CORDEX- LAC: Overview and Challenges for the LAC region

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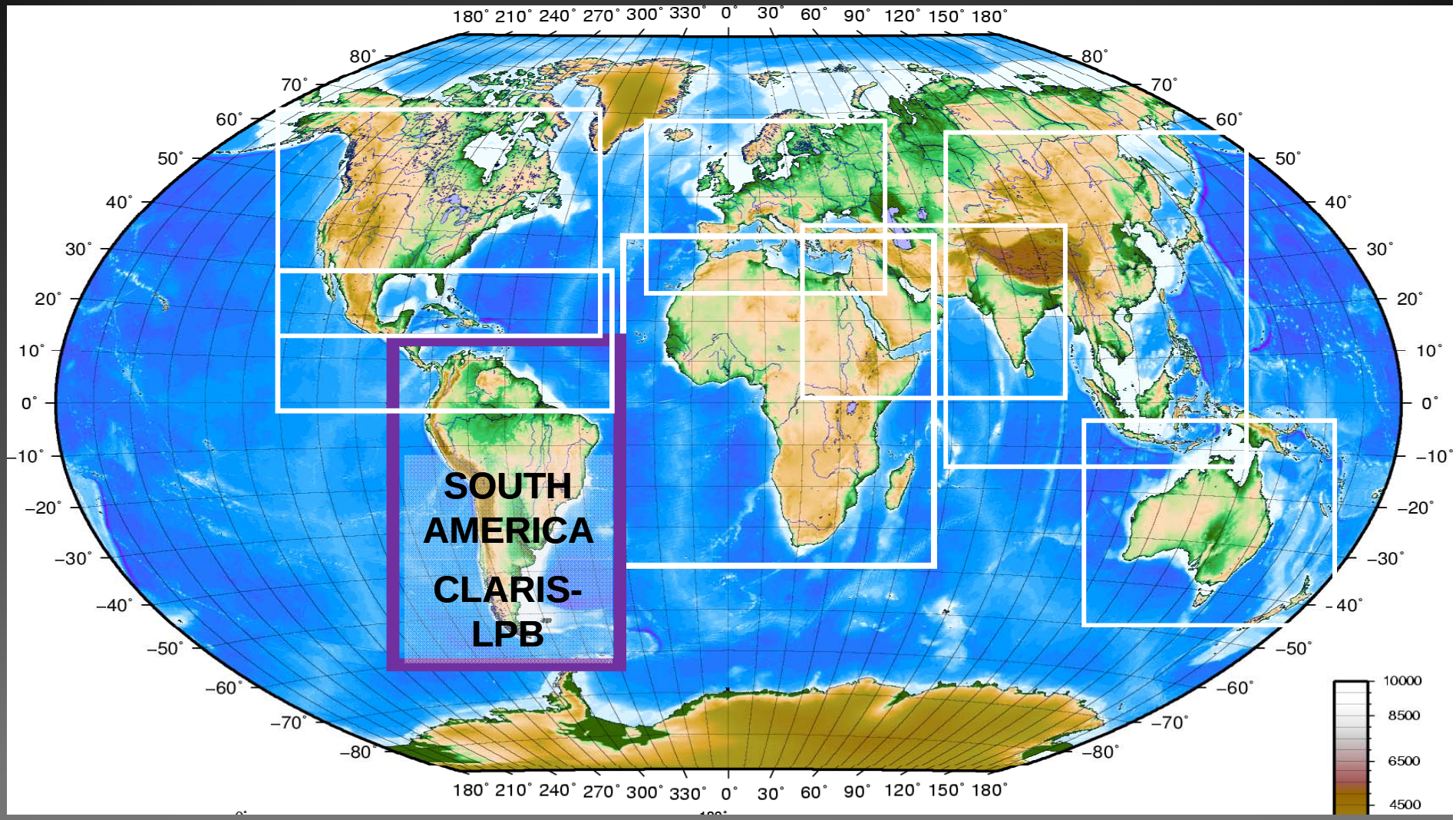
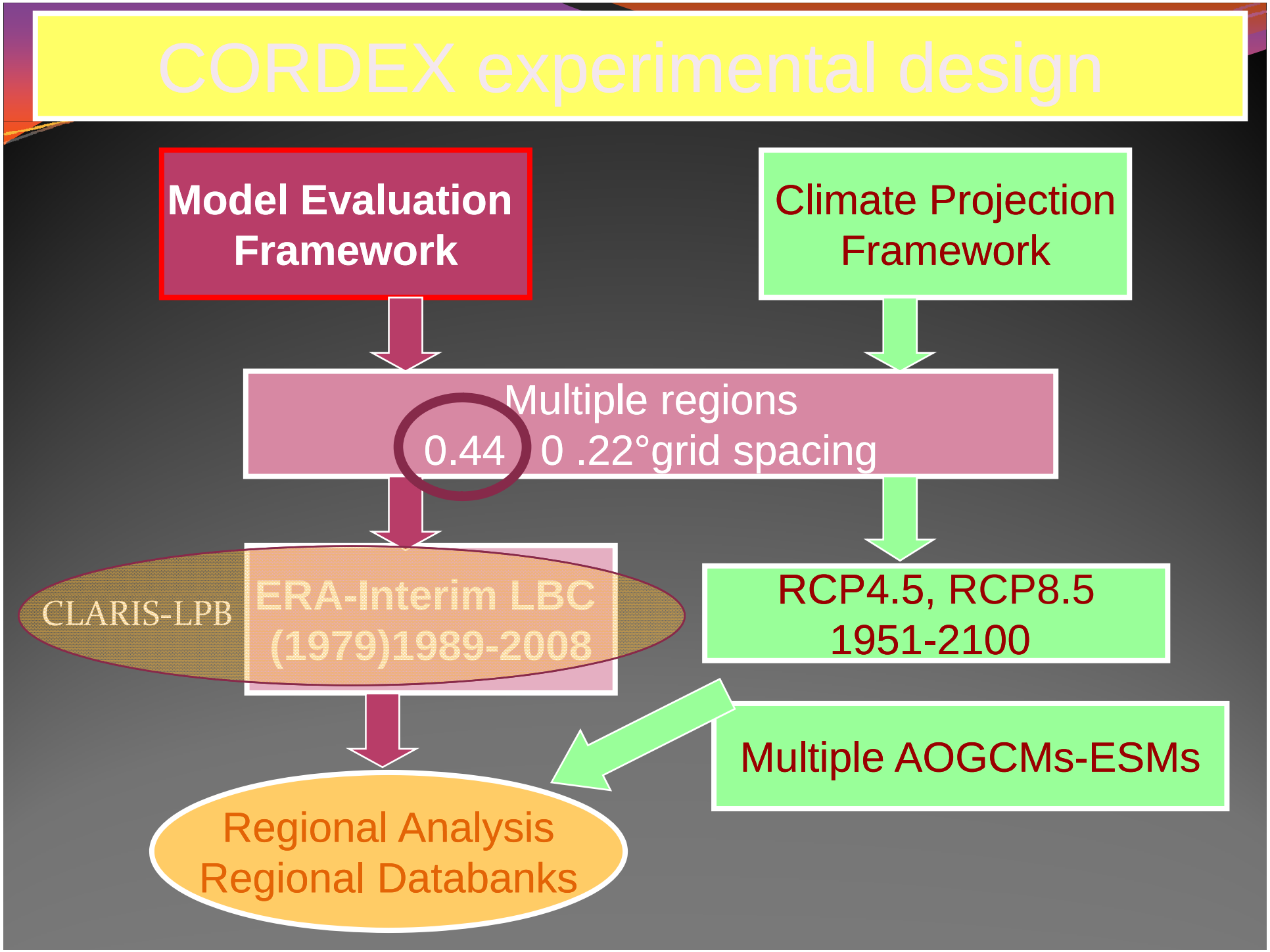
WCRP VAMOS/CORDEX LAC Workshop: Phase I - South America
September 11-13, 2013, Lima, Perú

CORDEX-South America




CORDEX experimental design
Model Evaluation Framework
Climate Projection Framework
Multiple regions
0.44 0 .22°grid spacing
CLARIS-LPB
ERA-Interim LBC
(1979)1989-2008
RCP4.5, RCP8.5
1951-2100
Multiple AOGCMs-ESMs
Regional Analysis
Regional Databanks

CORDEX-SAM ERA-Interim driven simulations

RCM/Institution
RegCM3/USP-Brazil
RCA/SMHI-Sweeden
MM5/CIMA-Argentina
REMO/MPI-Germany
PROMES/UCLM-Spain
LMDZ/IPSL-France
ETA/INPE-Brazil
COSMO/IACS-Switzerland
WRF/IPSL-France
PRECIS/Met Office-UK
HadGEM3-RA /Met Office-UK

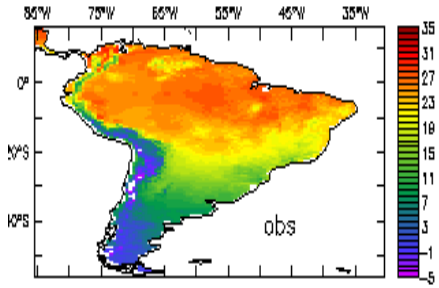
CLARIS-LPB
(1989-2008)

