Multiscale analysis of precipitation variability over South America: A preliminar analysis of the added value of RCMs

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Advanced School on Regional Climate Modeling over South America
February 15 - 19, 2016
São Paulo, Brazil

Outline

- Are RCMs able to reproduce the main patterns of precipitation variability over South America at different timescales?
  - Interannual
  - Intraseasonal
  - High-frequency (synoptic scale)
- Do RCMs add value compared with the driving GCM? At which scales?

- CORDEX

Precipitation Data (1979-1990):

Observations:

- CRU (0.5°x0.5°) monthly
- CPC-Unified (0.5°x0.5°) monthly and daily
- GPCP (2.5°x2.5) monthly
- CMAP (2.5°x2.5°) monthly
- CPC-NIEJSEN (2°x2°) daily

Models:

- REMO/EC5OM1 RCM (0.5°x0.5°) CLARIS-LPB/ CMIP3 (1.875°x1.875°) (CMIP3)
- RCA4/ICHEC-EC-EARTH (0.5°X0.5°) CORDEX/ CMIP5 (1.1215°x1.1215°)
- RCA4/MPI-M-MPI-ESM-LR (0.5°X0.5°) CORDEX/ CMIP5 (1.865°x1.865°)

Methodology

- Interannual timescales:
  - Standard deviation of monthly timeseries of rainfall anomalies (σ)
- Intraseasonal timescales:
  - Standard deviation of the filtered daily anomalies (Lanczos filter) for 10-90 days window.
- High-frequency timescales:
  - Standard deviation of the filtered daily anomalies for 4-10 days window.

Extended seasons:

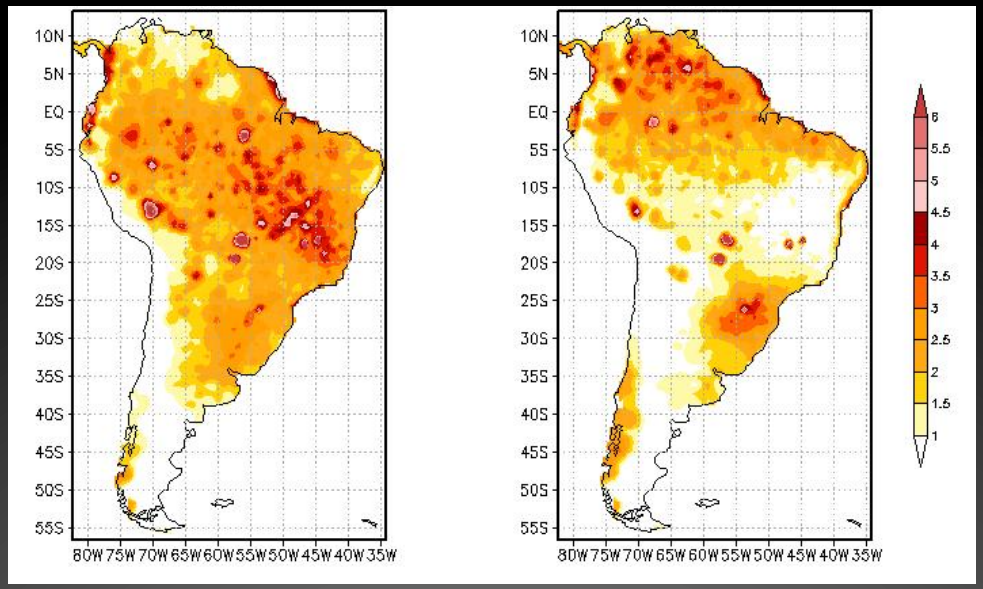
- April to September
- October to March

Observed patterns of rainfall variability: **Interannual timescales**

CPC-UNI

ONDJFM AMJJAS

- SACZ and LPB



- LPB and northern Amazon

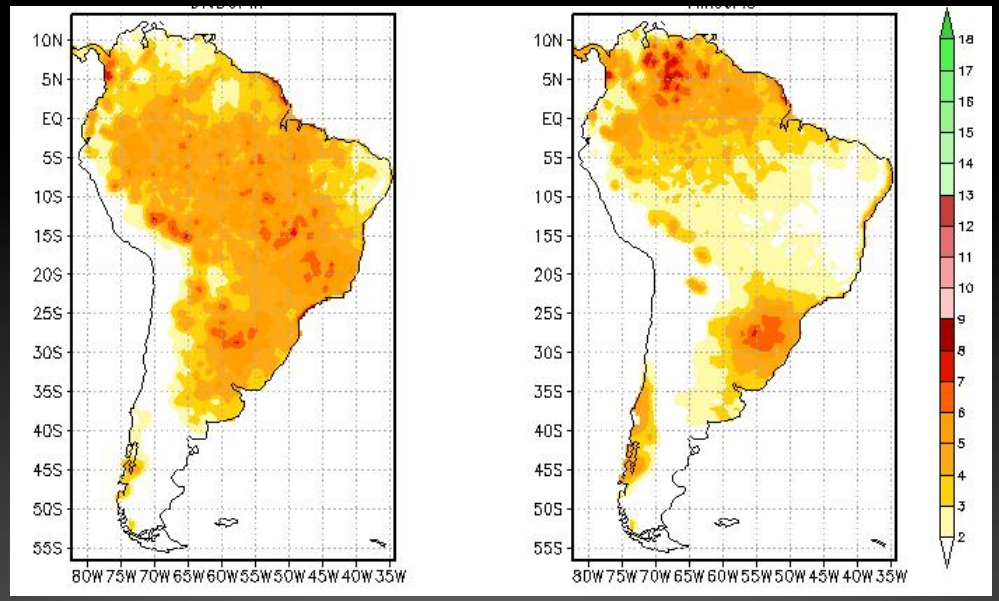
Standard deviation of monthly rainfall anomalies (mm/day)

