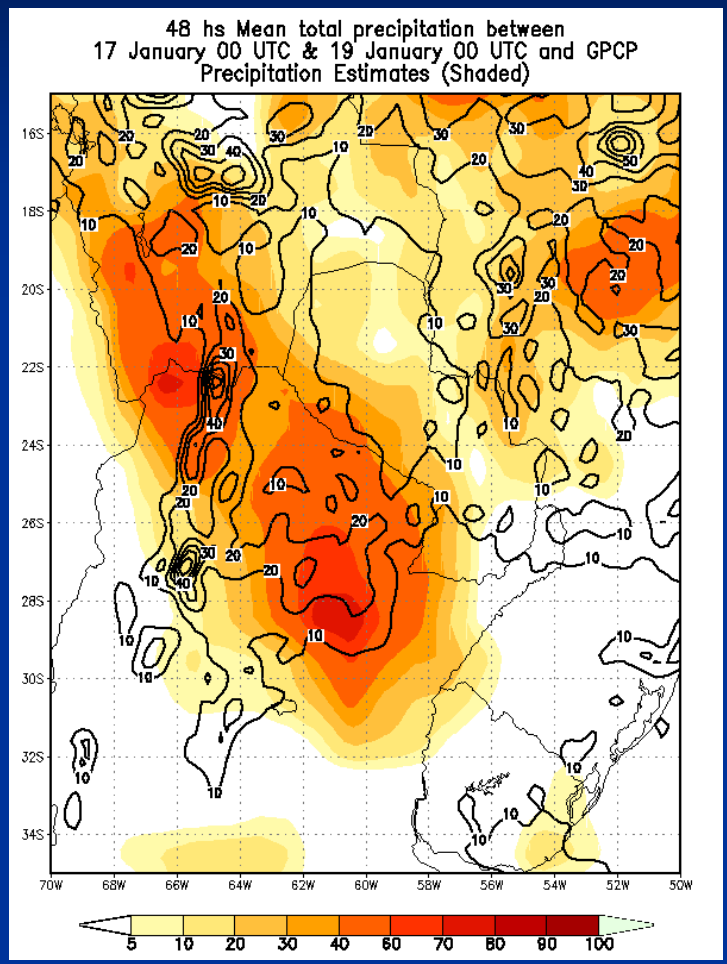


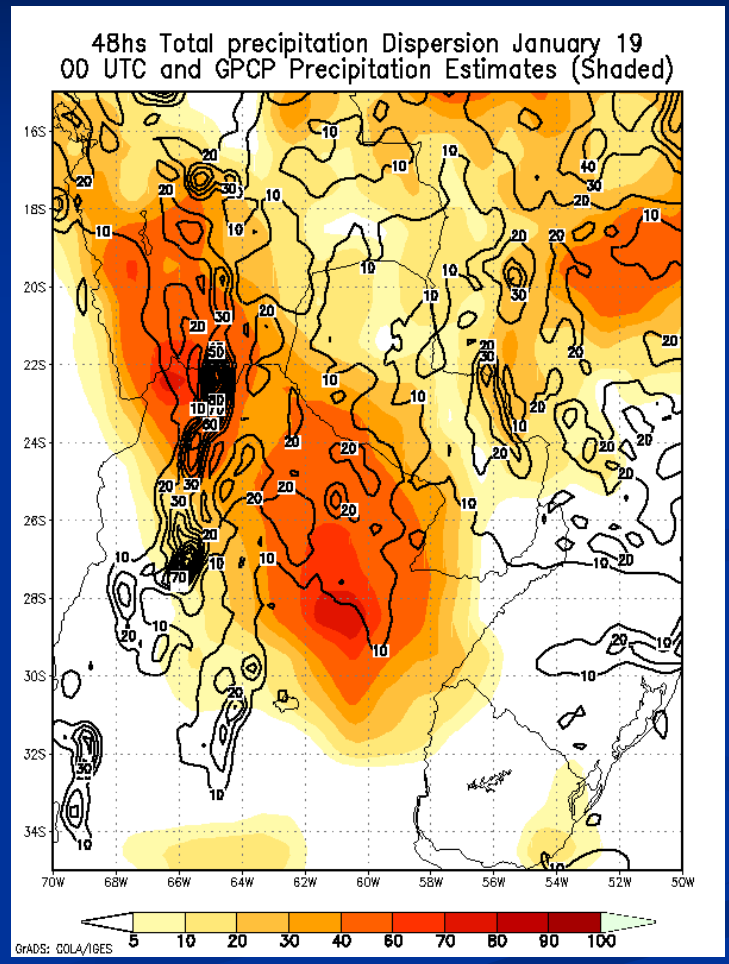


Exp 1: 80 km Covering South America

Exp 2: 20 km Covering SALLJEX area

Experiment 2

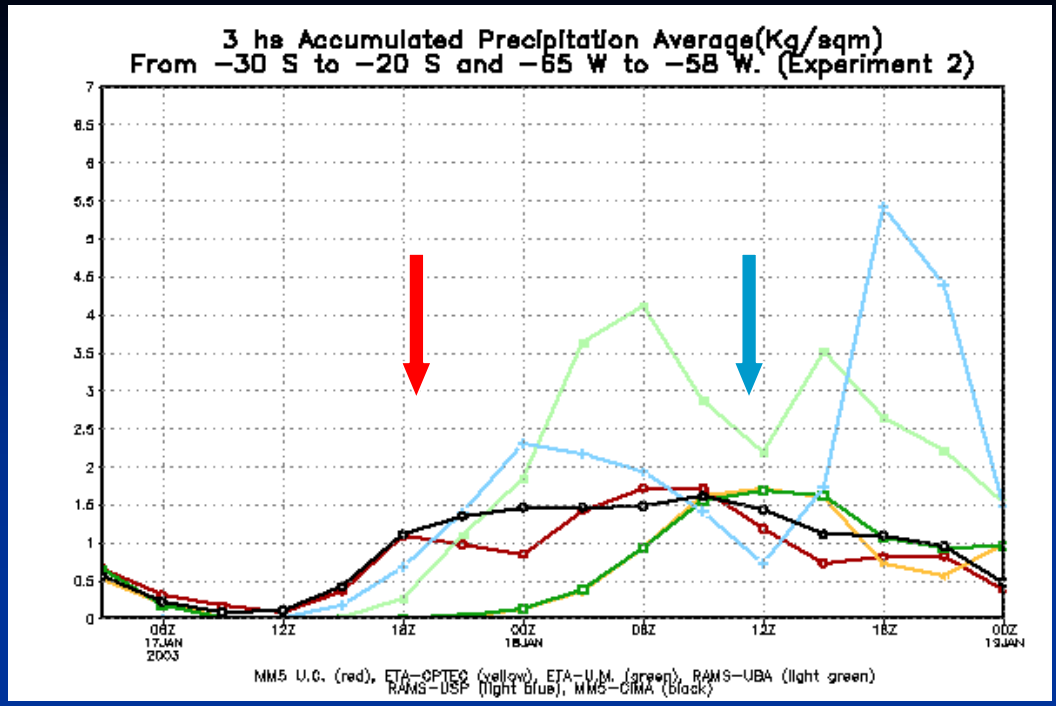


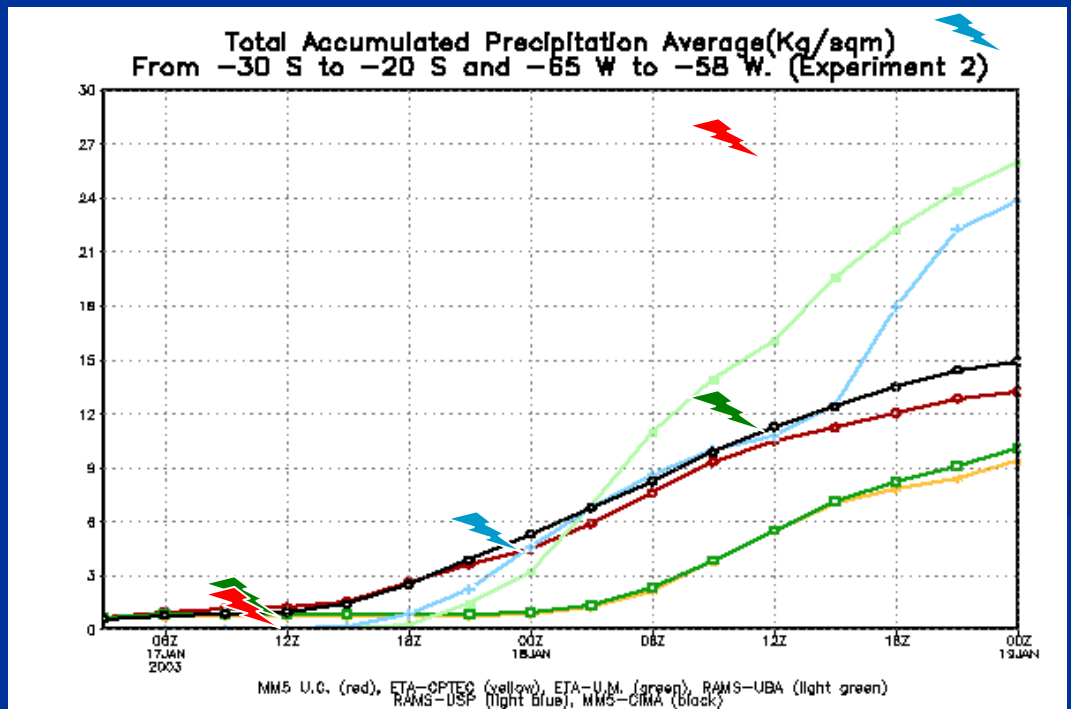


GPCP