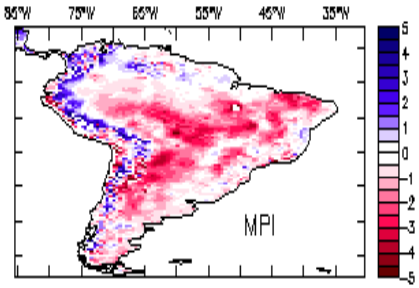
Solman et al, 2032 Clim Dyn
Pessacg et al., 2013 Clim Dyn
Marengo et al., 2013 Clim Dyn

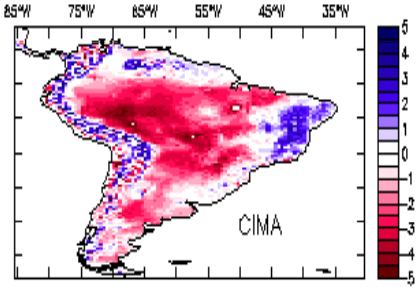
Evaluation of multi-RCM ERA-interim driven ensemble

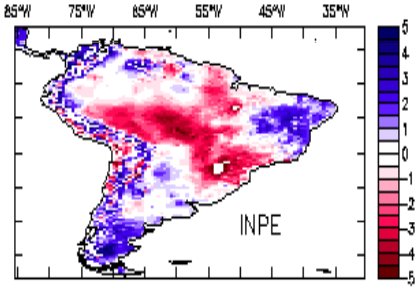
Temperature bias (°C)

