WCRP VAMOS/CORDEX Workshop on
Latin-America and Caribbean CORDEX
LAC: Phase I - South America

Precipitation and Temperature representation over the South America Monsoon Region by CMIP3/CMIP5 Models and Dynamical Downscaling Simulations

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Lima, Peru

12 – September - 2013

Precipitation and Temperature:

- Climatologies, Annual maps, Seasonal maps [Austral Spring (SON) and Summer (DJF)]

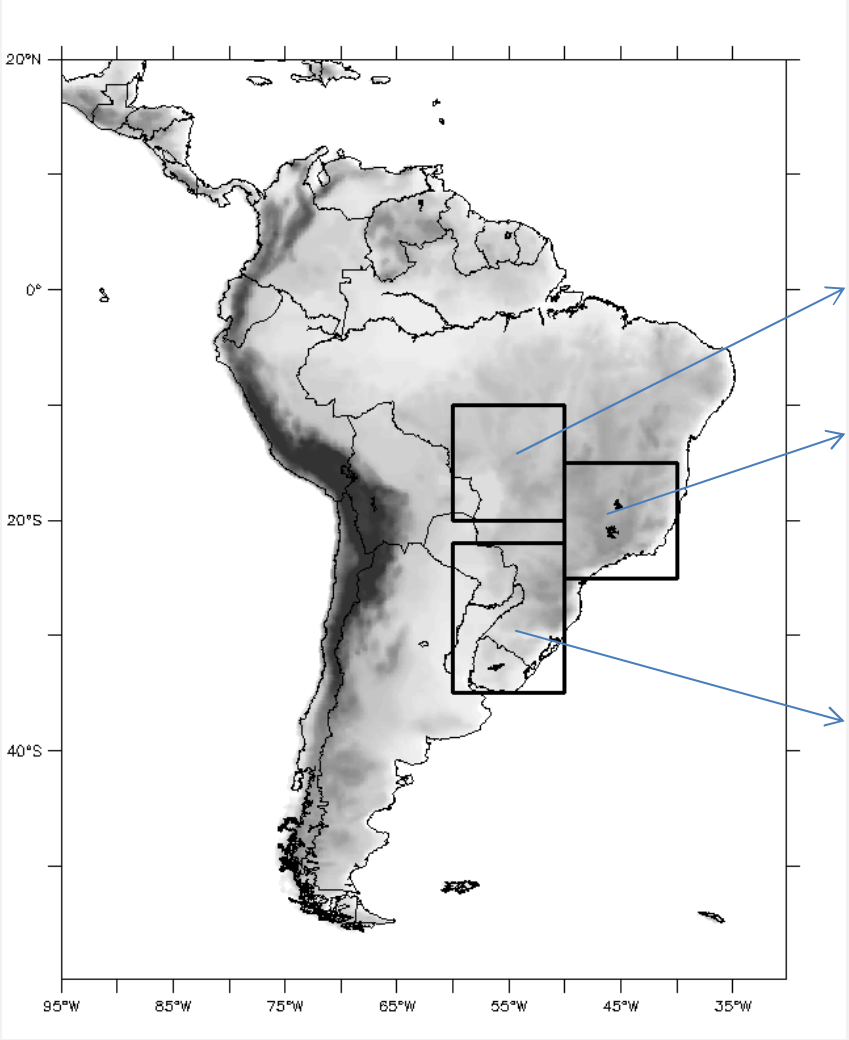
Period:

- Present: 1961-1990
- Future: 2070-2099 (A2-SRES/CMIP3 and RCP8.5/CMIP5)

Data:

- Observation: CRU (Climatic Research Unit)
- CMIP3 Models Mean (CMIP3MM)
- CMIP5 Models Mean (CMIP5MM)
- Dynamical Downscaling: RAMS6.0 forced by HadGEM2-ES

South America Monsoon region:



3 REGIONS (SETH et al., 2010):

- MONSOON: 50°-60°W/ 10°-20°S
- CONTINENTAL SOUTH ATLANTIC CONVERGENCE ZONE (CSACZ): 40°-50°W / 15°-25°S
- SOUTHEASTERN SOUTH AMERICA (SESA): 50°-60°W / 22°-35°S

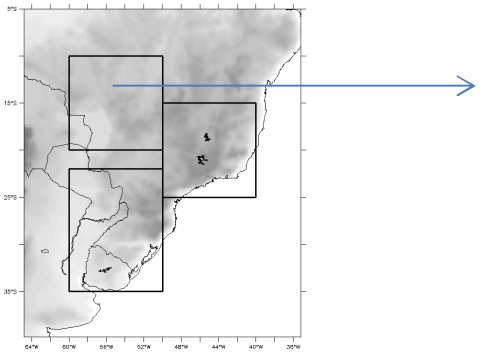
CMIP3/CMIP5 MODELS: 13 centers

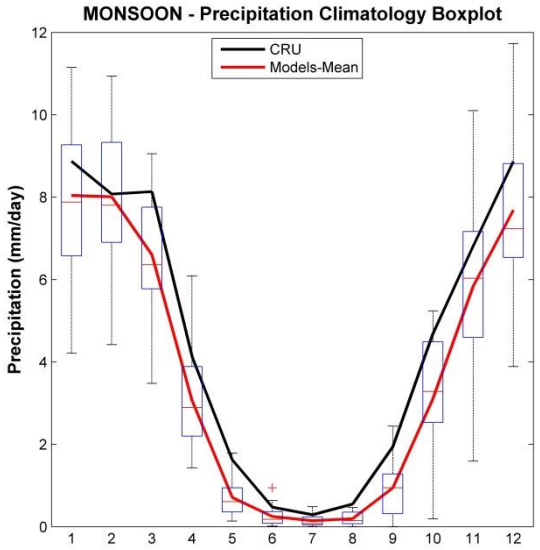
CENTERS	CMIP3	CMIP5	CENTERS	CMIP3	CMIP5
CCCma	CGCM3.1	CanCM4	CNRM-CERFACS	**CNRM-CM3**	**CNRM-CM5**
	CGCM3.1-T63	**CanESM2**			CNRM-CM5-2
CSIRO-QCCCE	**CSIRO-Mk3.0**	**CSIRO-Mk3.6**	INM	**INM-CM3.0**	**INM-CM4.0**
GFDL	**GFDL2.0**	GFDL-CM2.1	GISS	GISS-AOM	**GISS-E2H**
	GFDL2.1	**GFDL-CM3**		GISS-EH	GISS-E2H-CC
		GFDL-ESM2G		**GISS-ER**	**GISS-E2R**
		GFDL-ESM2M			GISS-E2R-CC
IAP (LASG & CESS)	FGOALSg1.0	**FGOALSg2**	MRI	**MRI-CGCM2.3.2**	MRI-CGCM3
		FGOALSs2			MRI-ESM1
IPSL	**IPSL-CM4.0**	**IPSL-CM5A-LR**	MOHC	**HadCM3**	**HadGEM2-AO**
		IPSL-CM5A-MR		HadGEM1	**HadGEM2-CC**
		IPSL-CM5B-LR			**HadGEM2-ES**
MPI	**ECHAM5/MPI-OM**	**MPI-ESM-LR**	MIROC	**MIROC3.2 MR**	MIROC4h
		MPI-ESM-MR		MIROC3.2 HR	**MIROC5**
		MPI-ESM-P			**MIROC-ESM-CHEM**
NCAR	**CCSM3.0**	**CCSM4**			**MIROC-ESM**
	NCAR-PCM1				