CPC

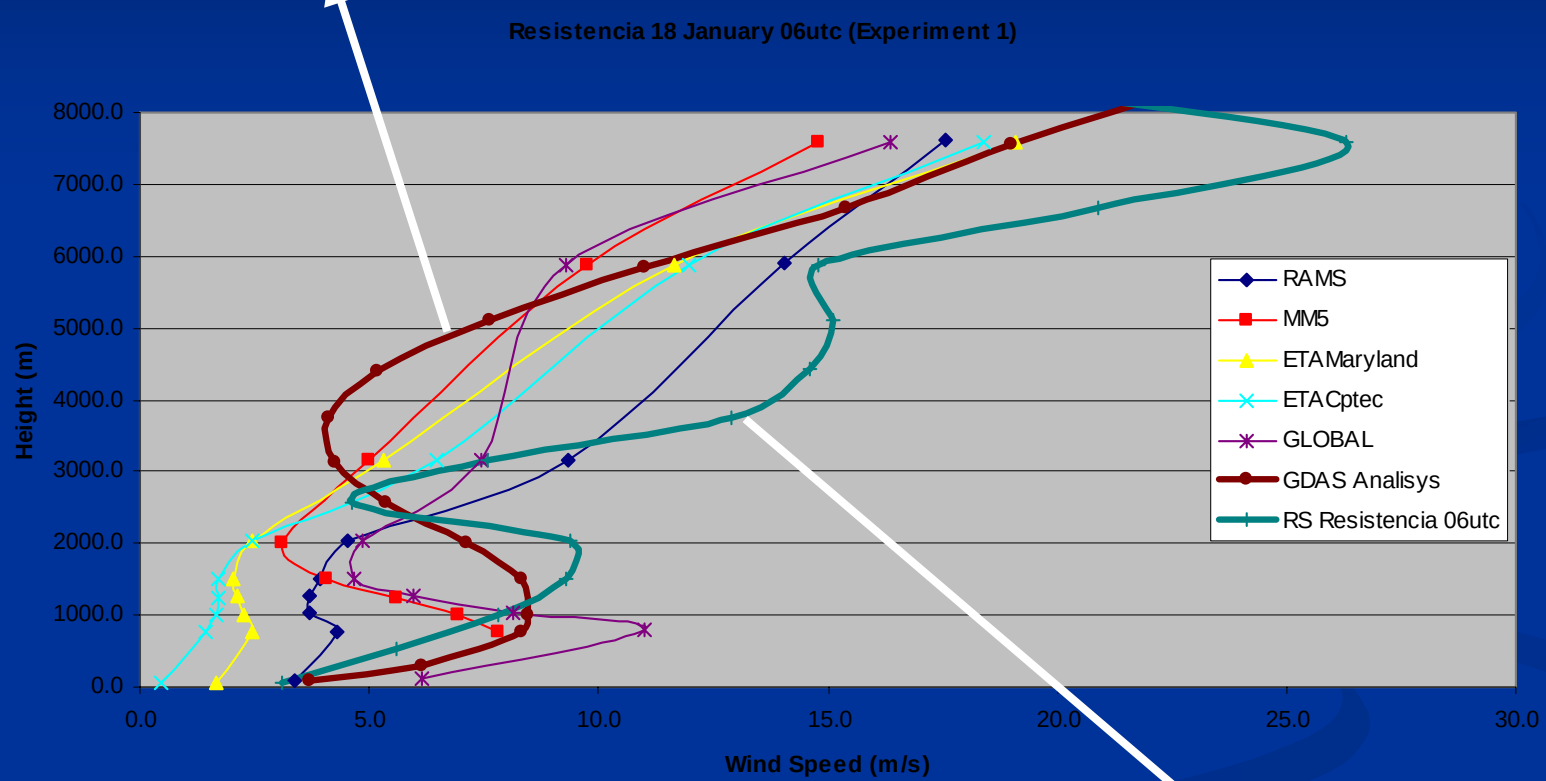
SALLJEX





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

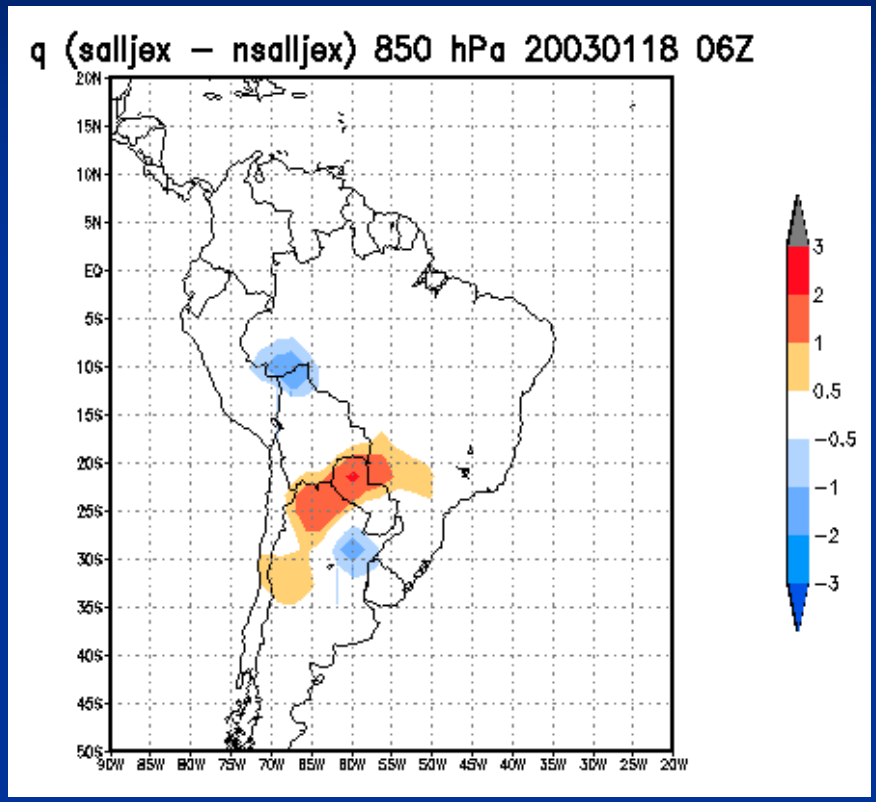
CPTEC – Brazil

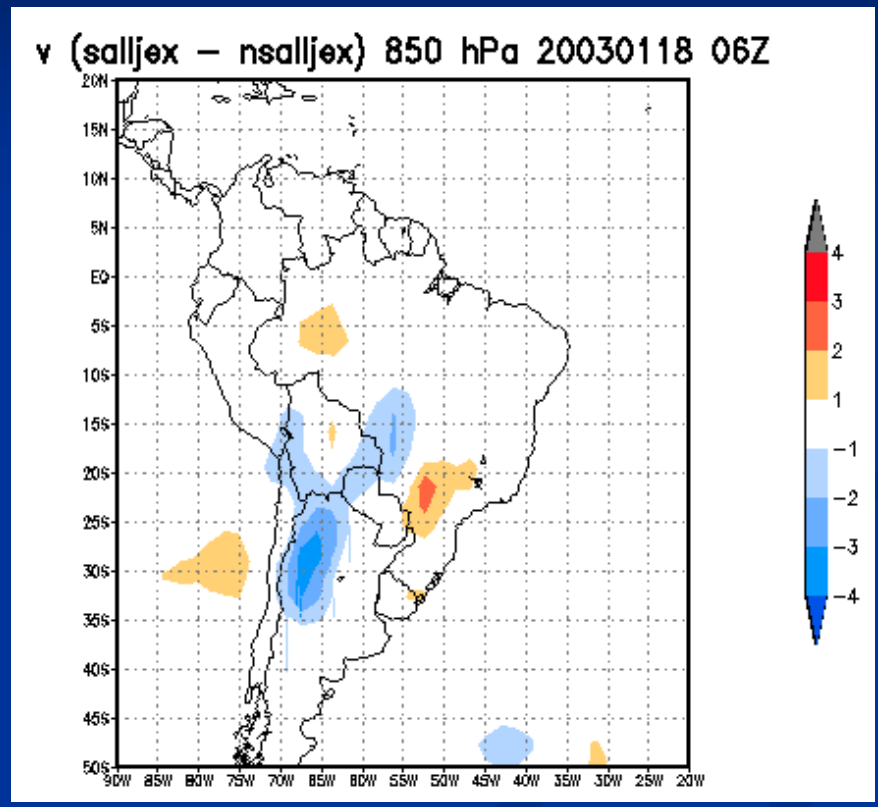
USP – Brazil

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 (σ) Coordinate Systems