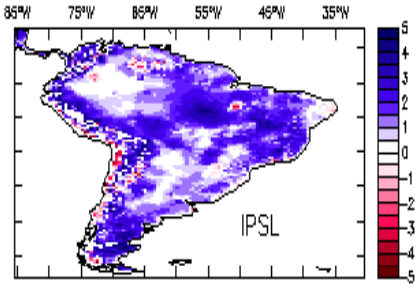
JJA

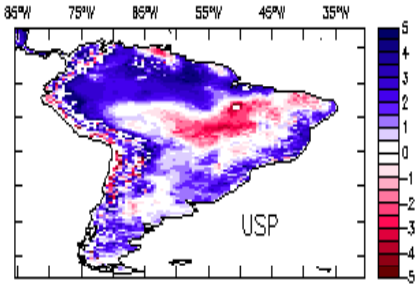


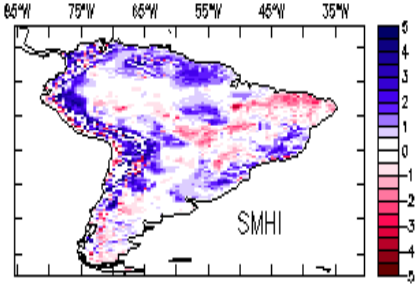


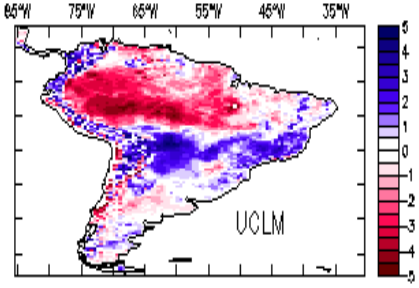




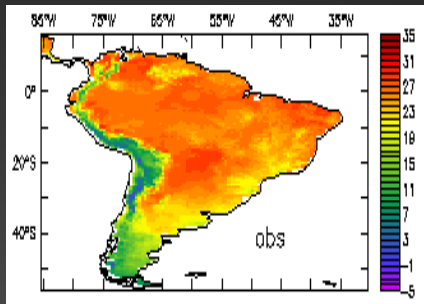


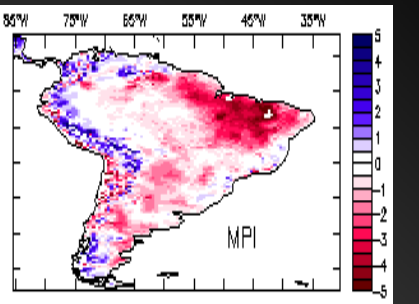


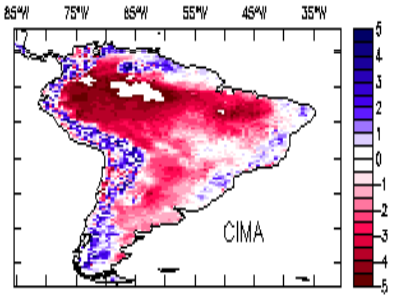


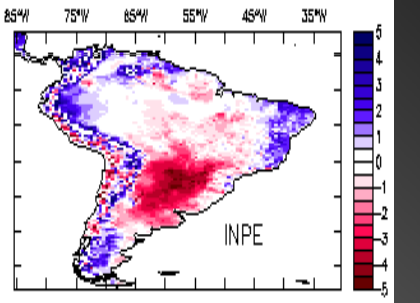


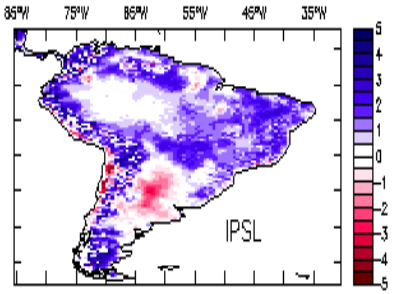
DJF

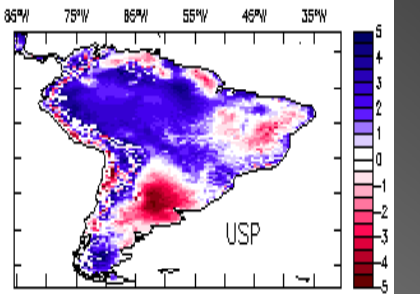


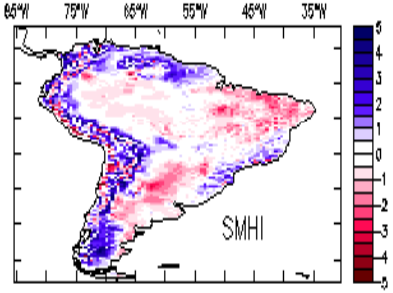


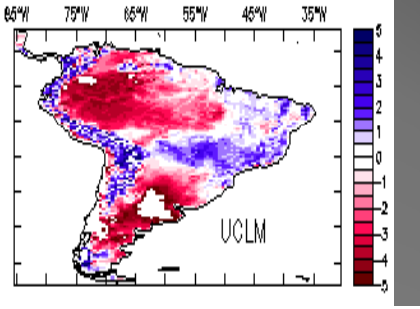






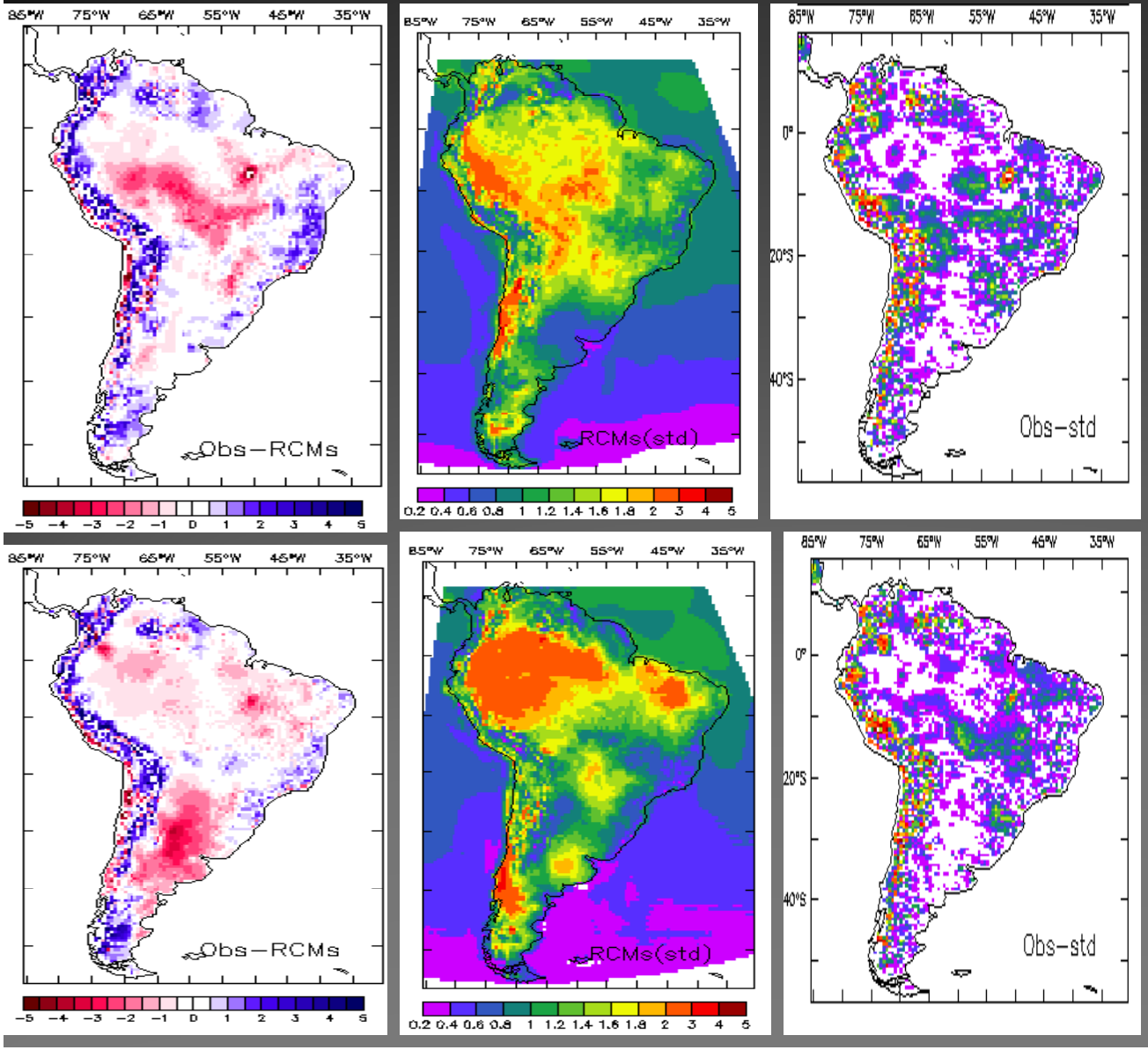






Temperature: Ensemble bias & spread

BIAS **RCMs SPREAD** **OBS SPREAD**