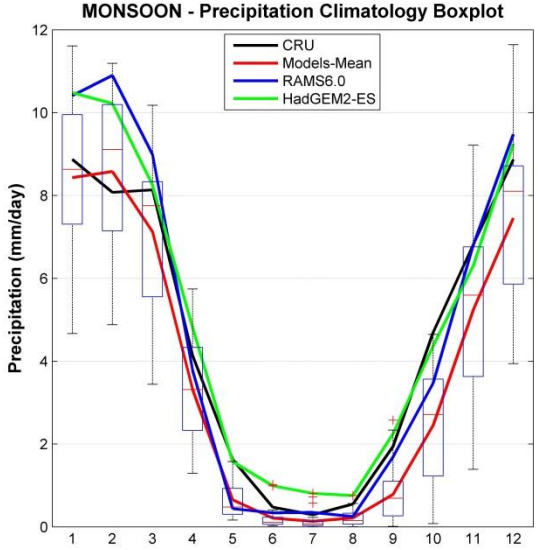
Dynamical Downscaling Simulations:

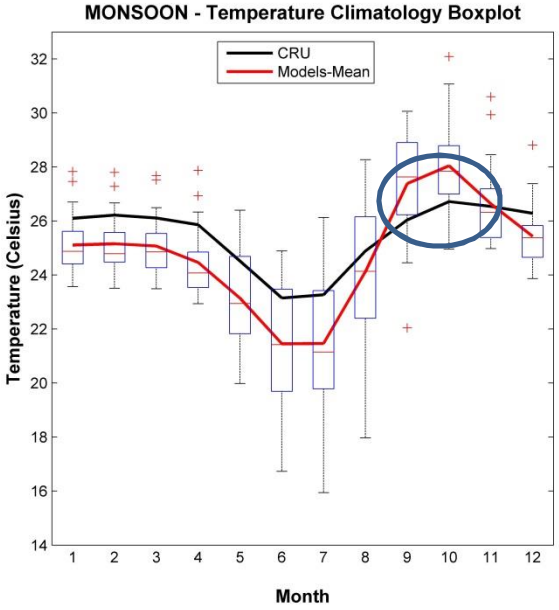
> Regional Model: RAMS6.0 (forced by HadGEM2-ES/CMIP5),
> Model Domain: South America CORDEX Domain
> Grid: 182 X 112 horizontal points (50 km spacing), 29 levels,
> Physical Parameterizations:
    > Radiation: Chen-Cotton
    > Cloud Microphysics: Walko et al.
    > Turbulence: Mellor-Yamada
    > Surface Processes: LEAF
    > Convection: Kain-Fritsch