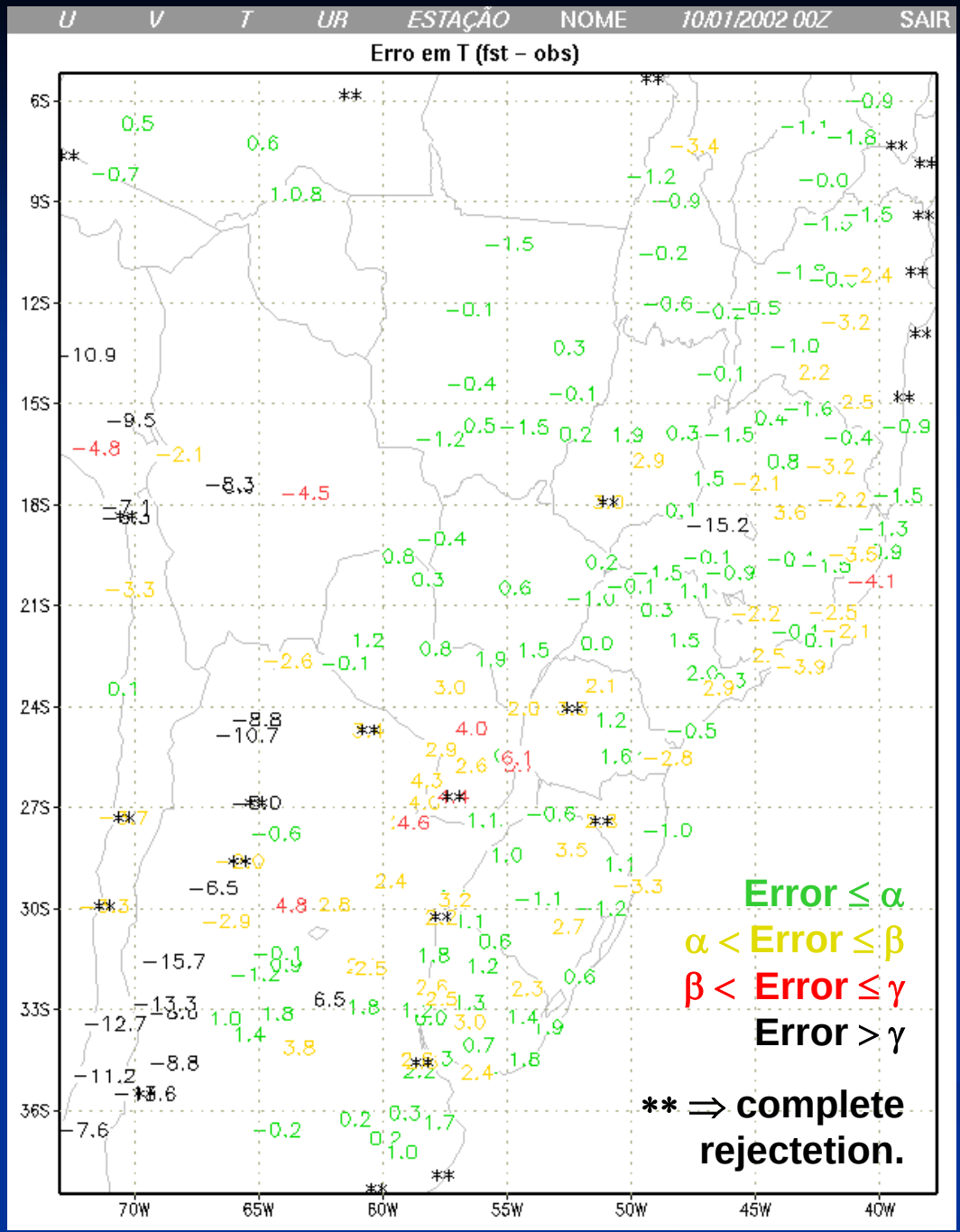
Surface data rejection in the assimilation module near mountains

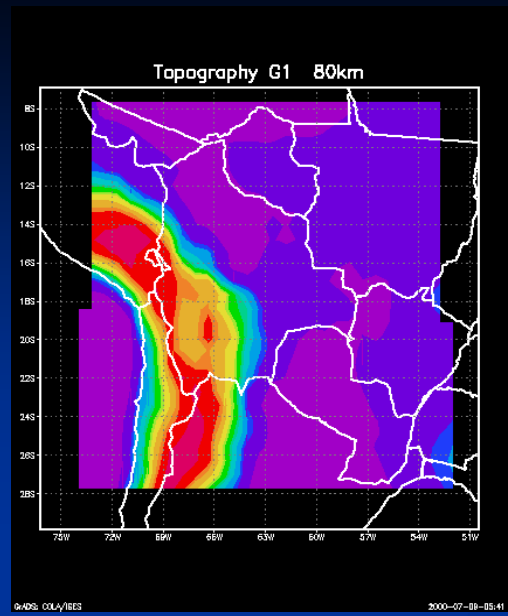
Adaptative vertical coordinate (shaved eta) – RAMS

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