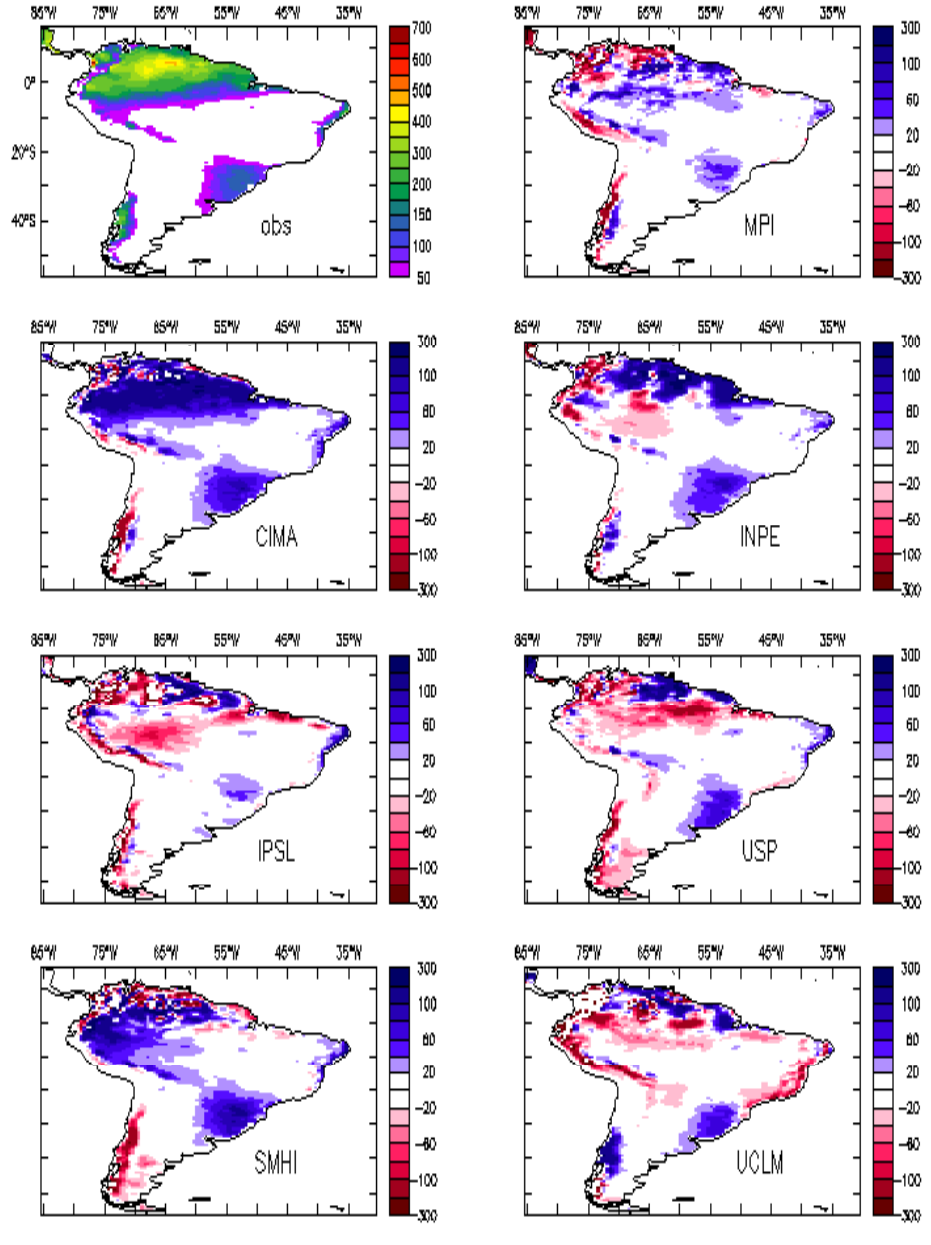
JJA

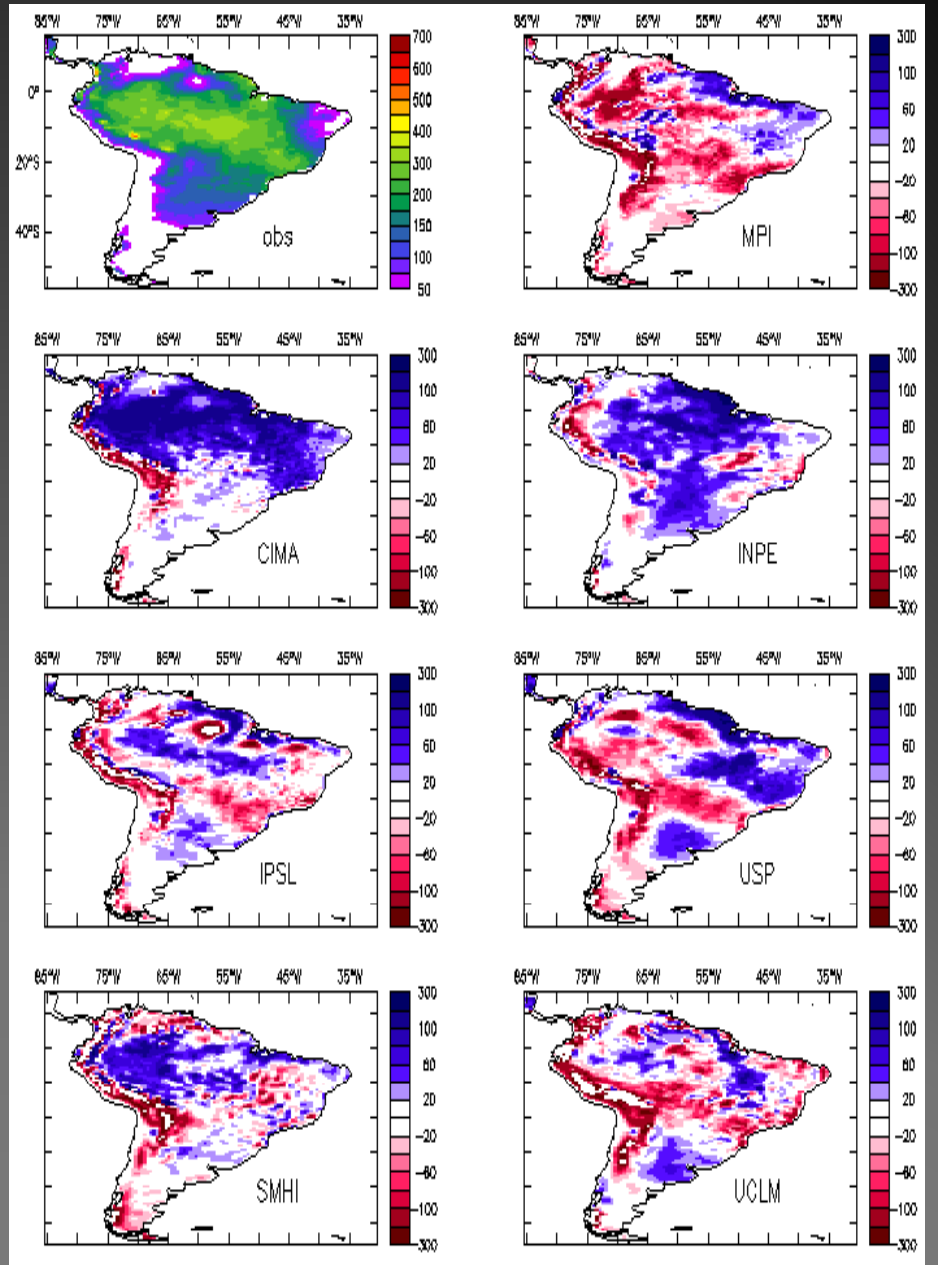
Temperature observations: CRU; UDEL

Bias =OBS-RCM

DJF

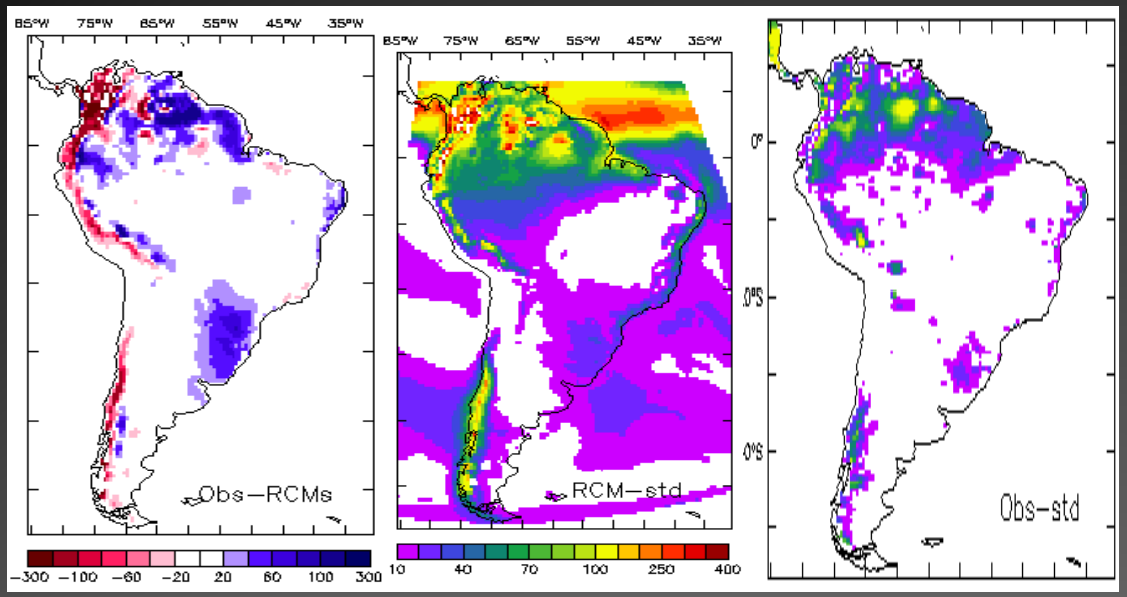
JJA Precipitation bias (mm/month) DJF





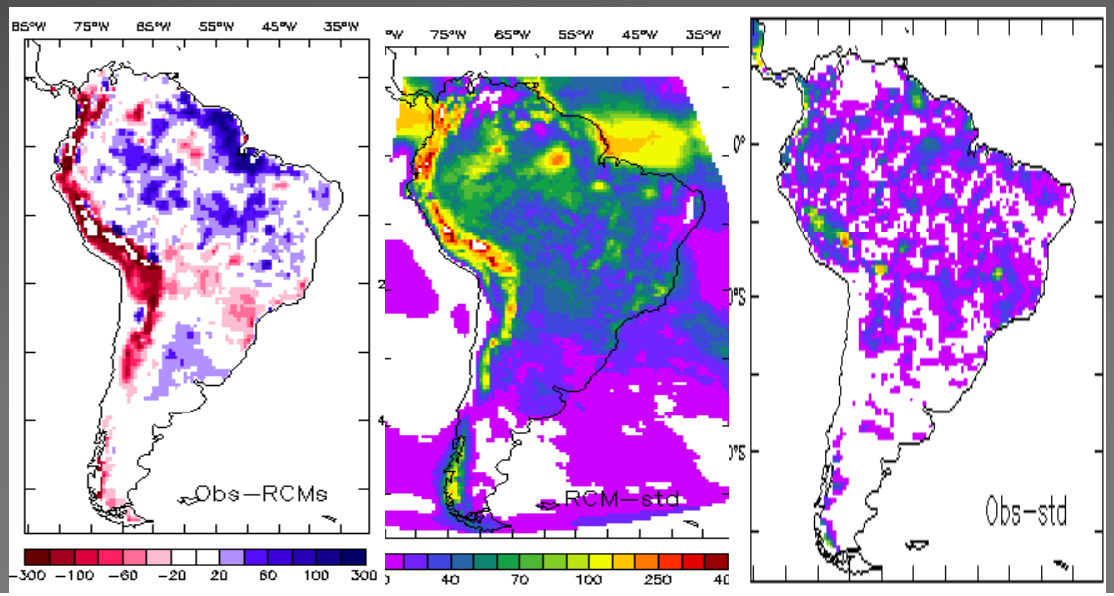
Precipitation: Ensemble bias & spread

BIAS **RCMs SPREAD** **OBS. SPREAD**



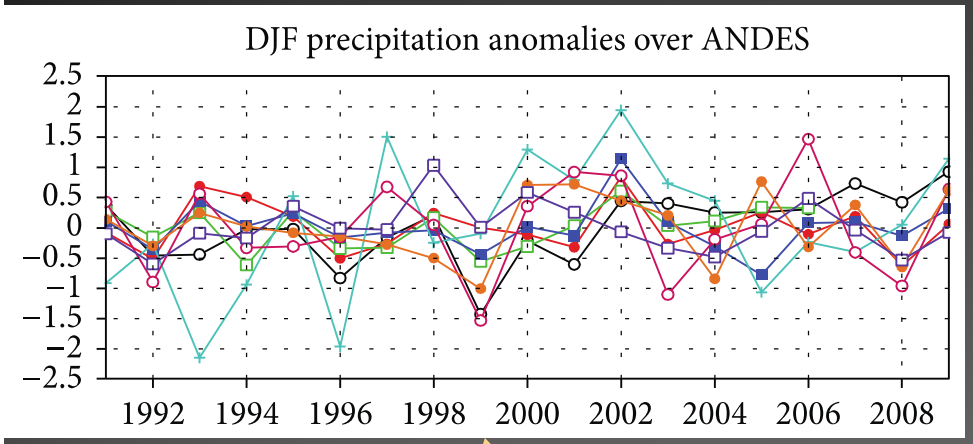
JJA

Precipitation observations:
CRU; UDEL;
GPCC; CPC-UNI



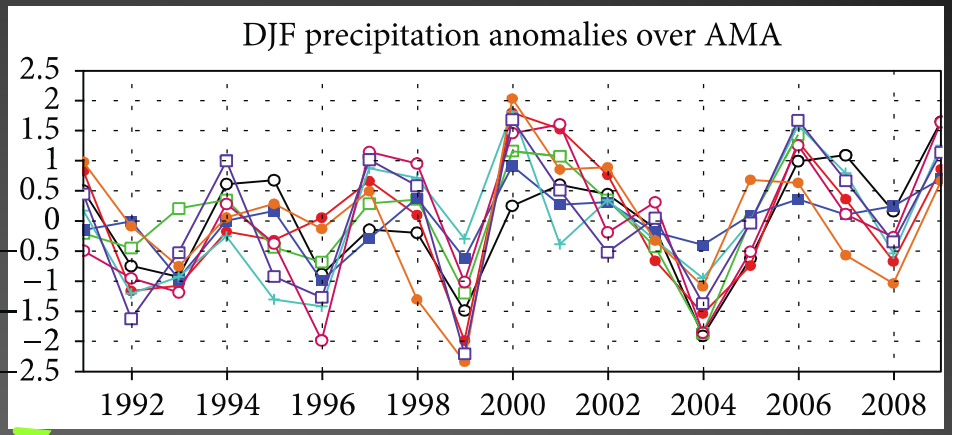
DJF

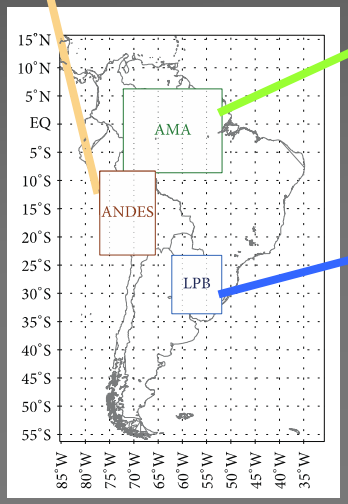
Interannual variability of precipitation from the Era-Interim forced RCMs

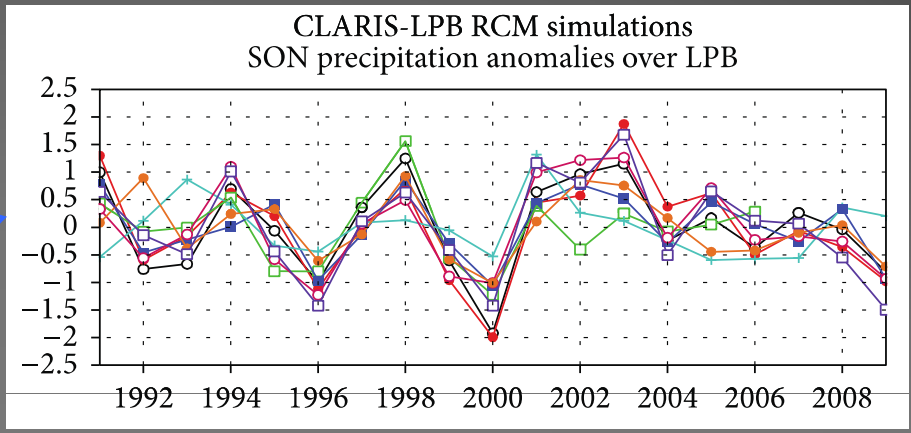


(mm/day)