Mainly associated with ENSO forcing (Grimm et al., 2000)

Observed patterns of rainfall variability: **Intraseasonal timescales (10-90 days)**

CPC-UNI

ONDJFM AMJJAS



- Seesaw pattern between SACZ and LPB
- LPB and northern Amazon

Standard deviation of filtered daily rainfall anomalies (mm/day) (10-90 days)

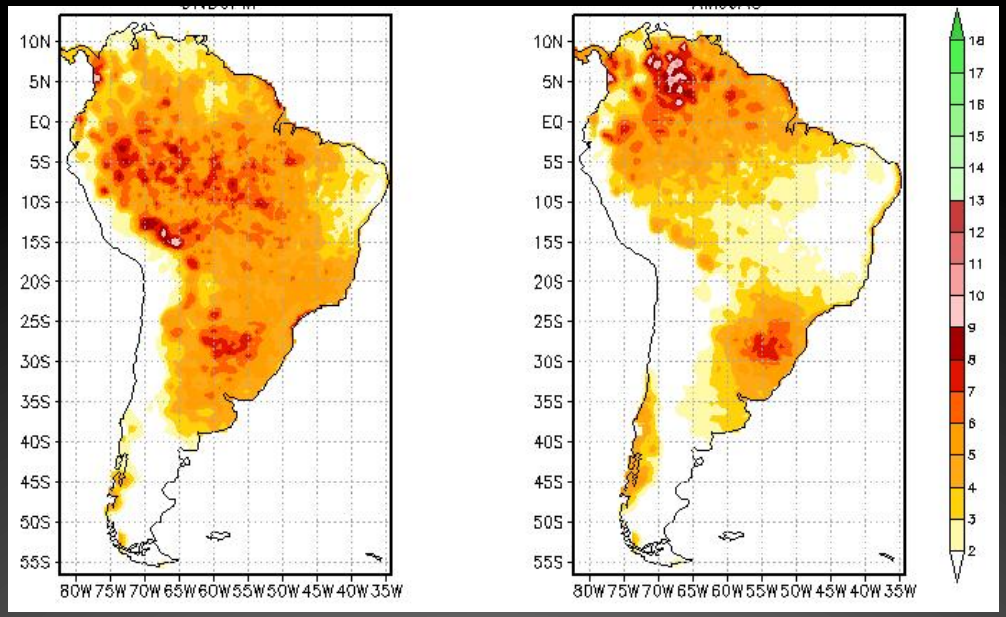
Mainly associated with Rossby waves and MJO (Solman and Orlanski, 2010; Liebmann et al 1999)