***ATMET** ****Duke University**

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



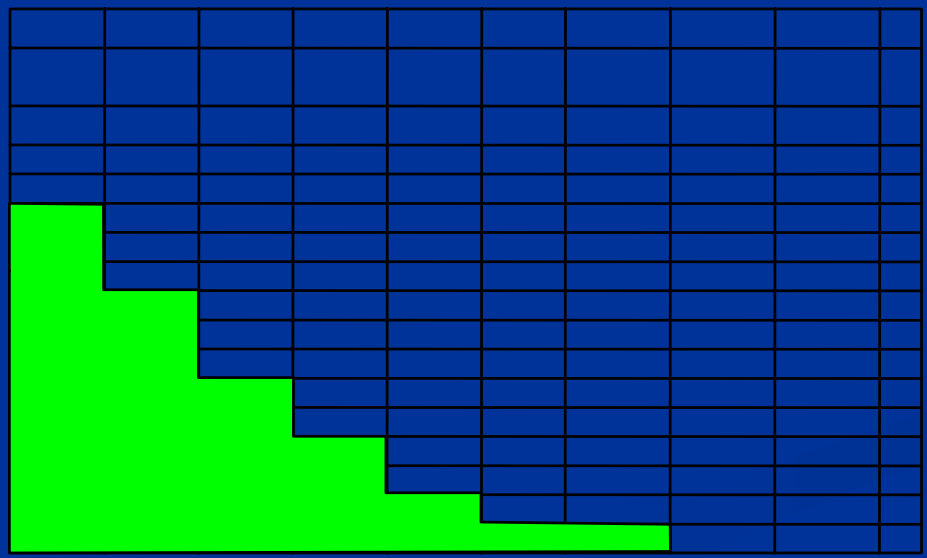


Diference between first guess (BRAMS-20km) and the observed temperature (METAR+SYNOP) on Jan 10,2002 00UTC.