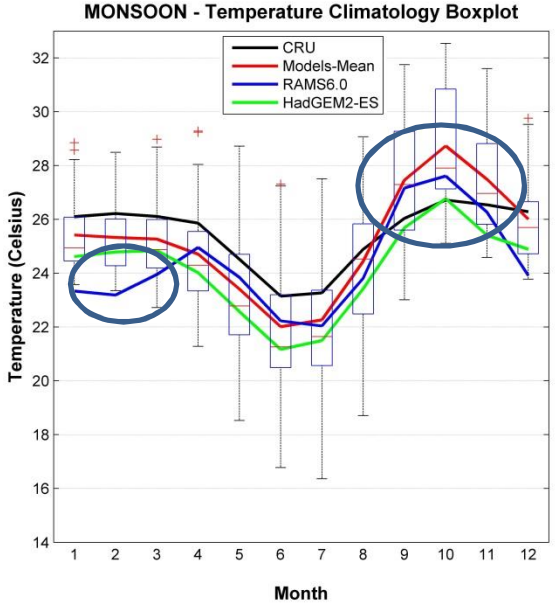
Climatologies: MONSOON











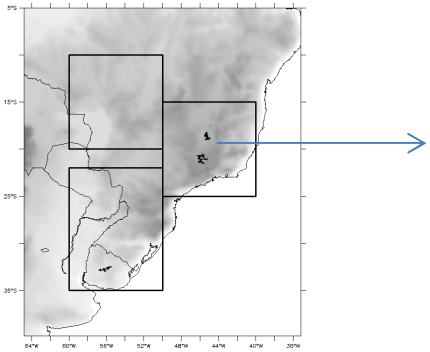
Correlation PR

CMIP3MM	CMIP5MM
0.990	0.977
RAMS6.0	HadGEM2-ES
0.979	0.982

Correlation TAS

CMIP3MM	CMIP5MM
0.915	0.895
RAMS6.0	HadGEM2-ES
0.682	0.958

Climatologies: CSACZ

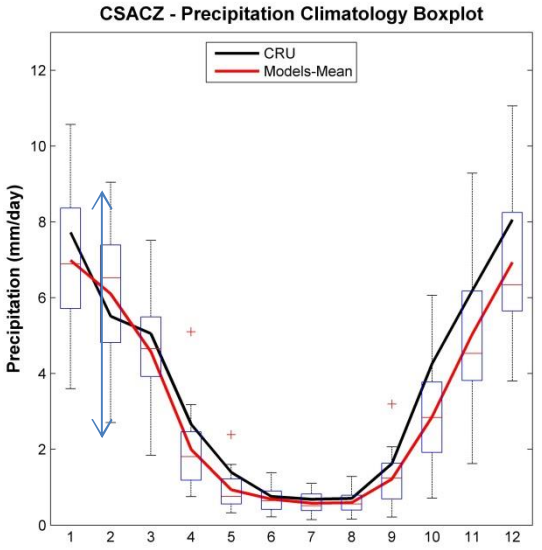


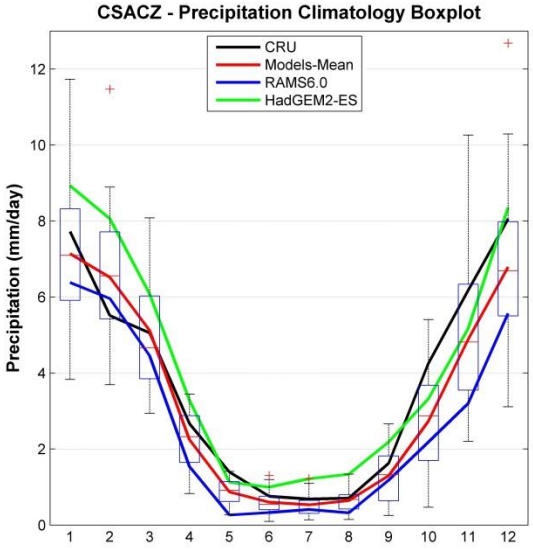
Correlation PR

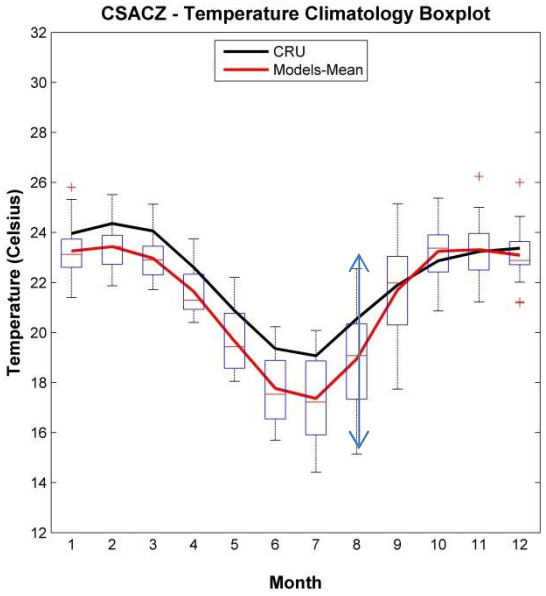
CMIP3MM	CMIP5MM
0.981	0.968
RAMS6.0	HadGEM2-ES
0.934	0.950