Observed patterns of rainfall variability: **High-frequencies (4-10 days)**

CPC-UNI

ONDJFM AMJJAS

- LPB and the Amazon basin



- LPB and northern Amazon

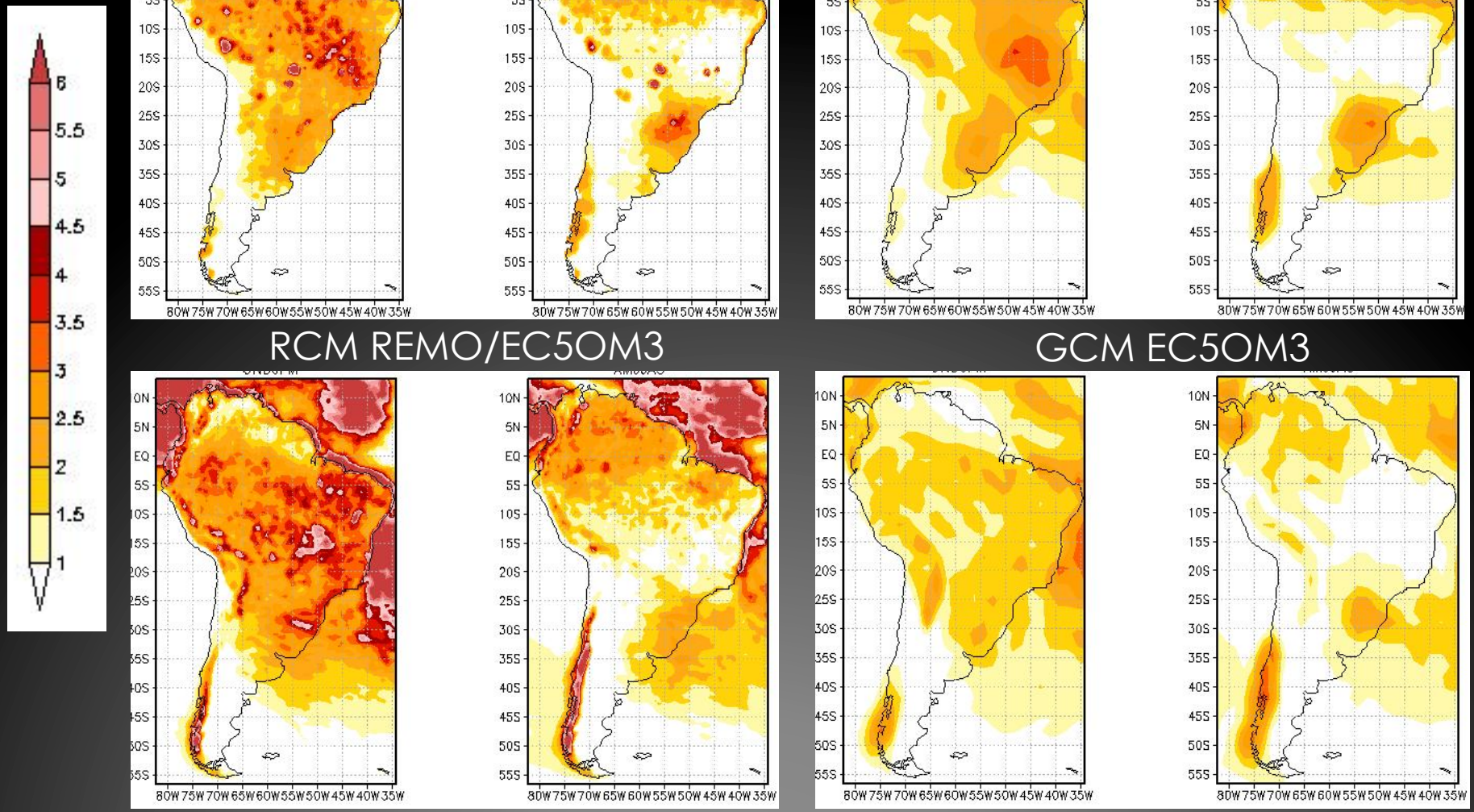
Standard deviation of filtered daily rainfall anomalies (mm/day) (4-10 days)

Mainly associated with frontal systems and convective activity (Solman and Orlanski, 2014)

Interannual variability (σ)

ONDJFM CPC-UNI AMJJAS

ONDJFM GPCP AMJJAS



RCM REMO/EC5OM3

GCM EC5OM3

Intraseasonal variability (σ)

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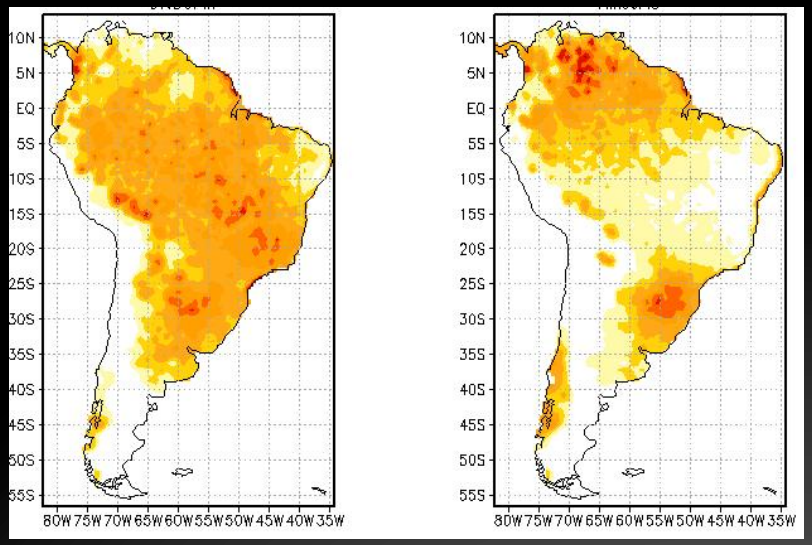