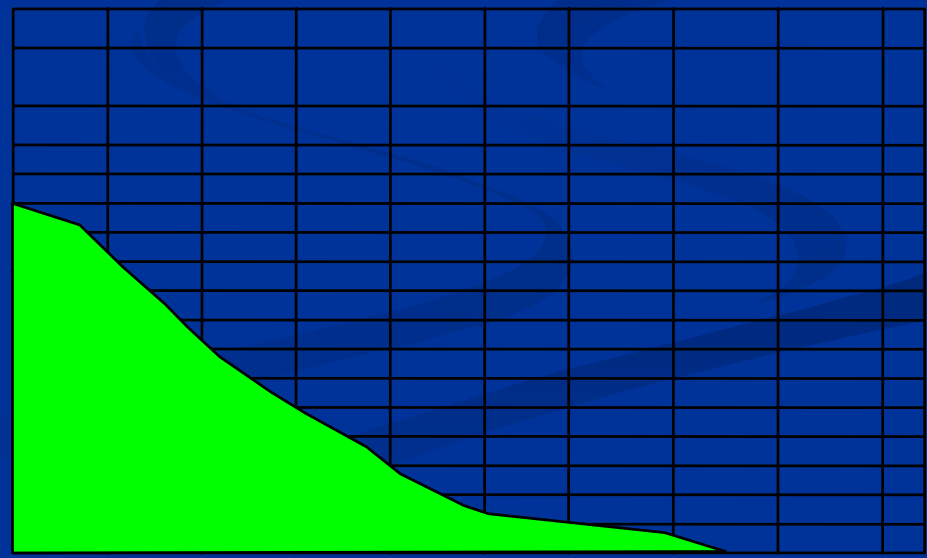
Toward a Robust Solution…

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

Standard ETA coordinate

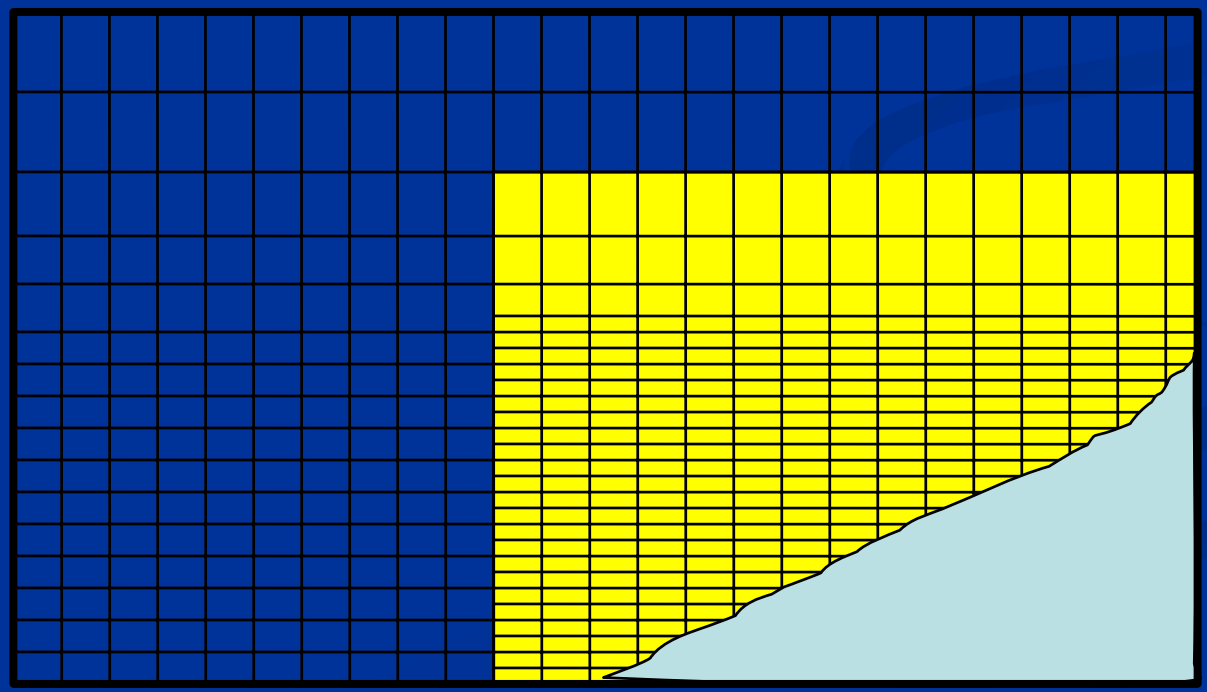