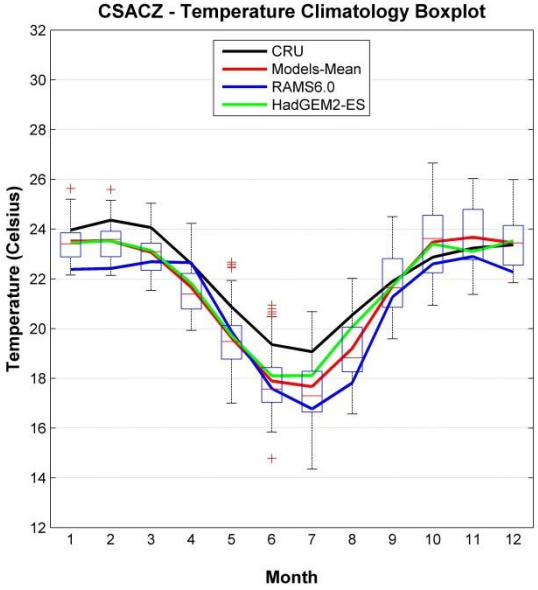
Correlation TAS

CMIP3MM	CMIP5MM
0.972	0.967
RAMS6.0	HadGEM2-ES
0.939	0.929

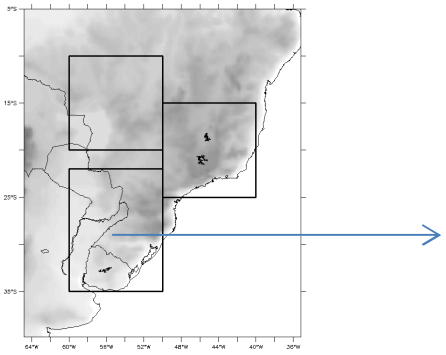


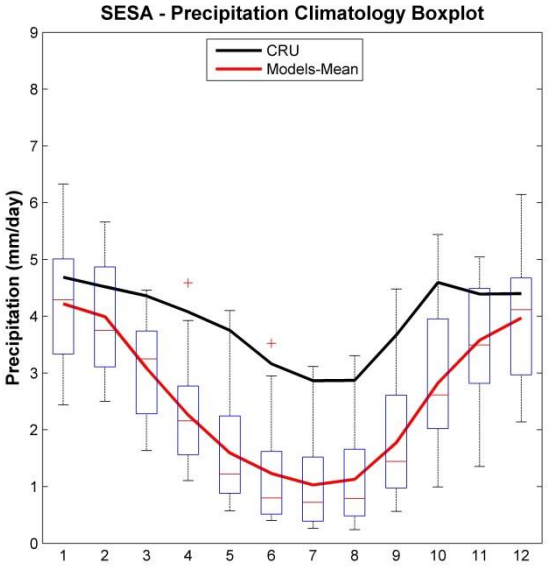


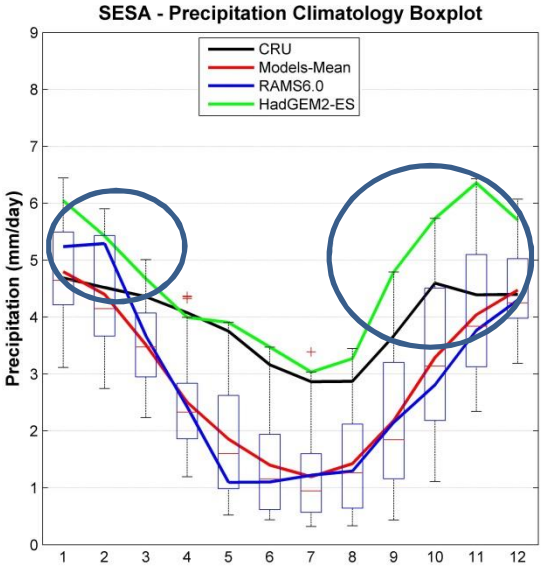


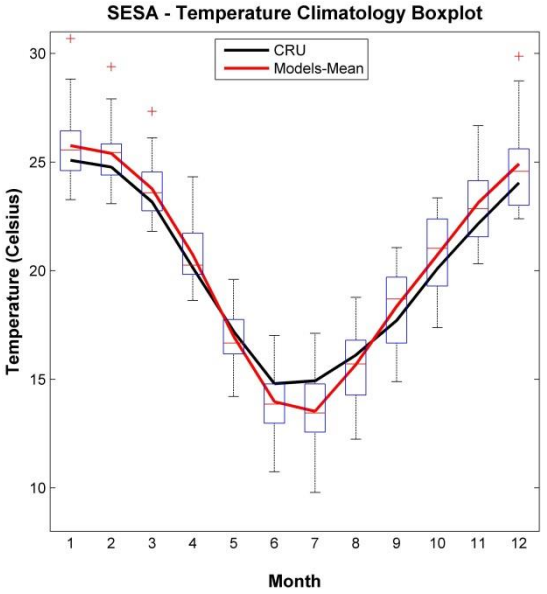


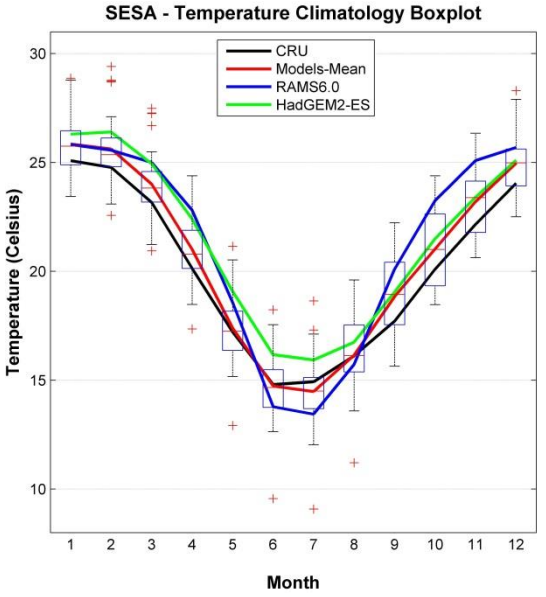
Climatologies: SESA











Correlation PR

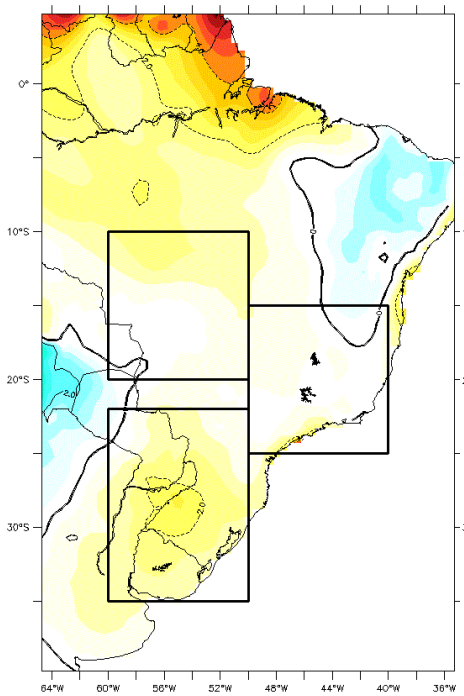
CMIP3MM	CMIP5MM
0.915	0.917
RAMS6.0	HadGEM2-ES
0.848	0.894

Correlation TAS

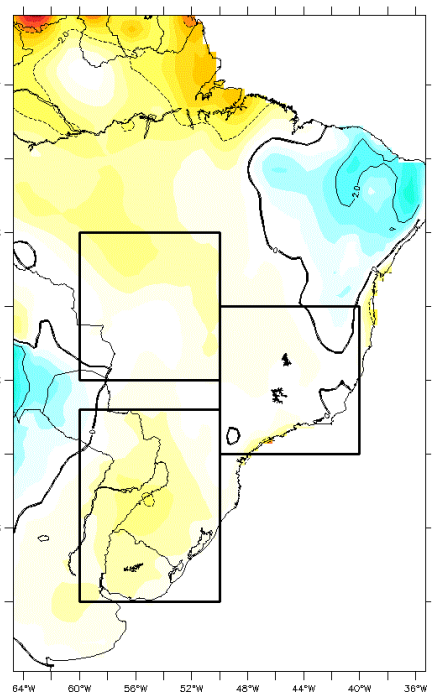
CMIP3MM	CMIP5MM
0.995	0.997
RAMS6.0	HadGEM2-ES
0.960	0.994

Precipitation Annual Field - present:

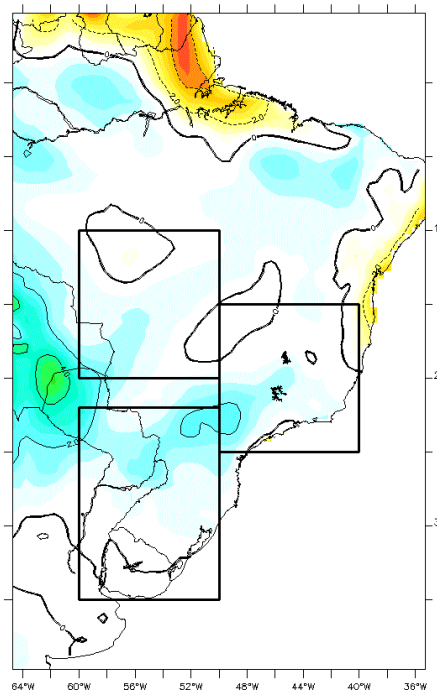
CMIP3MM



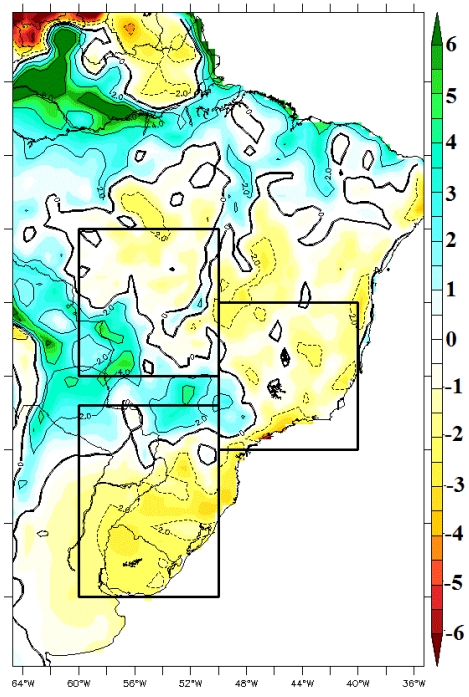
CMIP5MM



HadGEM2-ES



RAMS6.0

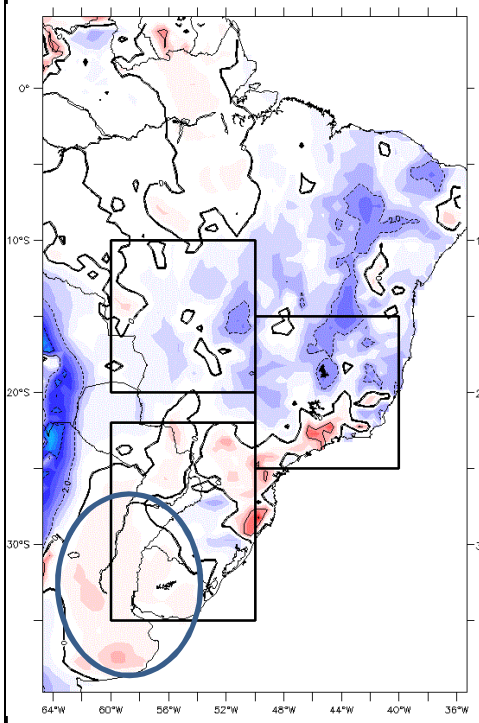


BIAS:

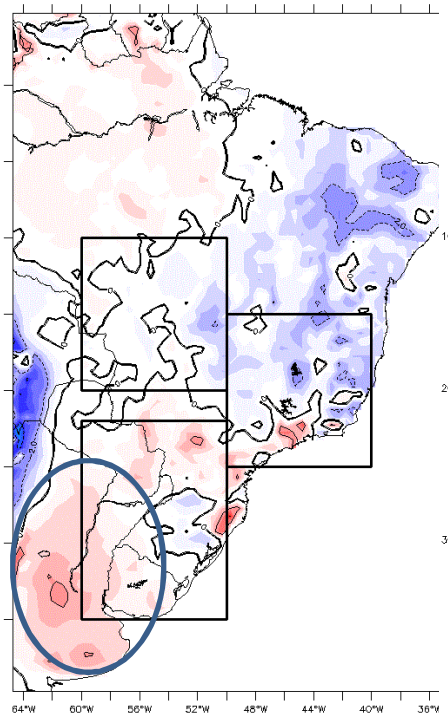
Region	CMIP3MM	CMIP5MM	HadGEM2-ES	RAMS6.0
Monsoon	-0.823	-0.824	0.464	0.201
CSACZ	-0.510	-0.436	0.455	-1.068
SESA	-1.389	-1.023	0.755	-1.082

Temperature Annual Field - present:

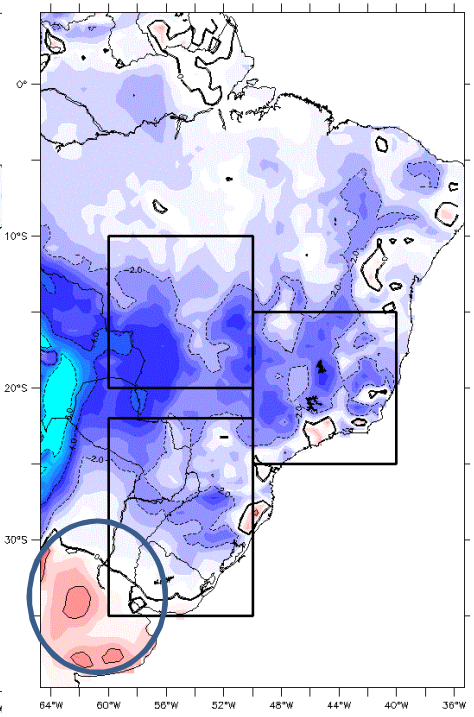
CMIP3MM



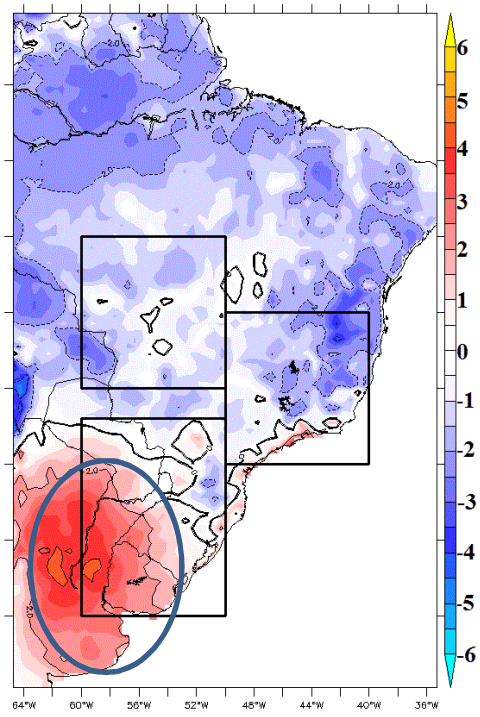
CMIP5MM



HadGEM2-ES



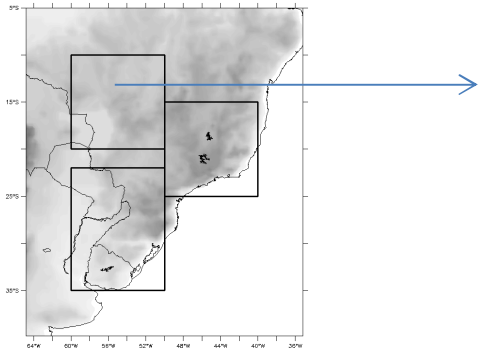
RAMS6.0

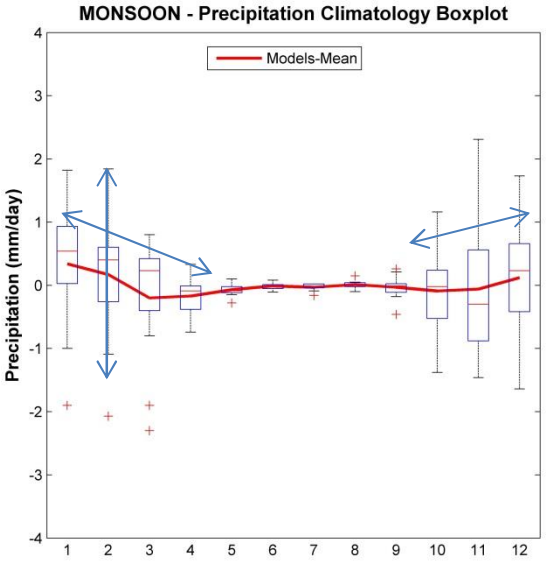


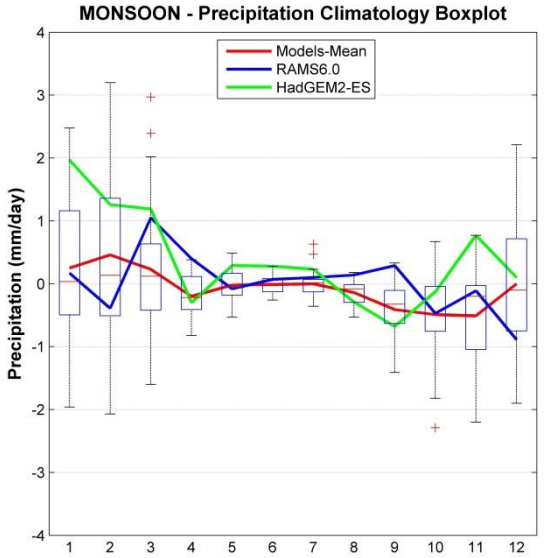
BIAS:

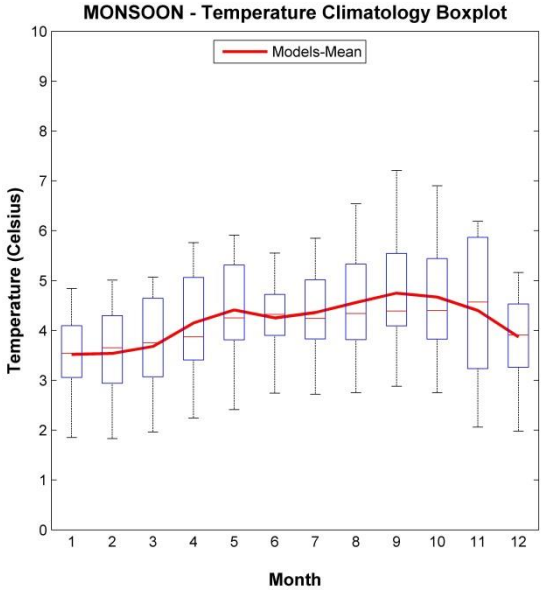
Region	CMIP3MM	CMIP5MM	HadGEM2-ES	RAMS6.0
Monsoon	-0.684	-0.265	-2.324	-1.114
CSACZ	-0.819	-0.645	-1.933	-1.247
SESA	0.227	0.588	-1.365	1.217

