El enfoque de Argentina para la generación de escenarios de cambio climático

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A subset of climate simulations of the 20th century from the IPCC-AR4 was analyzed in the paper to assess the ability of these models to reproduce the observed climatological seasonal precipitation in South America during the period 1970-1999.
Climatological seasonal mean precipitation (1970-1999)
Results show that models are able to reproduce the main features of the precipitation seasonal cycle over South America, although the precipitation in the SACZ region and the precipitation maximum over southeastern South America observed during the cold season are not well represented.
Differences of simulated seasonal mean precipitations between 2070-2099 and 1970-1999 periods, standardized by the corresponding seasonal mean precipitation for present climate.
In addition, changes of such climatology in a climate change scenario (SRESA1b) over the period 2070-2099 are also discussed.
Number of models depicting (1\textsuperscript{st} row) positive changes and (2\textsuperscript{nd} row) negative changes between 2070-2099 and 1970-1999 periods. Contour level is 1, values larger than 4 are shaded.

Vera et al. (GRL, 2006)
There is a generalized consensus among models that the precipitation changes projected are mainly: i) an increase of summer precipitation over southeastern subtropical South America; ii) a reduction of winter precipitation over most of the continent; and iii) reduction of precipitation during the four seasons along the southern Andes.
“Precipitation Variability in South America from IPCC-AR4 Models, Part II: Influence of SH Circulation Leading Patterns” by, C. Vera, G. Silvestri, B. Liebmann, P. Gonzalez was published in the Pre-Prints of the 8th International Conference on Southern Hemisphere Meteorology and Oceanography, held in Foz do Iguacu, Brazil, 24-28 April 2006.
The analysis of the interannual variability of the seasonal precipitation over South America, depicted by the IPCC-AR4 simulations of the 20th century, show models in general have serious deficiencies in reproducing the location and intensity of the maximum variability in regions like those over the ITCZ, the SACZ and the southeastern South America.
Correlation between the 3 leading EOFs of 500-hPa height variability in the SH and the precipitation anomalies in South America
Regarding the observed relationship between ENSO and SAM and precipitation anomalies in South America, it was found while some models are able to reproduce in some extent, the ENSO signal, most of the models are not able to reproduce the SAM influence on precipitation interannual variability.
Escenarios de cambio de temperatura anual (°C) para las décadas 2020/29 respecto de 1961-90 para el escenario A2. Ensamble de 9 MCGs - IPCC AR4.

Inés Camilloni
Escenarios de cambio de precipitación estacional (%) para las décadas 2020/29 respecto de 1961-90 para el escenario A2. Ensamble de 14 MCGs.
Escenarios de cambio de precipitación estacional (%) para las décadas 2020/29 respecto de 1961-90 para el escenario A2. Ensamble de 14 MCGs.
“Comparisons Between Observed And Modeled Precipitation And Temperature Extremes In South America During The XX Century (Ipcc 20c3m). Part I: Mean, Variability and MSE”.

Matilde Rusticucci (UBA),
José Marengo (CPTEC), Olga Penalba (UBA), Madeleine Renom (UR)
## Extreme Indices Data Availability

(as of 31 March 2005)

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A shaded box indicates that at least some, but not necessarily all, fields of this type are available.
Extreme indices were derived from IPCC models (IPCC web site) and from observations in South America [based on Frich et al. 2002, Vincent et al. 2005, Haylock et al. 2005]

### Table A4: Extremes indices (longitude, latitude, time:year) from Frich et al. (their Table 1).

<table>
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<th>output variable name</th>
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<th>notes</th>
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<tr>
<td>1 fd</td>
<td>days</td>
<td>Total number of frost days (days with absolute minimum temperature &lt; 0 deg C)</td>
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<tr>
<td>2 etr</td>
<td>K</td>
<td>Intra-annual extreme temperature range: difference between the highest temperature of any given calendar year (T_h) and the lowest temperature of the same calendar year (T_l)</td>
</tr>
<tr>
<td>3 gsl</td>
<td>days</td>
<td>Growing season length: period between when ( T_{day} &gt; 5 ) deg C for &gt; 5 d and ( T_{day} &lt; 5 ) deg C for &gt; 5 d</td>
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<tr>
<td>4 hwdi</td>
<td>days</td>
<td>Heat wave duration index: maximum period &gt; 5 consecutive days with ( T_{max} &gt; 5 ) deg C above the 1961-1990 daily ( T_{max} ) normal</td>
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<tr>
<td>5 m90</td>
<td>%</td>
<td>Fraction (expressed as a percentage) of time ( T_{min} &gt; 90)th percentile of daily minimum temperature, where percentiles are for the 1961-1990 base period.</td>
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<tr>
<td>6 tr10</td>
<td>days</td>
<td>No. of days with precipitation greater than or equal to 10 mm d(^{-1})</td>
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<tr>
<td>7 cdd</td>
<td>days</td>
<td>Maximum number of consecutive dry days (( R_{day} &lt; 1 ) mm)</td>
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<tr>
<td>8 r5d</td>
<td>kg m(^{-2})</td>
<td>Maximum 5 d precipitation total</td>
</tr>
<tr>
<td>9 sdii</td>
<td>kg m(^{-2})s(^{-1})</td>
<td>Simple daily intensity index: annual total / number of ( R_{day} ) greater than or equal to 1 mm d(^{-1})</td>
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<tr>
<td>10 r95t</td>
<td>%</td>
<td>Fraction (expressed as a percentage) of annual total precipitation due to events exceeding the 1961-1990 95th percentile</td>
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</table>
Objective:
how IPCC global models simulate climate extreme indices over South America.

we compare simulated indices with station data indices, for 1961-2000

- Mean
- Standard Deviation and
- Mean Square Error:
  - diff between the nearest station to the grid point.
Warm Nights (TN90) StD.