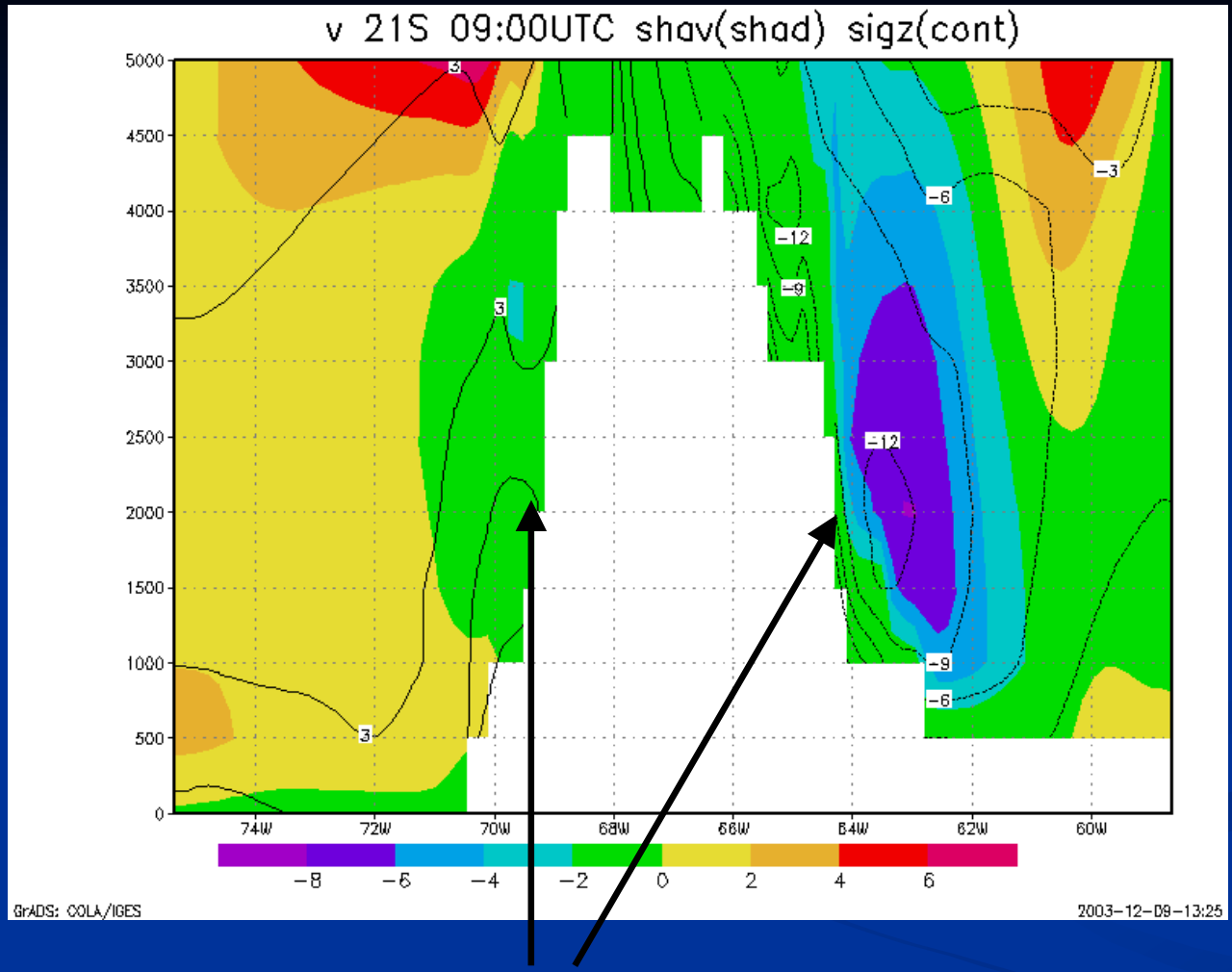
ADAP coordinate



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.

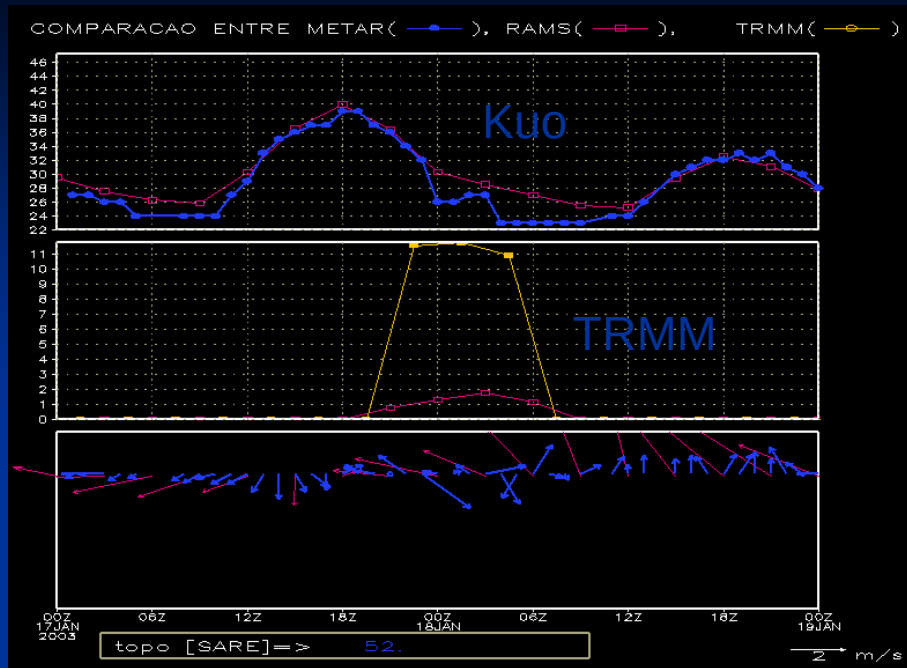
Testing different parameterizations of convection