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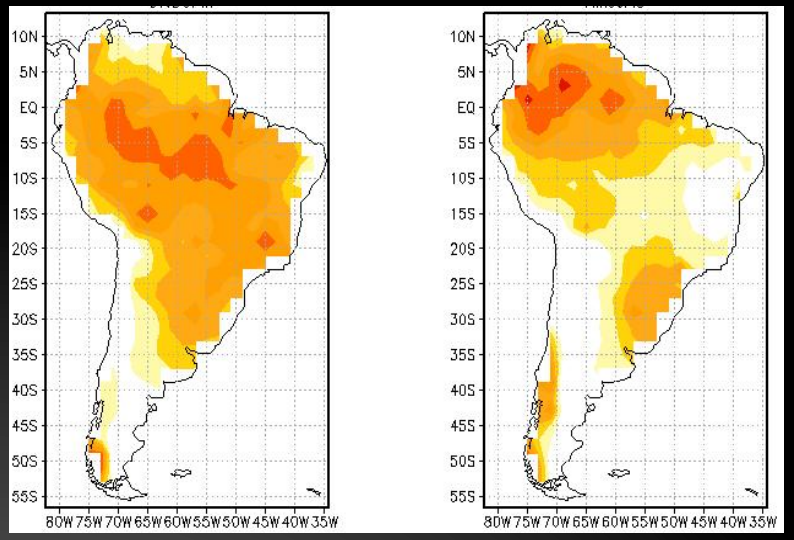
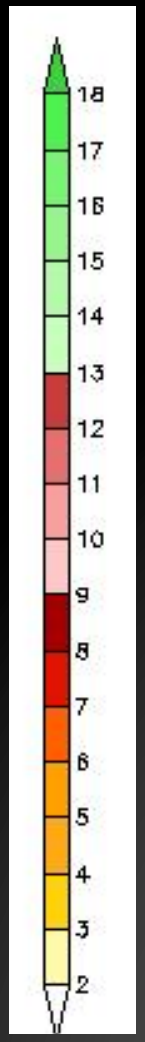
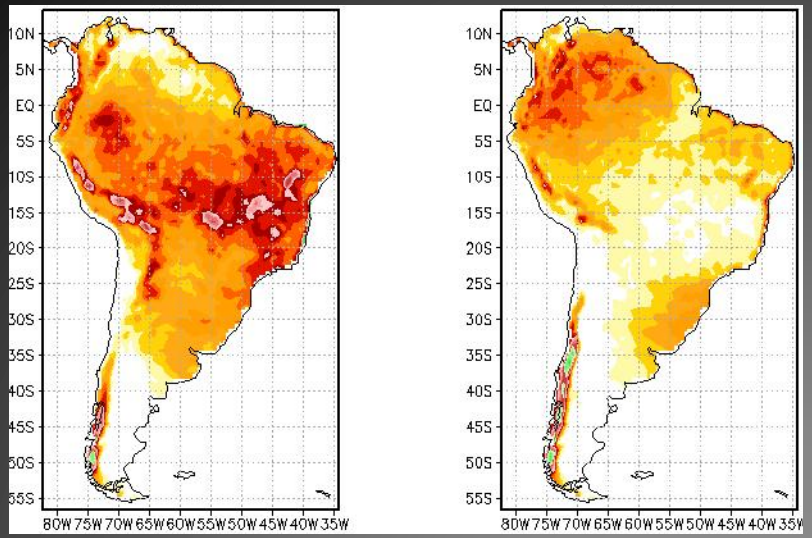
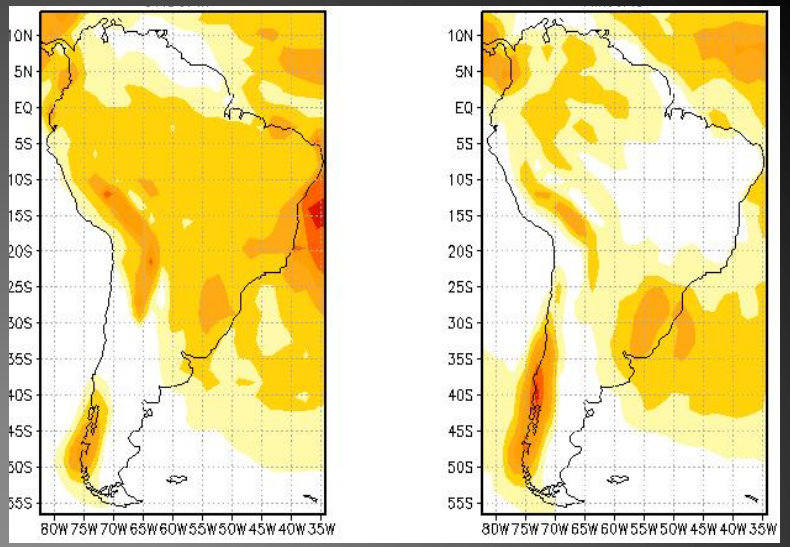




RCM REMO/EC5OM3



GCM EC5OM3



High-frequency variability (σ)