GFDL 2.0

CCSM3

GFDL 2.1

MIROC3.2 hires

18 14 10 6 2
Warm nights (Tn90) MSE

GFDL 2.0

GFDL 2.1

CCSM3

MIROC3.2 hires
Consecutive Dry Days (CDD) Mean

GFDL 2.0

GFDL 2.1

CCSM3

MIROC3.2 hires
Consecutive Dry Days (CDD) StD

GFDL 2.0

CCSM3

GFDL 2.1

MIROC3.2 hires

Consecutive Dry Days (CDD) StD

53 40 28 15 2
Max. 5 Days precipitation (R5d) Mean

GFDL 2.0

GFDL 2.1

CCSM3

MIROC3.2 hires
Max. 5Days Precipitation (R5d) MSE

- GFDL 2.0
- GFDL 2.1
- CCSM3
- MIROC3.2hires
Heavy Precipitation Days (R10) Mean

GFDL 2.0

GFDL 2.1

CCSM3

MIROC3.2hires
Heavy Precipitation Days (R10) MSE

GFDL 2.0

GFDL 2.1

CCSM3

MIROC3.2 hires

Heavy Precipitation Days (R10) MSE

GFDL 2.0

GFDL 2.1

CCSM3

MIROC3.2 hires
Figure: The observed R10 (annual number of days with precipitation over 10 mm) mean for the 1961-2000 period, the ensemble for the IPCCAR4 models, and the difference (observed minus ensemble) between both values, in percentage over the observed. Green (violet-blue) values mean models underestimation (overestimation).
Algunas iniciativas downscaling

Estadística

- Por medio de la visita a la “Fundación para la Investigación del Clima” se comenzó con un método estadístico de dos pasos para estimar temperatura y precipitación a mayor resolución en la cuenca del Plata a partir de los ERA 40 reanalysis.

- Bettolli y Penalba
Mean climate and annual cycle in a regional climate change experiment over Southern South America.
Cambios proyectados para la Temperatura Media. Década 2081 - 2090

Fuente: Nuñez, Solman, Cabré y Rolla (2005)
Cambios proyectados para la lluvia Media Anual. Década 2081 - 2090

Fuente: Nuñez, Solman, Cabrè y Rolla (2005)
CLARIS
A Europe-South America Network for Climate Change Assessment and Impact Studies

A project within the EC 6th Framework Programme

1 July 2004 to 30 June 2007

http://www.claris-eu.org
Analysed variables: daily and monthly averages of
- rainfall
- 2-m temperature
- maximum temperature
- minimum temperature
- diurnal temperature range

Models: RCA3, PROMES, LMDZ, REMO

Results of the "short" simulations of extreme months driven by ERA40
CRU T2m and rainfall: Jan. 1971 minus 1960-2000

SIMULATION #1

COLD ANOMALY

WET ANOMALY
Rainfall for ensemble average and for individual models (25 Dec 70 – 25 Jan 71)
AREAL MEAN DAILY RAINFALL OVER NORTH-EASTERN ARGENTINA (SIMULATION #1)


+ENSEMBLE
LMDZ
PROMES
RCA3
REMO
AREAL MEAN DAILY RAINFALL OVER CENTRAL-EASTERN ARGENTINA (SIMULATION #1)


+ENSEMBLE
LMDZ
PROMES
RCA3
REMO

DEC.1970  JAN.1971
Frequency distribution of precipitation

Methodology: The four ensemble members are combined by counting, for each grid point and each model, the total number of days within each interval. Then, we evaluate the mean frequency for the considered region during the analyzed period (NE Argentina, 25/12/70 –25/01/71).
Frequency distribution of precipitation for ensemble average and for individual models (25 Dec 70 – 25 Jan 71)

Region: NE Argentina
Frequency distribution of precipitation for ensemble average and for individual models (25 Dec 70 – 25 Jan 71)

WET ANOMALY
Rainfall for ensemble average and for individual models (November 1986)
Frequency distribution of precipitation for ensemble average and for individual models (November 1986)

Region: NE Argentina
Frequency distribution of precipitation for ensemble average and for individual models (November 1986)

Region: CE Argentina
CRU T2m and rainfall: Jul. 1996 minus 1960-2000
Rainfall for ensemble average and for individual models (July 1996)
AREAL MEAN DAILY RAINFALL OVER CENTRAL-EASTERN ARGENTINA (SIMULATION #3)


- ENSEMBLE
  - LMDZ
  - PROMES
  - RCA3
  - REMO

8 mm/d
Accumulated total precipitation for 5 different July 1996 RCA simulations with varying spin-up period

Initialization dates left to right:
0521
0526
0531
0605
0610