— CRU







Solman 2013

CLARIS-LPB simulations driven by CMIP3 GCMs

RCM/ Institution	GCM	Present climate (1961-1990)	Near future (2011-2040) A1B	Far future (2071-2100) A1B	Continuous run (1961-2100)
RegCM3/USP	HadCM3-Q0	X	X	X	
	EC5OM-R1	X	X	X	
RCA/SMHI	EC5OM-R1				X
	EC5OM-R2				X
	EC5OM-R3				X
MM5/CIMA	HadCM3-Q0	X	X		
REMO/MPI	EC5OM-R3	X	X	X	X
PROMES/UCLM	HadCM3-Q0				X
LMDZ/IPSL	IPSLA1B				X
	HadCM3-Q0				X
ETA/INPE	HadCM3-Q0	X	X	X	

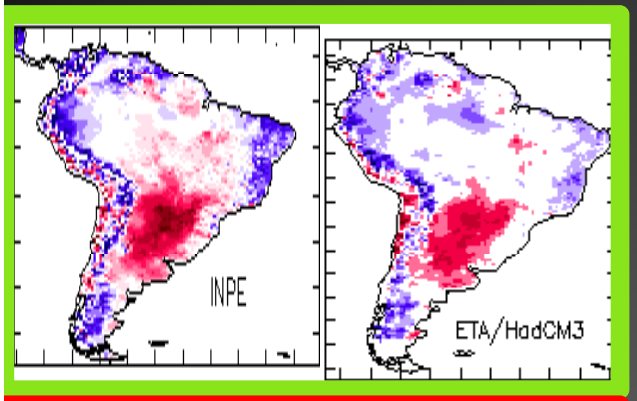
Evaluation of multi-RCM GMC driven ensemble (CMIP3)

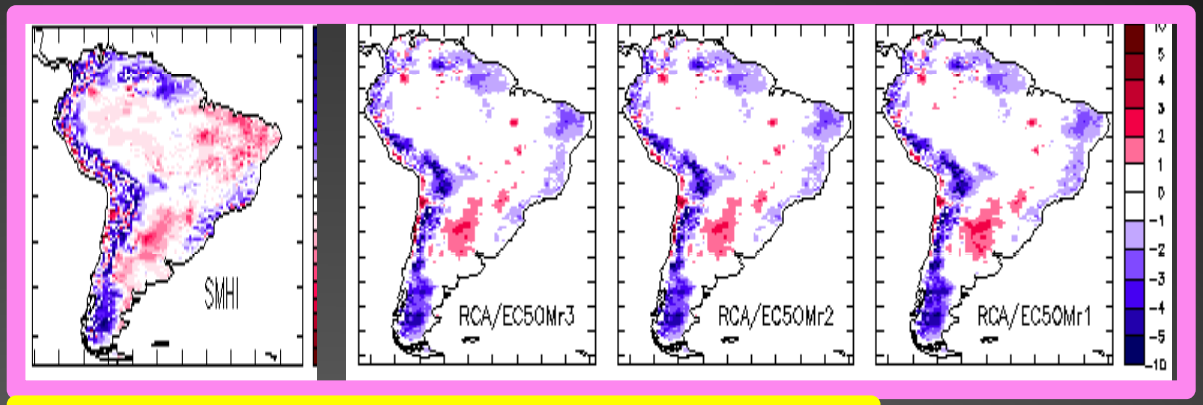
Historical period

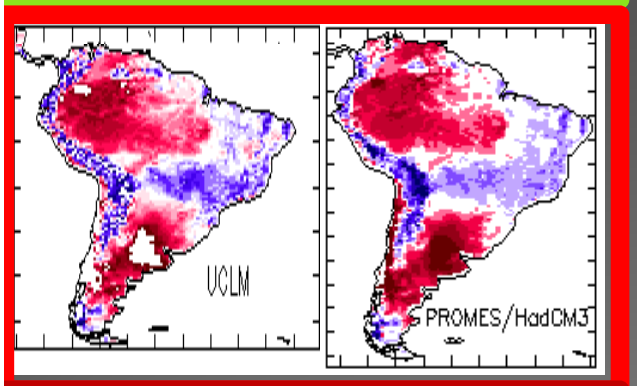
(1961-1990)

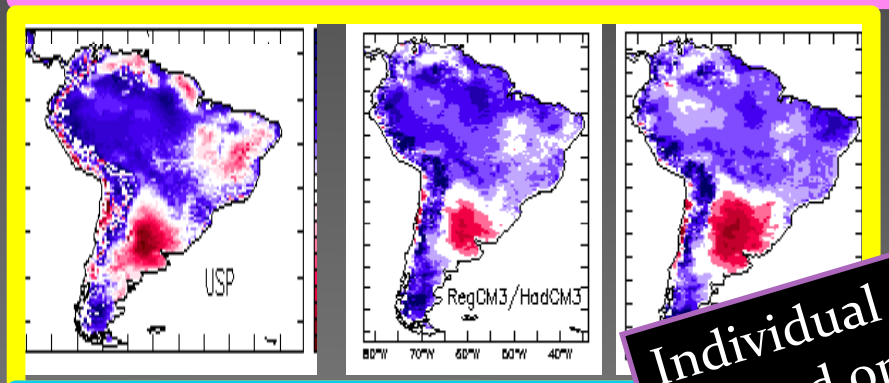
Historical runs: Temperature BIAS - DJF

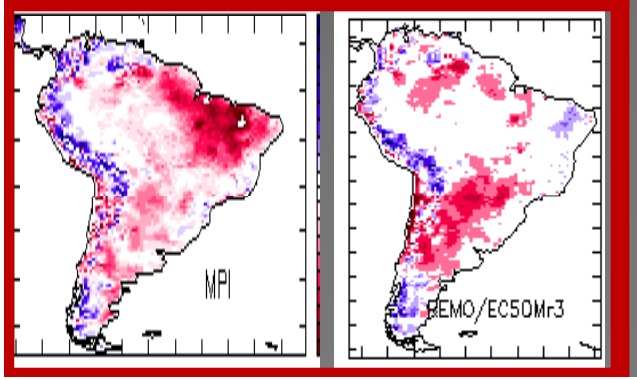
ERA-I BC GCM BC ERA-I BC GCM BC

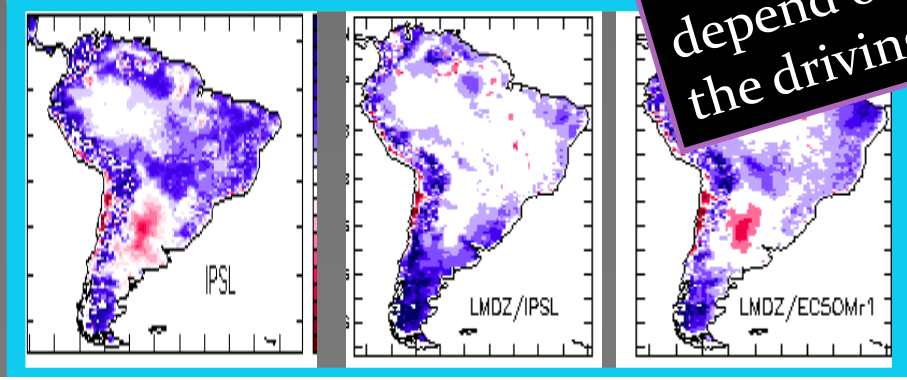








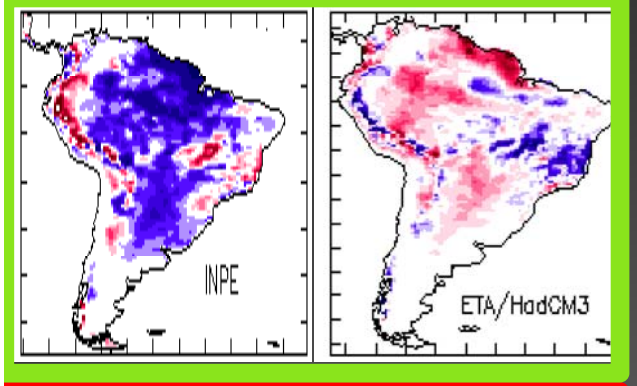


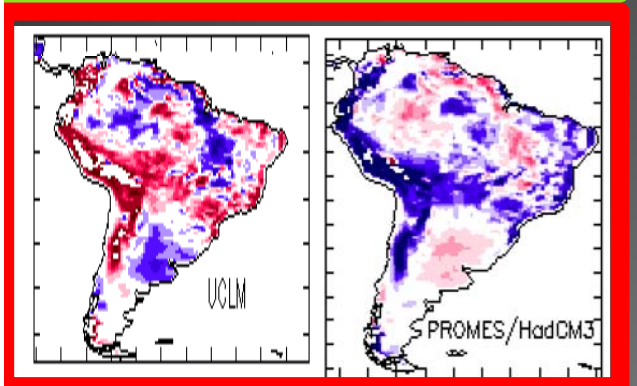


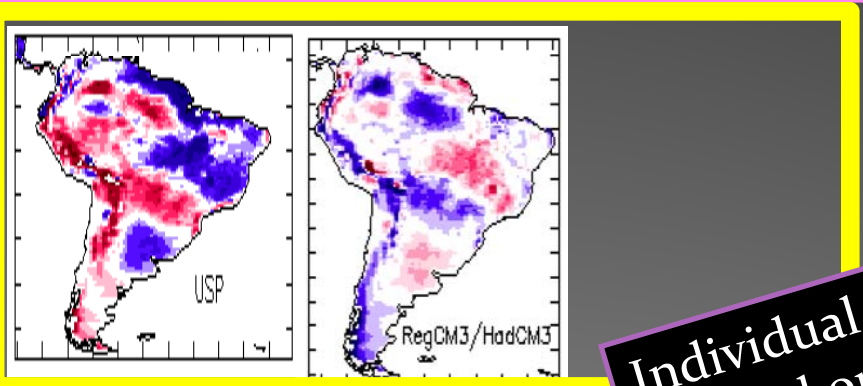
Individual model biases depend only weakly on the driving model !