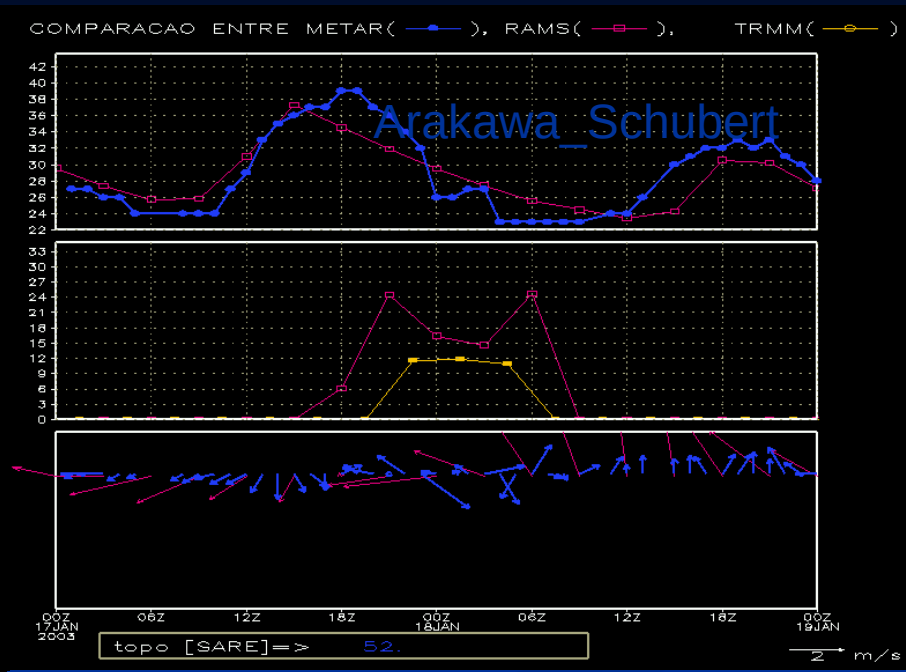
USP – Brazil

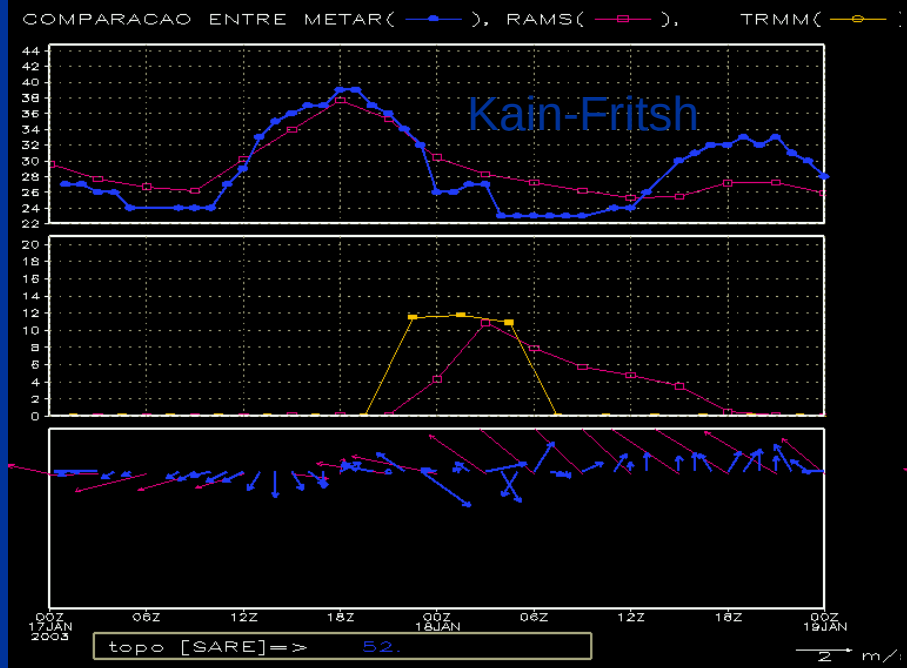
CPTEC – Brazil

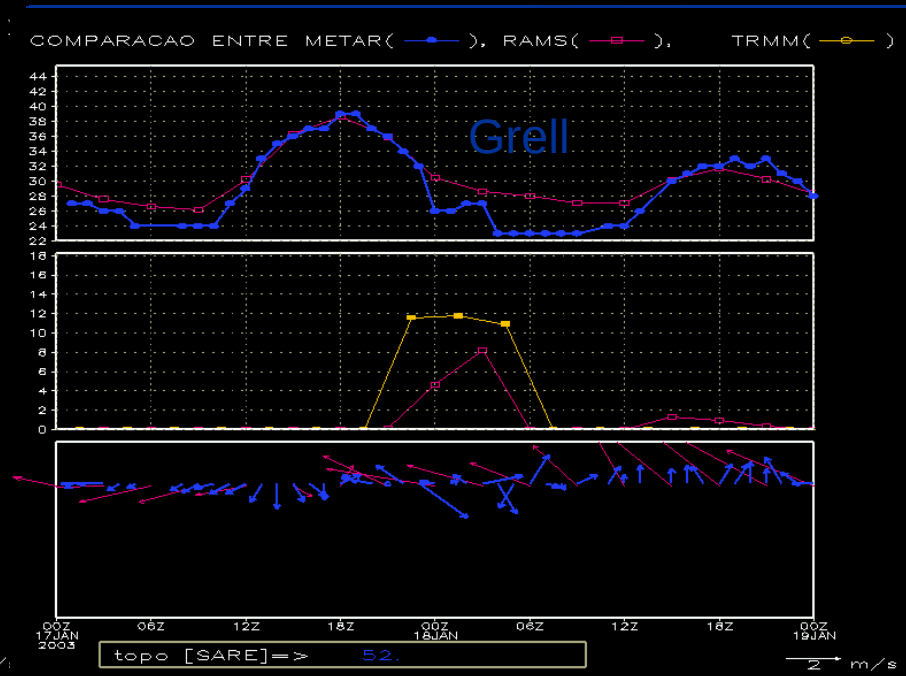
GFDL - USA

Different Cu-Parameterization Schemes – Case Jan 18 – Resistencia









Preliminary results

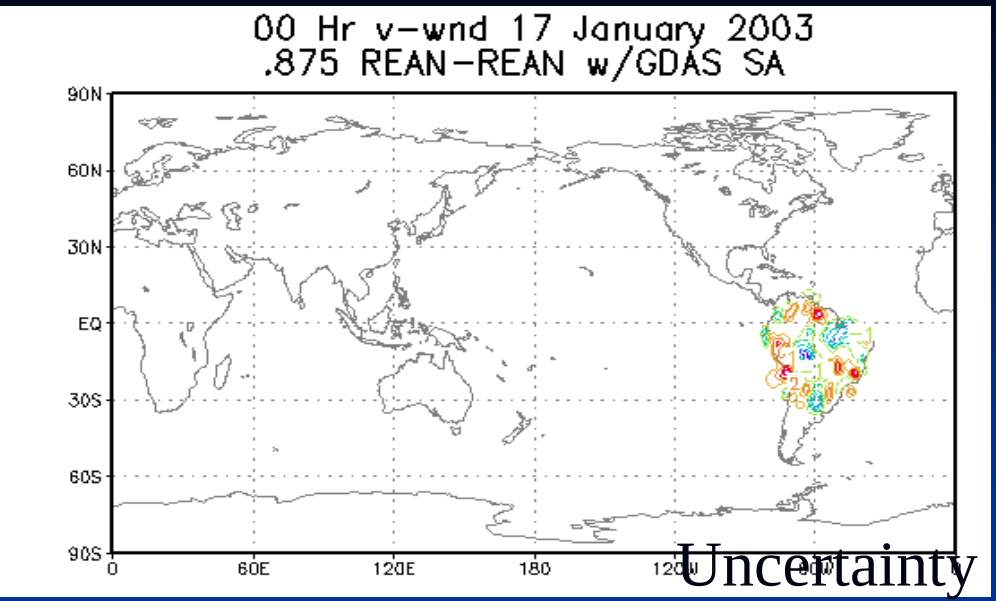
- Intensity distribution of precipitation events depends on cumulus parameterization
- This has been particularly observed for January 17-18, 2003.