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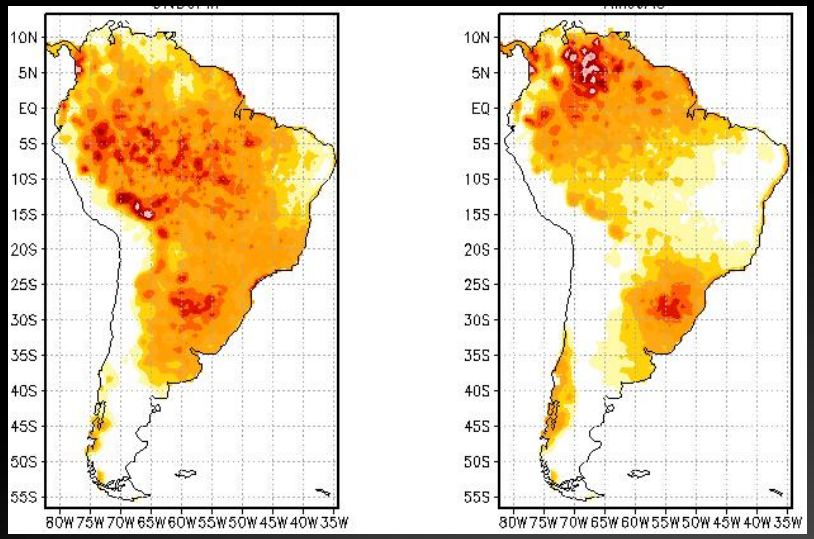

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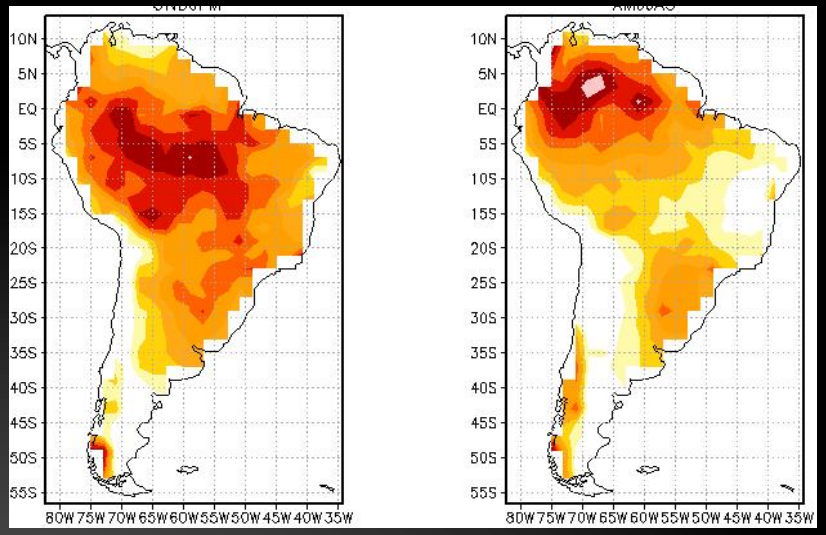
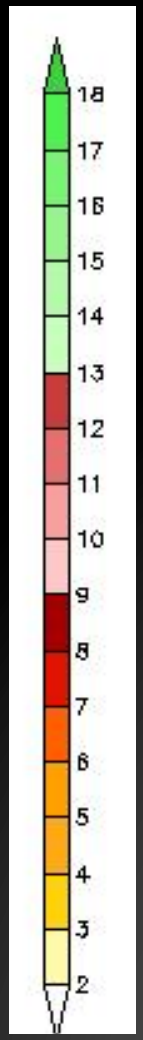
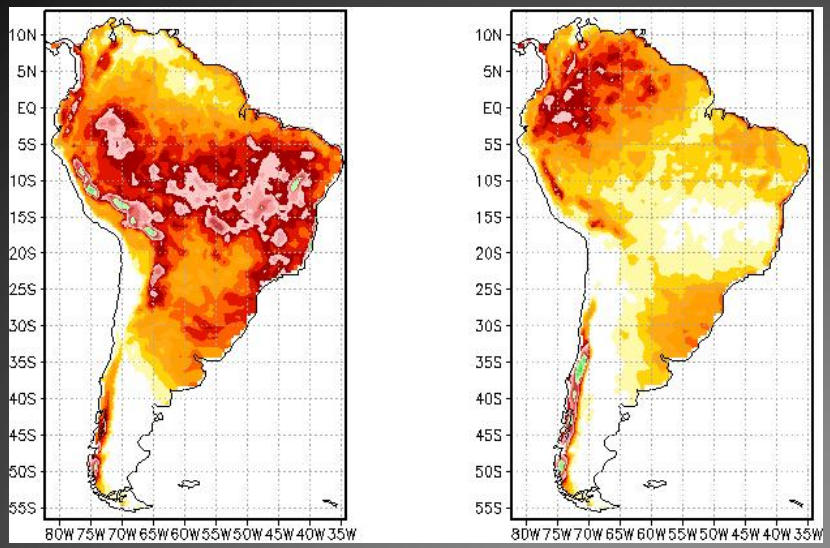
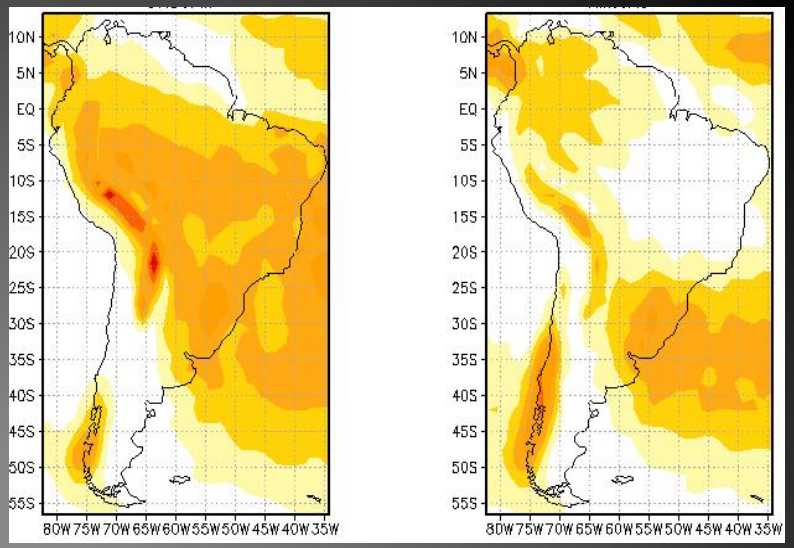