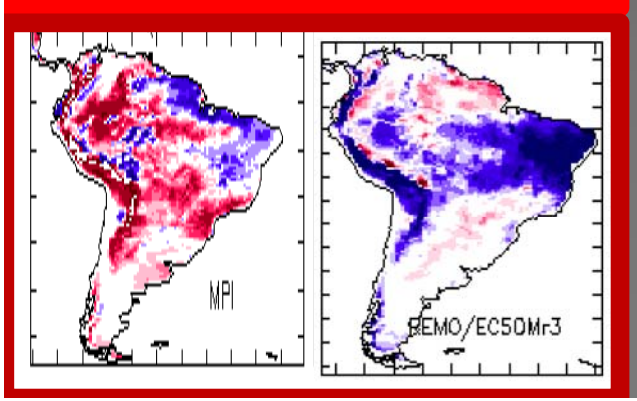
Historical runs: Precipiation BIAS - DJF

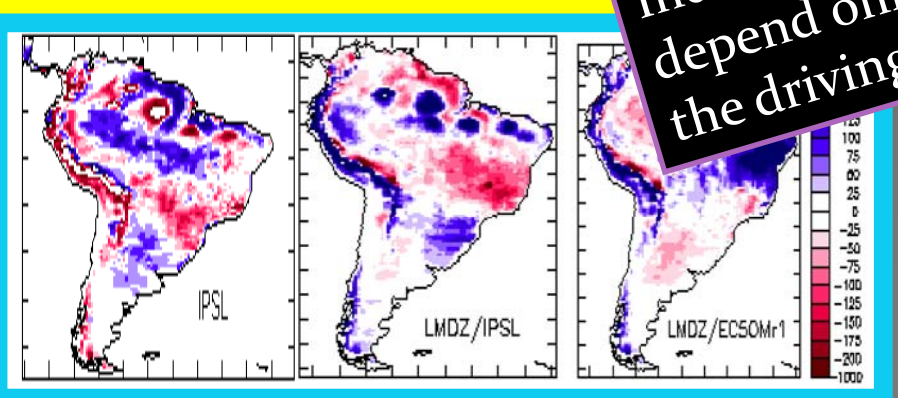
ERA-I BC GCM BC ERA-I BC GCM BC











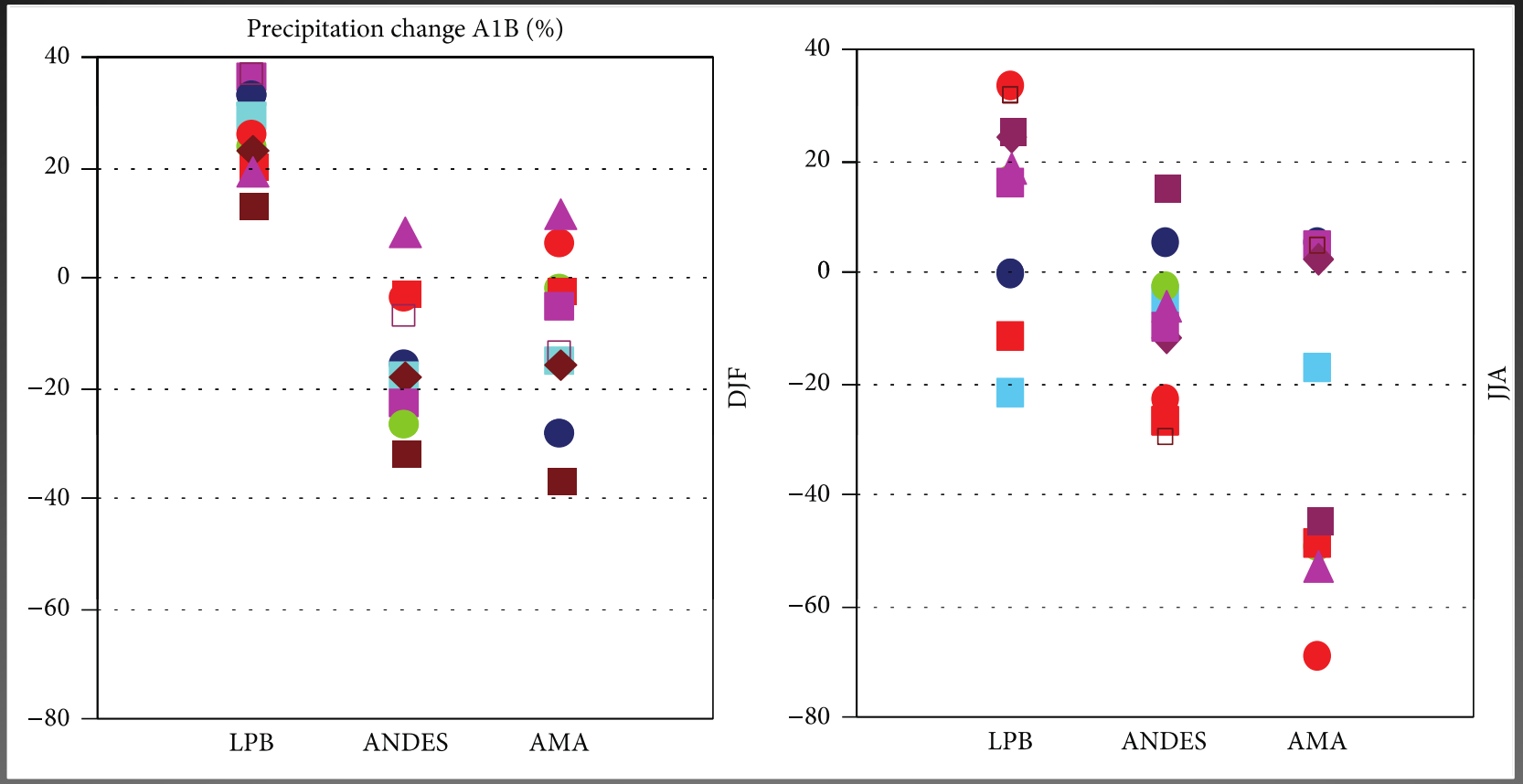
Individual model biases depend only weakly on the driving model !

COLORS ARE REVERSED!! (ERAI / GCM)

Evaluation of multi-RCM regional climate change signal (CMIP3)

SRES A1B

Regional climate change signal (2071-2100)



Solman 2013, Adv in Meteorol

CORDEX-South America simulations driven by CMIP5

CORDEX-SAM simulations

RCM/ GCM	ERA-Interim 1979-2008	Histrorical 1950-2005	RCP8.5 2006-2100	RCP4.5 2006-2100	RCP2.6 2006-2100
REMO/MPI-ESM		✔	✔	✔	✔
LMDZ/IPSL-CM5A	✔	✔		✔	
RCA/EC-Earth	✔	✔	✔	✔	
RegCM4/HadGEM2		✔	✔	✔	
RegCM4/MPI		✔	✔	✔	
RegCM4/GFDL		✔	✔	✔	
PRECIS V2/HadGem	✔	PRECIS V2 to be released by the end of this year			
PRECIS V2/ CMIP5		PRECIS V2 to be released in 2014			
HadGEM3-RA /CMIP5	✔	HadGEM3-RA /CMIP5 released in collaboration with R. Jones (Hadley Centre)			