Predictability issues

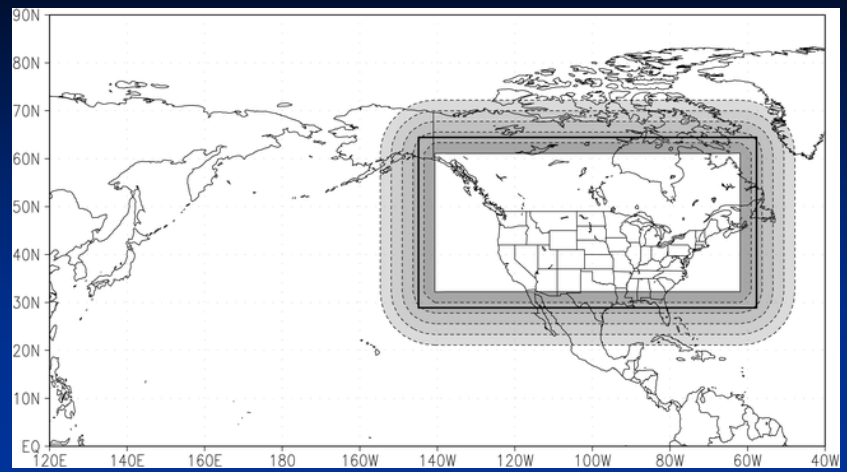
U. of Utah – USA

UBA/CIMA – Argentina

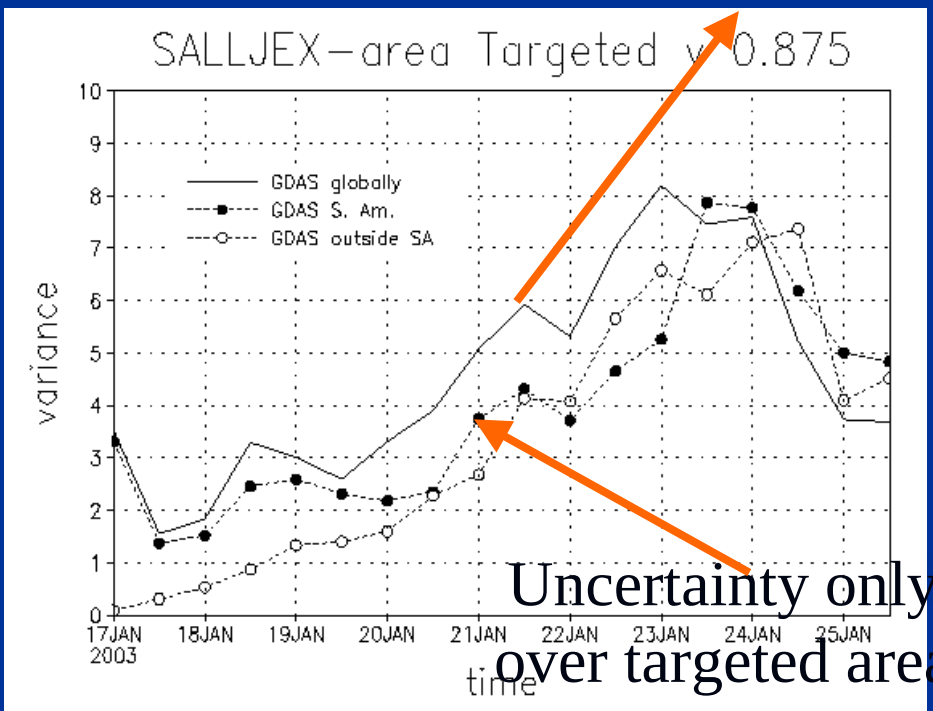
U. of Maryland - USA



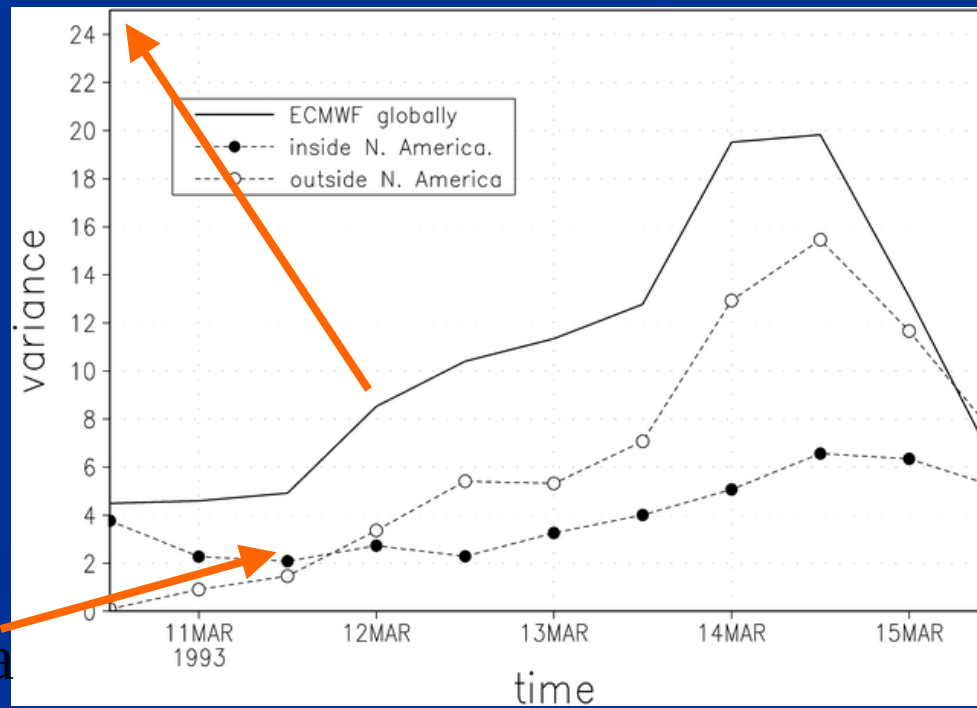
Uncertainty over the whole globe



Miguez-Macho & Paegle,2001



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?

SALLJEX

Global Models

Regional Models

Assimilation

Forecasts

Without SALLJEX data

With SALLJEX data

POTENTIAL IMPACT

Complex Orography

Convection

Surface processes

Predictability

Regional (& Global?) Model Improvements

Regional reanalysis for climate studies

Regional climate prediction Improvements

Expected improvements in Global climate predictions

Thank you