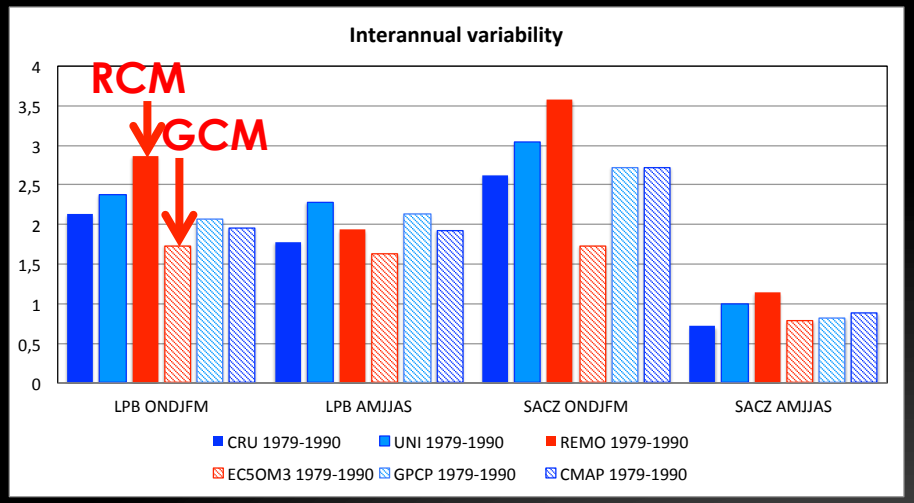
RCM REMO/EC5OM3

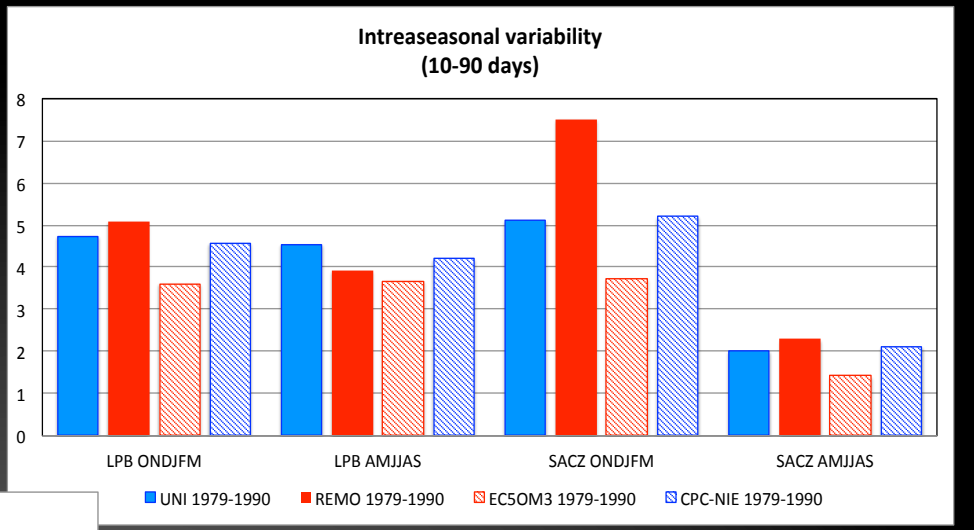


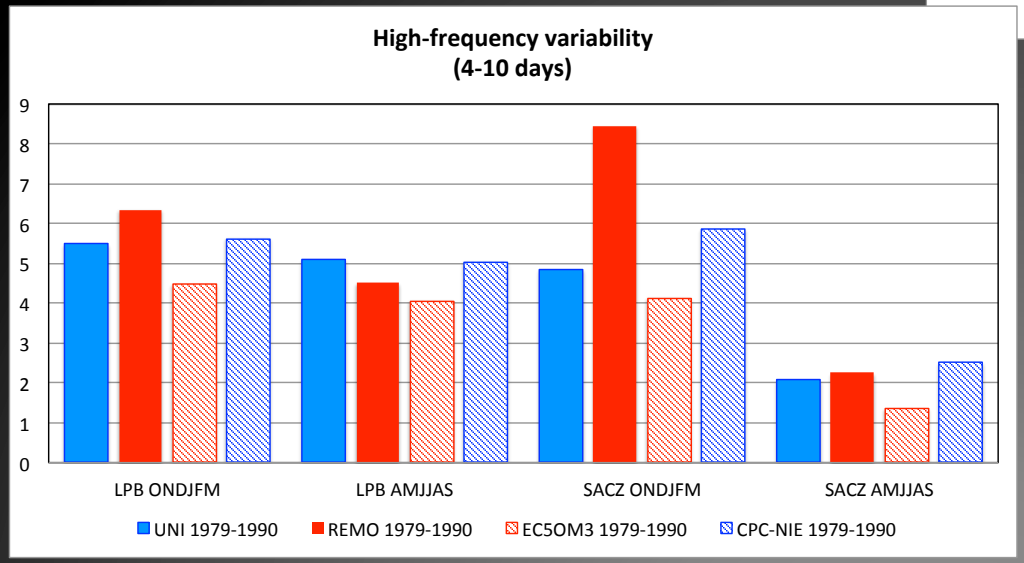
GCM EC5OM3



Multiscale variability over LPB and SACZ

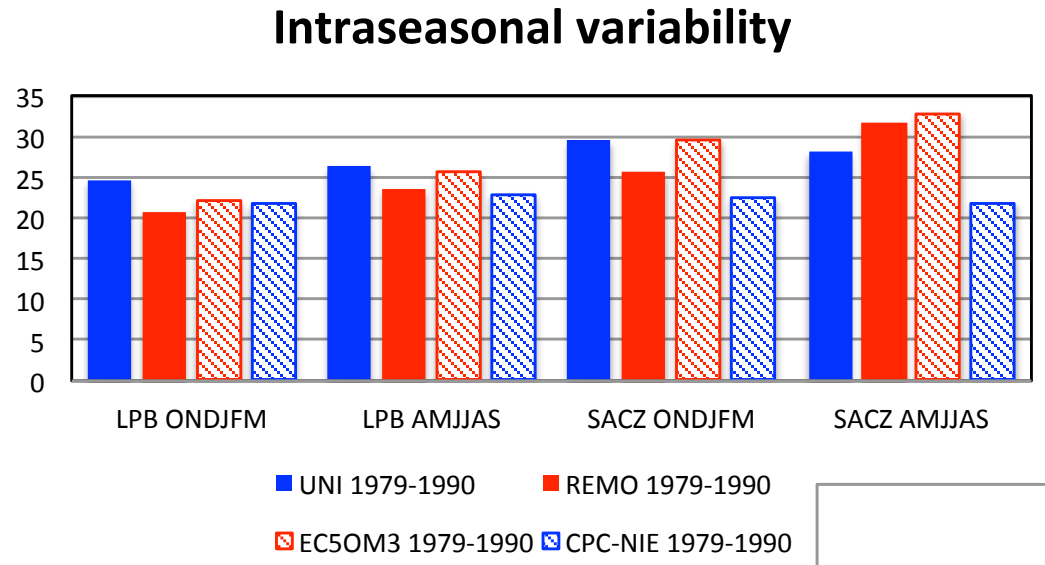






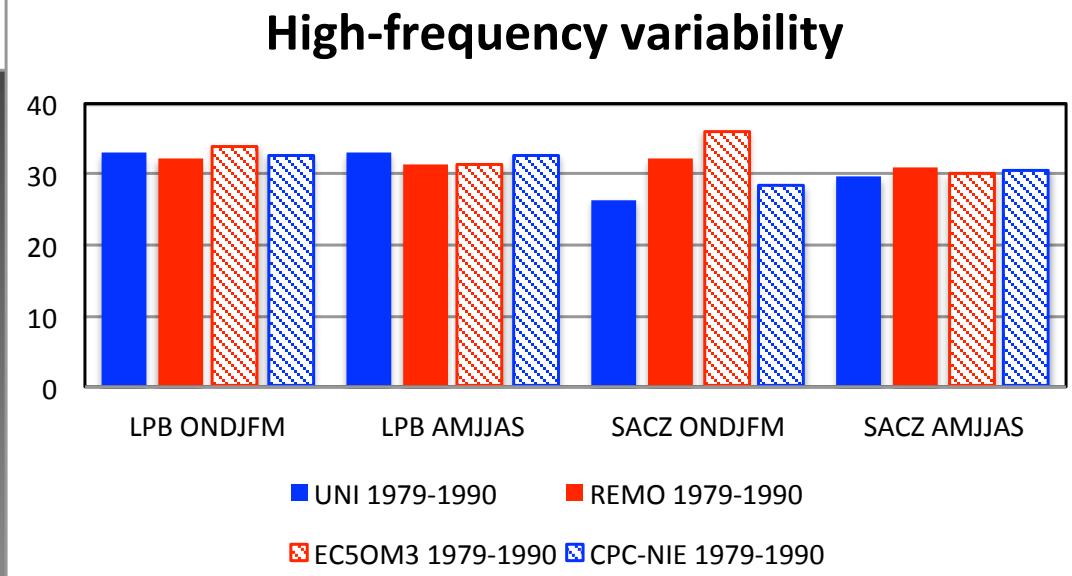
- The RCM performs better than the GCM in terms of the amplitude of the rainfall variability at almost all scales.
- The driving GCM tends to underestimate the variability of rainfall.

Contribution to the total variability



Percent of variance associated with intraseasonal and high-frequency variability

- The RCM captures better than the GCM the relative contribution particularly at the intraseasonal timescale with respect to the total daily variability.



Conclusions

- The performance of the REMO RCM and the driving EC5OM GCM are evaluated to assess their capability in reproducing patterns of precipitation variability over a range of timescales: Interannual, intraseasonal and high-frequency.
- The RCM outperforms the driving GCM when the rainfall variability features are associated with smaller scale processess: **Added value!!**