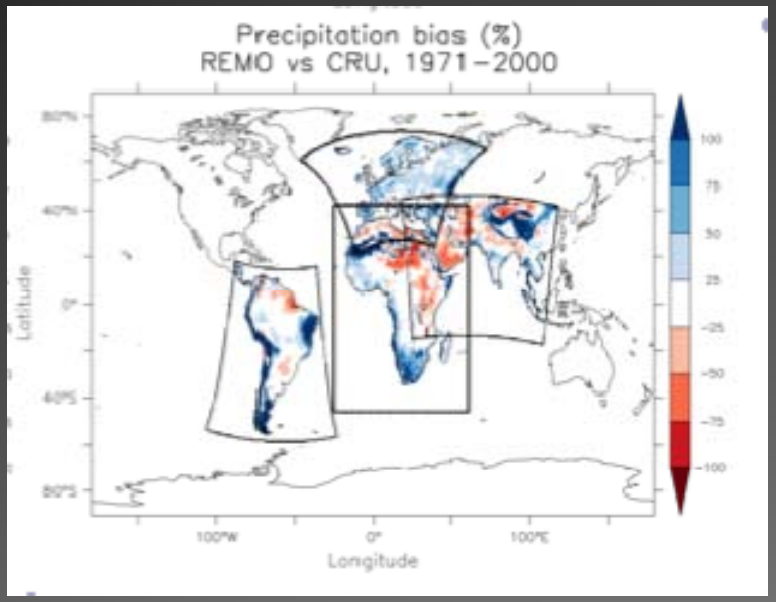
✔Completed ✔ Planned

CORDEX-SAM data availability

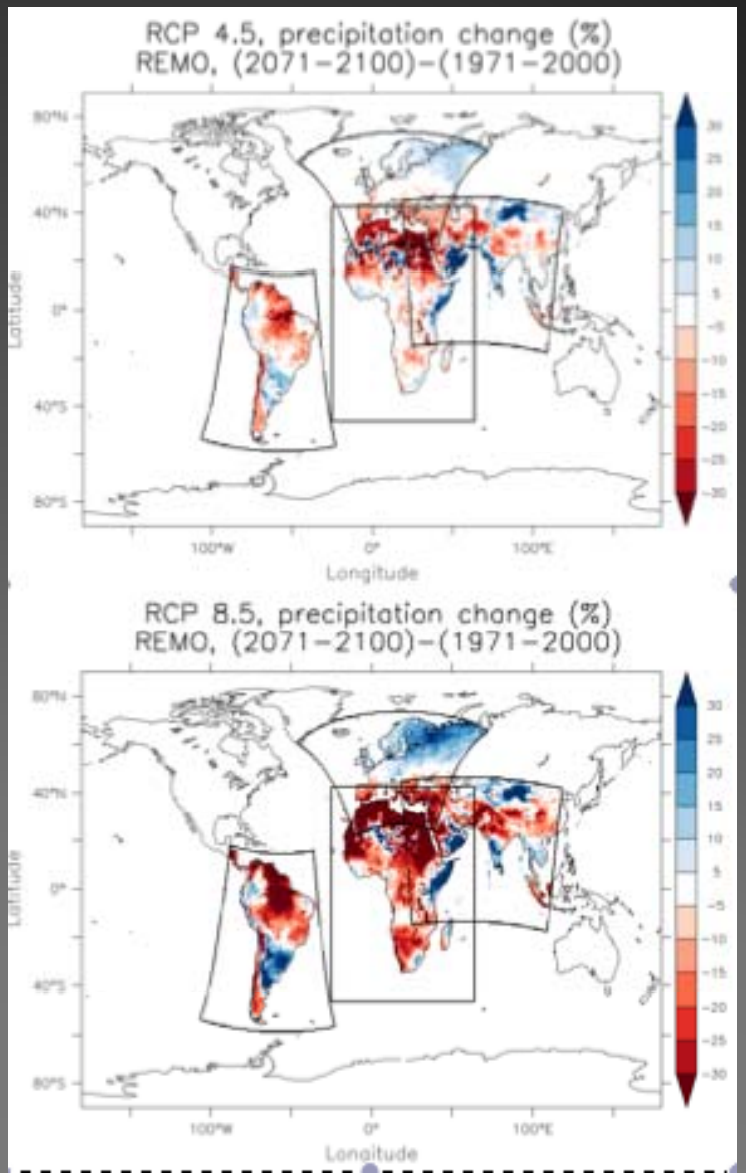
RCM/ GCM	ERA-Interim 1979-2008	Histrorical 1950-2005	RCP8.5 2006-2100	RCP4.5 2006-2100	RCP2.6 2006-2100
REMO/MPI-ESM	?				
LMDZ/IPSL-CM5A	http://www.lmd.jussieu.fr/~li/claris				
RCA/EC-Earth	Available soon at the CORDEX databank				
RegCM4/HadGEM2		?	?	?	
RegCM4/MPI		?	?	?	
RegCM4/GFDL		?	?	?	
PRECIS V2/HadGem	BADC UK node CMIP5 end of 2013				
PRECIS V2/ CMIP5					
HadGEM3-RA /CMIP5	BADC UK node CMIP5 Next year				

REMO/EC-Earth

Historical period
Precipitation bias



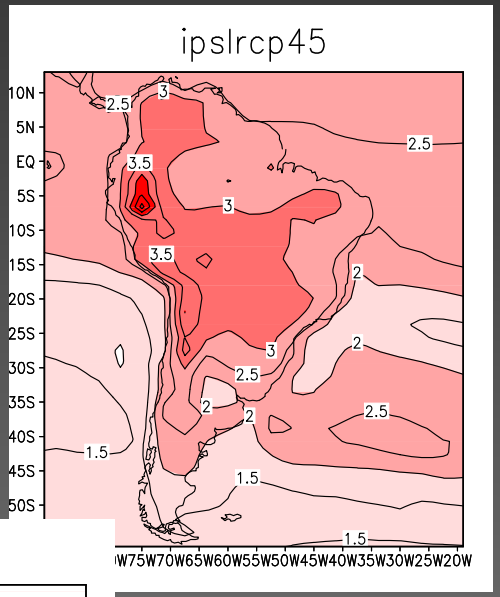
Precipiation change

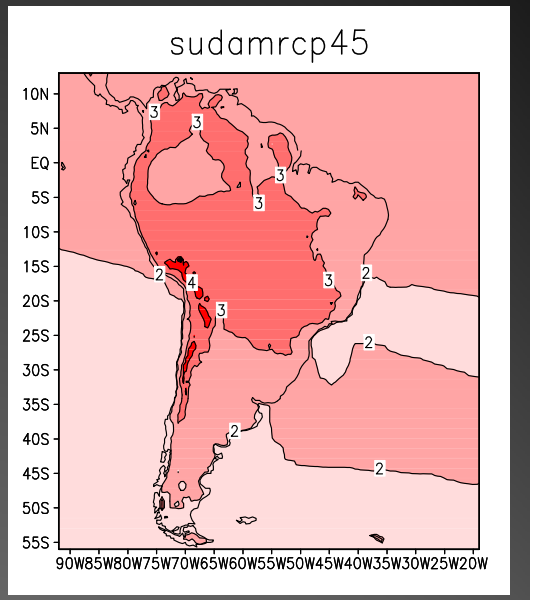


Teichmann C, et al.,. *Atmosphere*. 2013
Courtesy of Armelle Recca Remedio

LMDZ-IPSL CM5 RCP4.5 Changes (2071/2100 -1961/1990)

Temperature change (k)

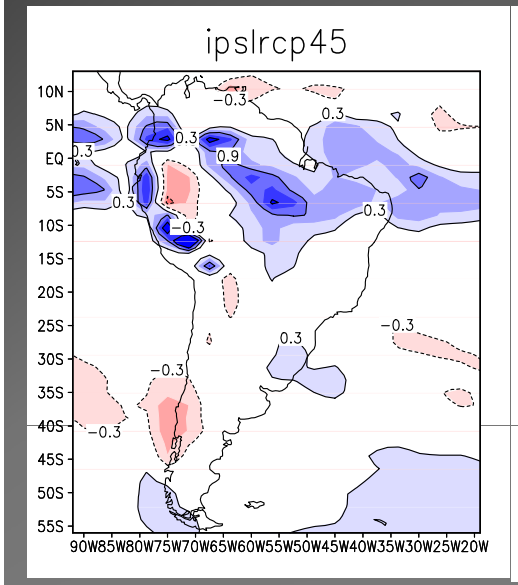


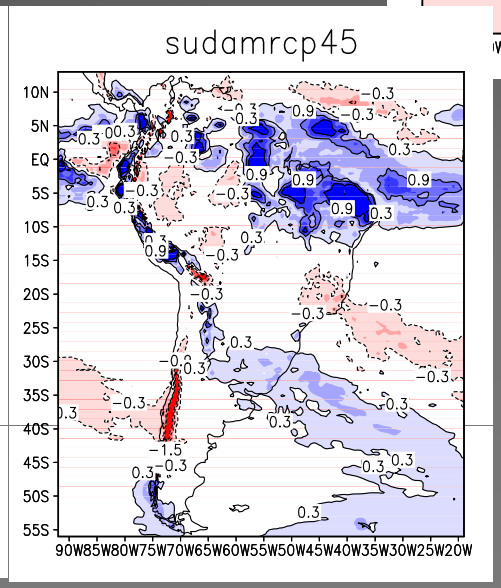


GCM RCM

Precipitation change (mm/day)