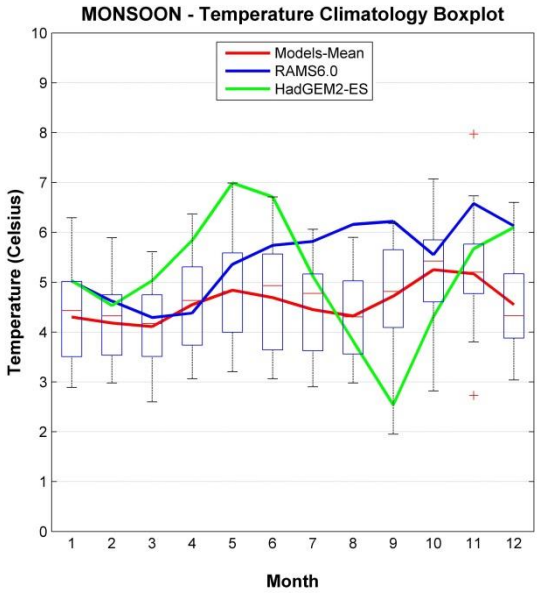
Climatologies: MONSOON Future



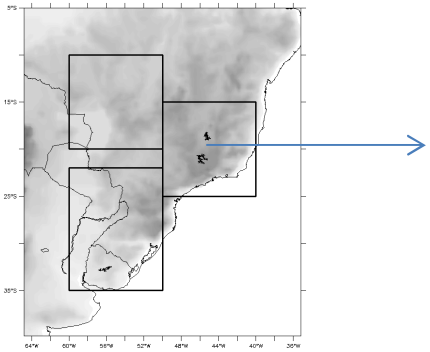


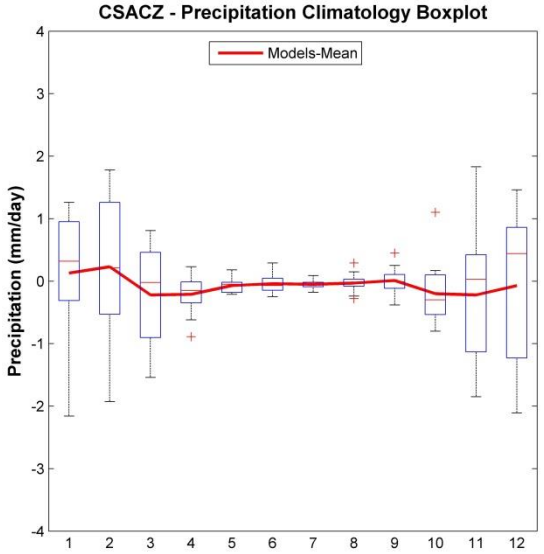


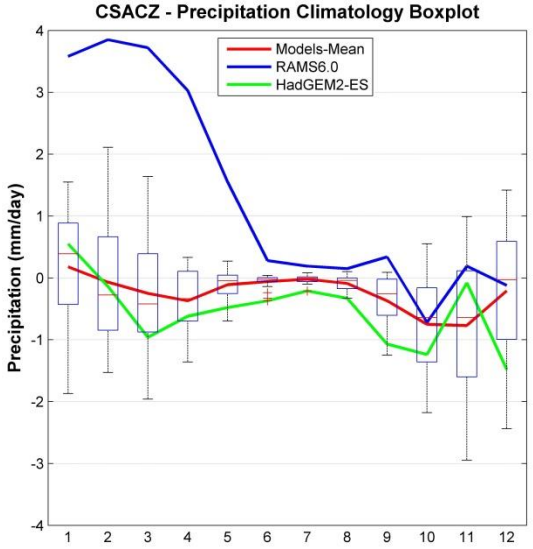


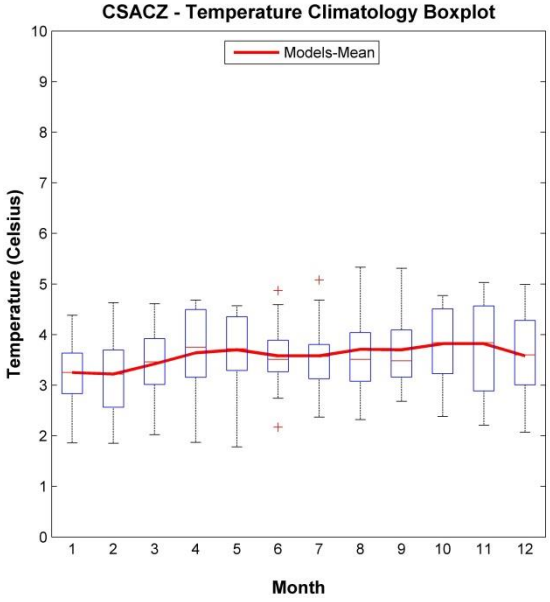


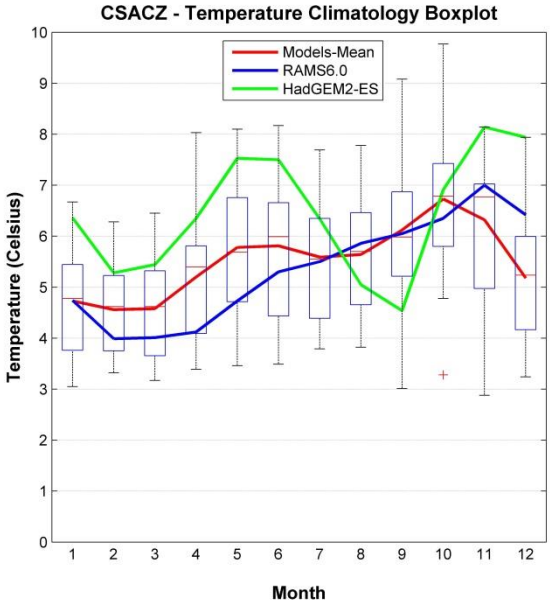
Climatologies: CSACZ Future



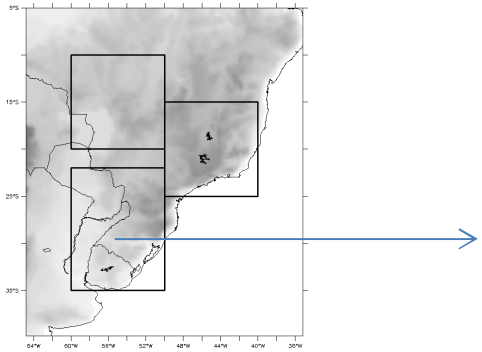


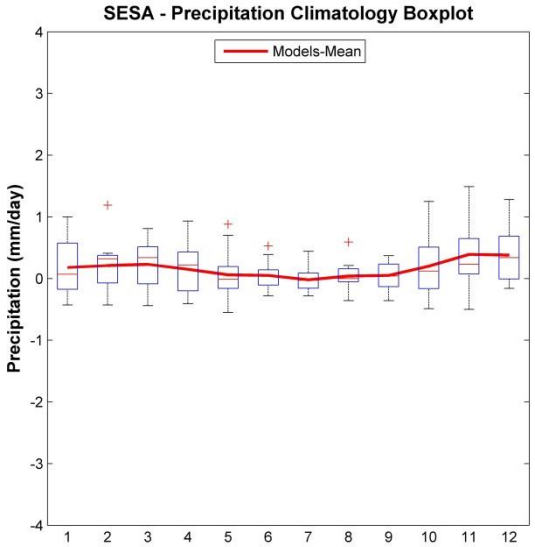


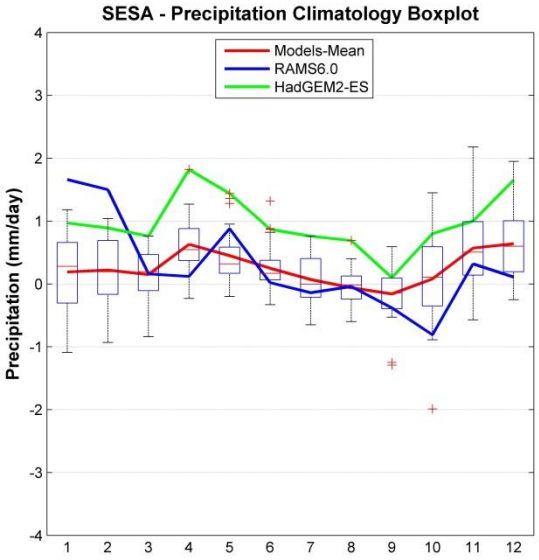


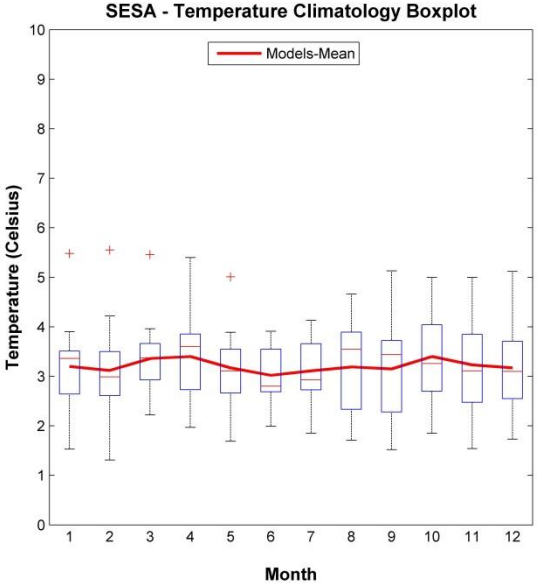


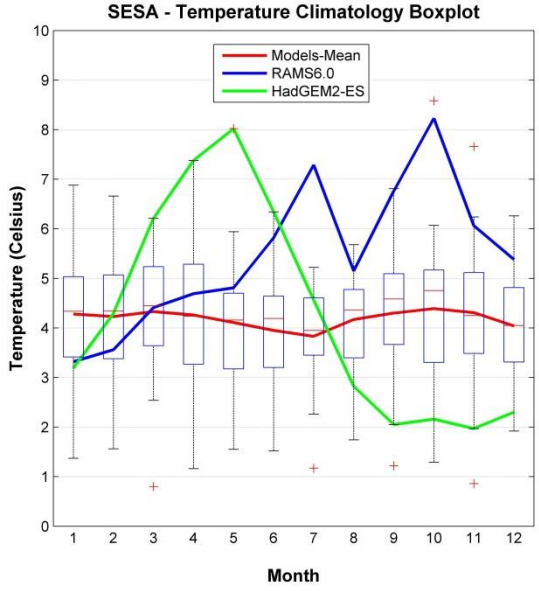
Climatologies: SESA Future





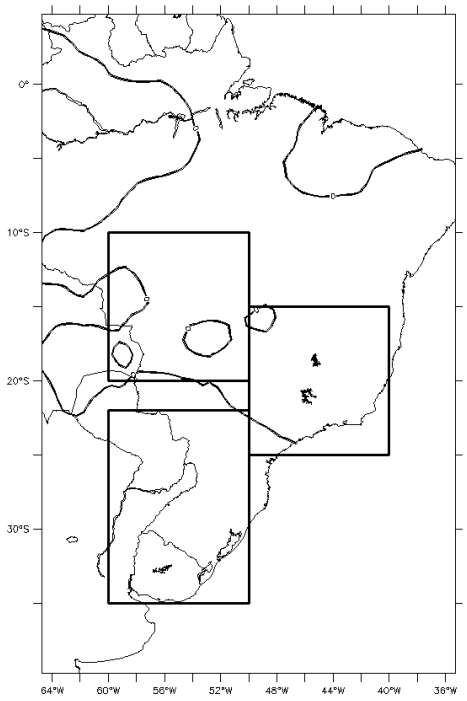




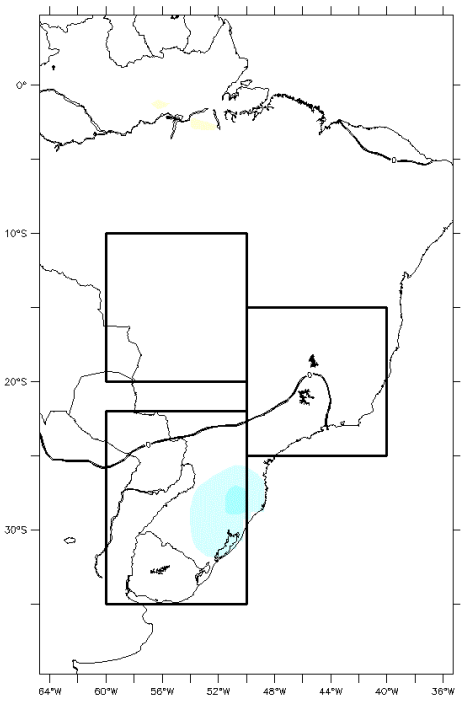


Precipitation Annual Field - future:

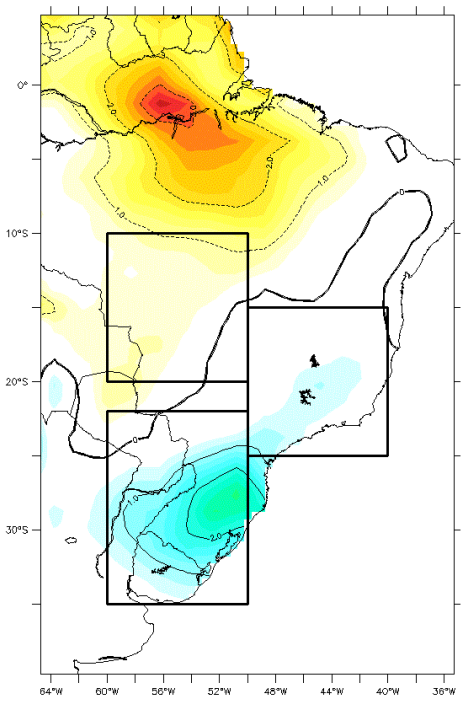
CMIP3MM



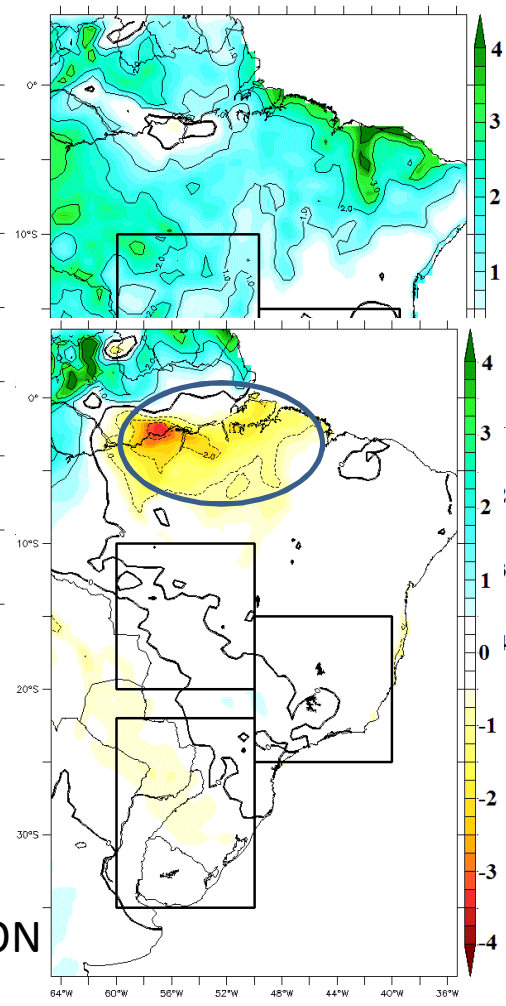
CMIP5MM



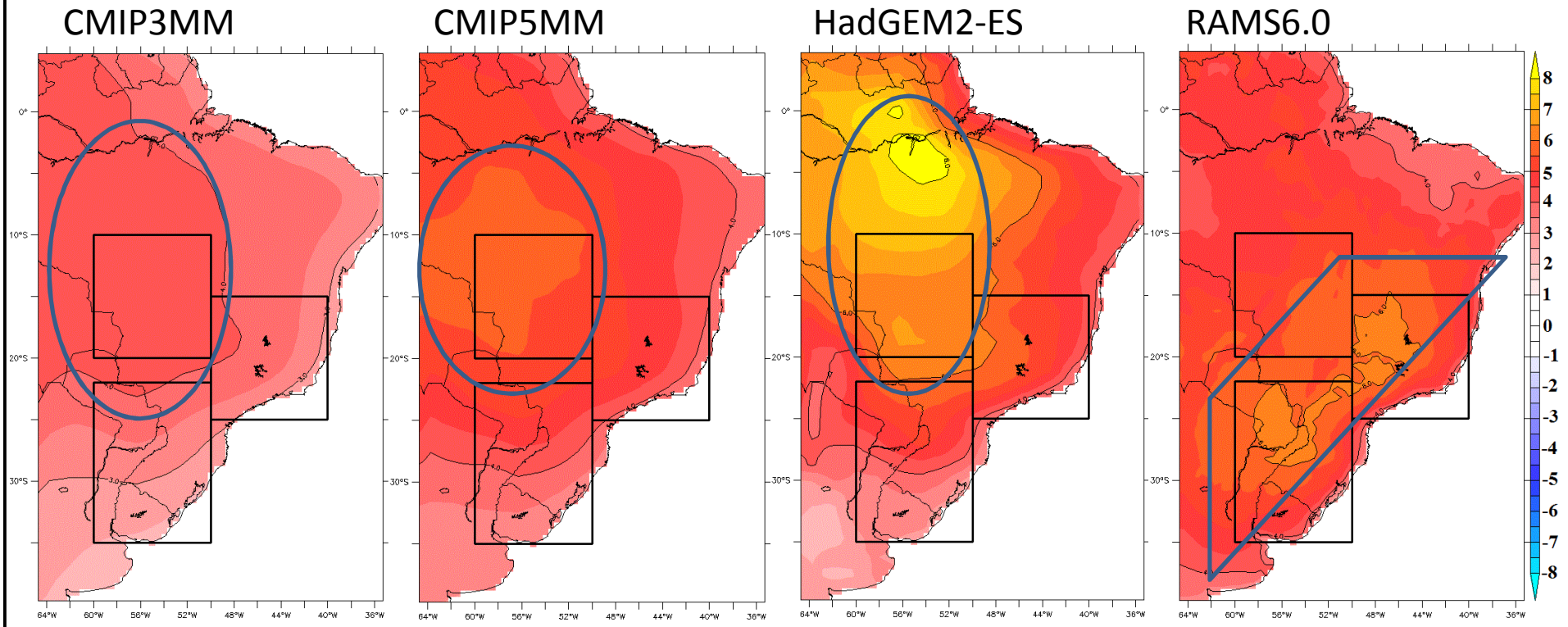
HadGEM2-ES



RAMS6.0



Temperature Annual Map - future:



Final Remarks:

> Only small changes were shown in Precipitation and Temperature representation from CMIP3 to CMIP5 ensemble.

> There is typically no consensus among the models regarding precipitation projections along the 21st century.

> Dynamical downscaling may add value to the GCM simulations regarding specific variables, regions and/or seasons.

> Sometimes the most robust signal among GCM and RCM simulations may be found in seasonal changes, as SON precipitation reduction in parts of the Amazon.

Thank you:

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