- The two models evaluated are capable of reproducing the percentage of variability associated with the intraseasonal and high-frequency.
- Further analysis is still in progress to characterize the main modes of variability and to evaluate the circulation anomalies associated with them at multi timescales.

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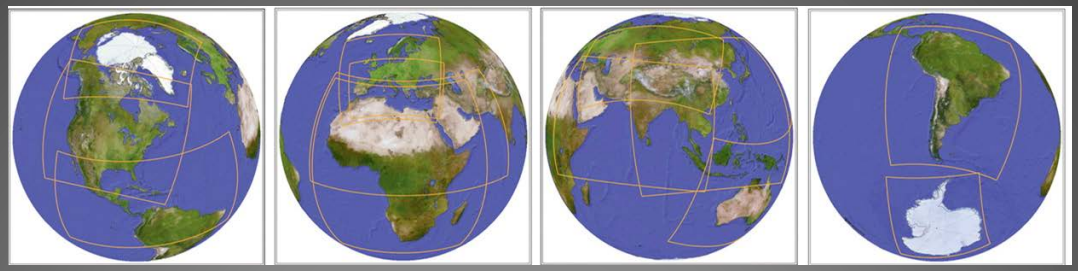
Coordinated **R**egional **D**ownscaling **Ex**periment

Vision and Goals

To advance and coordinate the science and application of regional climate downscaling through global partnerships.

1. To better understand relevant regional/local climate phenomena, their variability and changes, through downscaling
2. To evaluate and improve reginal climate downscaling models and techniques
3. To produce cooordinated sets of regional downscaled projections worldwide
4. To foster comunication and knoledge exchange with users of regional climate information



CORDEX Scientific Challenges

- Added value
  - Internal variability and added value as function of scale; Bias correction uncertainties and consistency; user-oriented metrics
- Human elements
  - Coupling regional climate and coastal megacities; Bridging with urban parameterization developement; Land use change
- Coordination of regional coupled modeling
  - Ocean-ice-atmosphere; Lakes, Dynamic land surface; Natural fires; Atmospheric chemistry; Carbon cycle; Aerosols; marine biogeochemistry
- Precipitation
  - Convective systems; Coastal storm systems; MJO/Monsoon
- Local wind systems
  - Wind storms; Strong regional winds; Wind energy.

CORDEX Flagship Studies

- Fine-scale processes important to region's climate – need of very high resolution (physical basis)
- Observational basis for verification (analysis basis)
- User applications (VIA basis)

➢ Specific FPS to be proposed by regions

➢ Deadlines:

- February 15th
- June 15th
- October 15th

Forthcoming Events:

➢ The International Conference on Regional Climate (ICRC)-CORDEX 2016 to be held from 17th to 20th May 2016 in Stockholm (Sweden)

Thank you for your attention!