GCM RCM

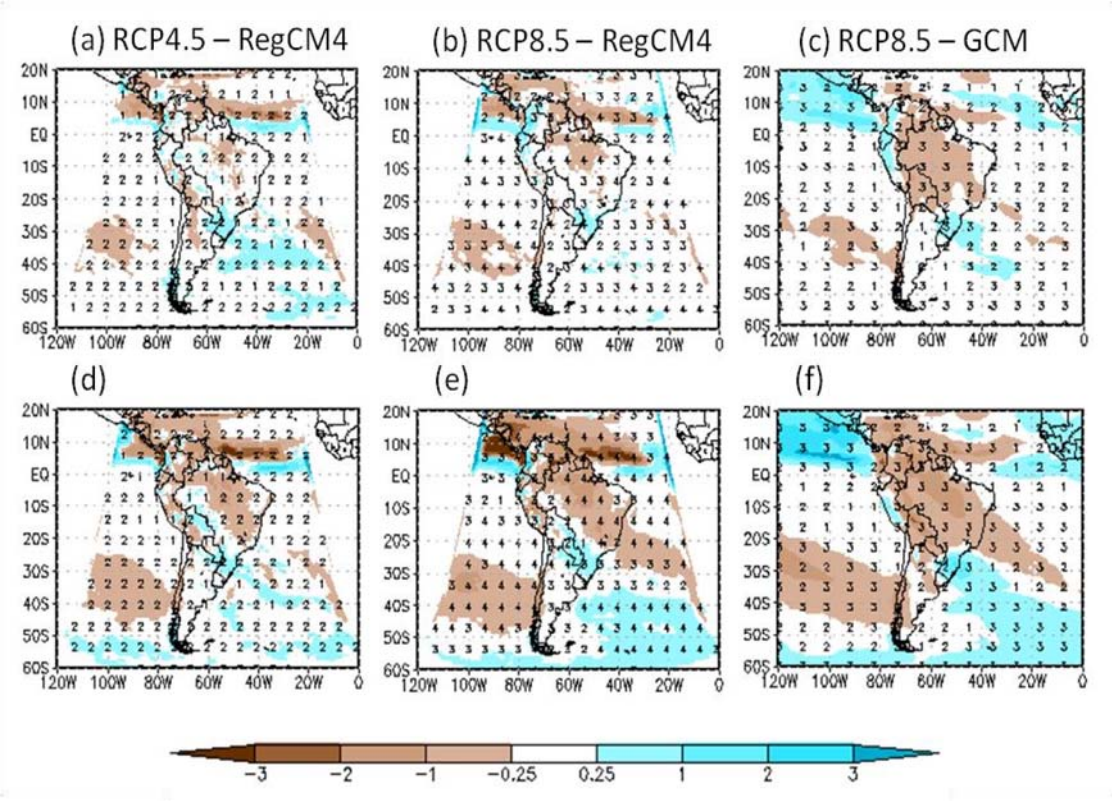




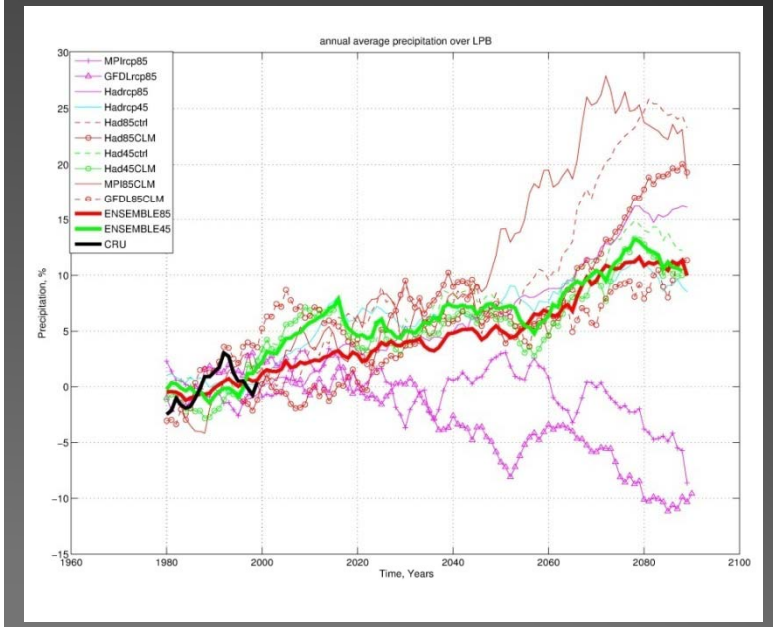
Courtesy of Laurent Li (LMD)

RegCM4 - RCP4.5 & RCP8.5 Changes (2070/2098 -1975/2005)

Change of precipitation – SON (mm/day)



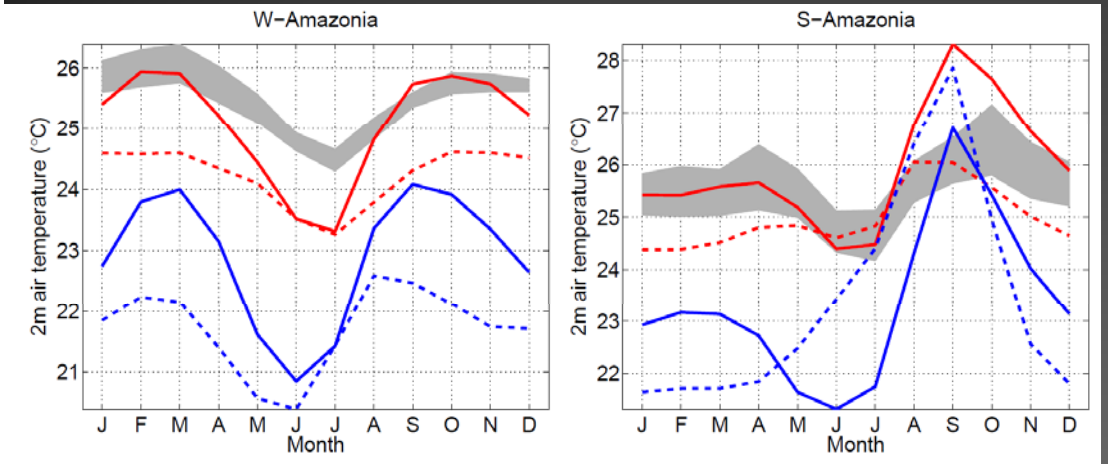
Mean annual trend of precipitation (mm/day) over LPB



M. Llopart (2013)
Courtesy of Rosmeri P. da Rocha

RCA4/EC-Earth RCP8.5 changes

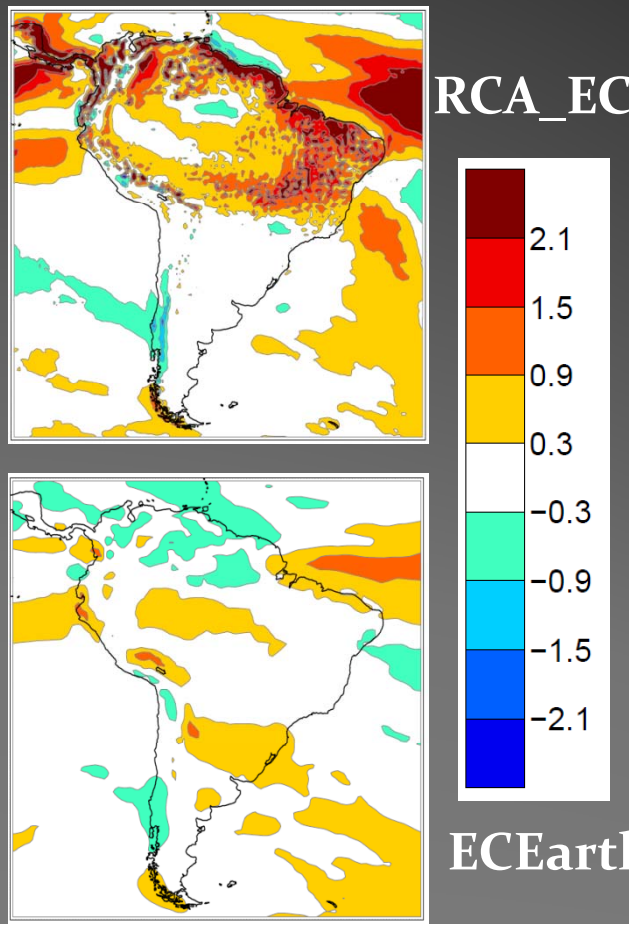
Present day temperature



CRU & Willmott
ERAInterim (dashed)
RCA_ERAInterim (solid)
ECEarth (dashed)
RCA_ECEarth (solid)

Courtesy of Christer Jansson, Patrick Samuelsson, Ulf Hansson - SMHI

Precipitation change RCP8.5 (mm/day)
2075/2100 – 1980/2005



Summary

- ERA-Interim driven simulations allow identifying ensemble bias and ensemble spread
  - Subtropical regions seem to be better simulated than tropical regions in terms of both model bias and uncertainty.
- The quality of RCM simulations over the SAM is not as good as that for Europe and North America.
- Some model biased are shared by different RCMs
- GCM-forced simulations:
  - Biases on the simulated temperature and precipitation patterns seem to be independent of boundary forcing.
  - Biases and uncertainties larger than for the ERA-I simulations (as expected).

Challenges for SAM

- Model improvements, particularly on the land-surface schemes
- Increasing resolution (22 km)
- Increasing the ensemble size
- Availability of reliable datasets of high-quality observations covering the whole South American continent