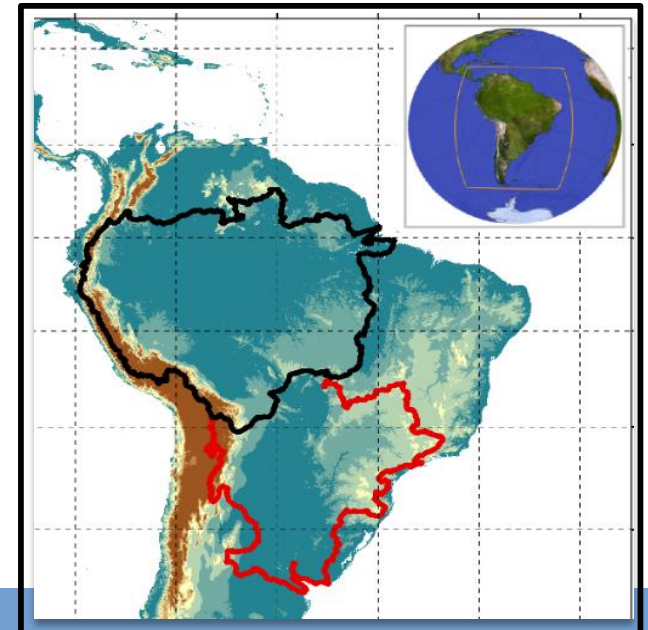


Hydroclimatological variables in the South America CORDEX domain for La Plata Basin

Vanesa Pántano - Alejandro Builes-Jaramillo

Results from the bi-national project:

*“Performance evaluation for the representation
of surface water availability of regional models in
the SAM-CORDEX domain for the Amazon and
Del Plata river basins”*

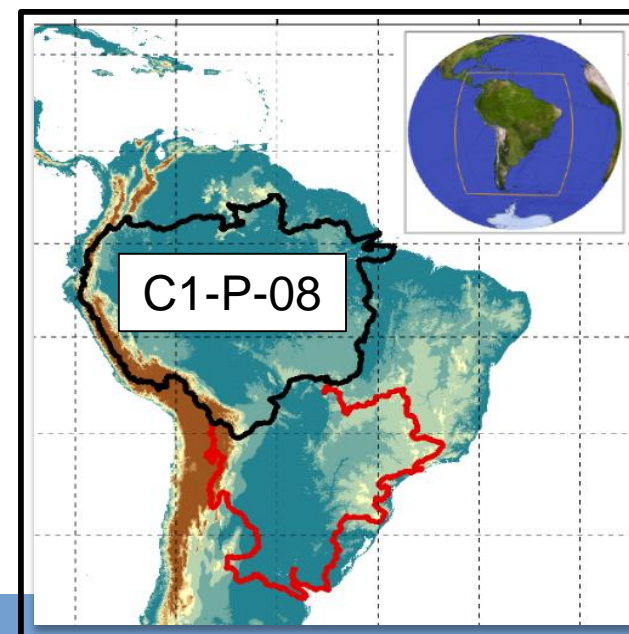


Hydroclimatological variables in the South America CORDEX domain for La Plata Basin

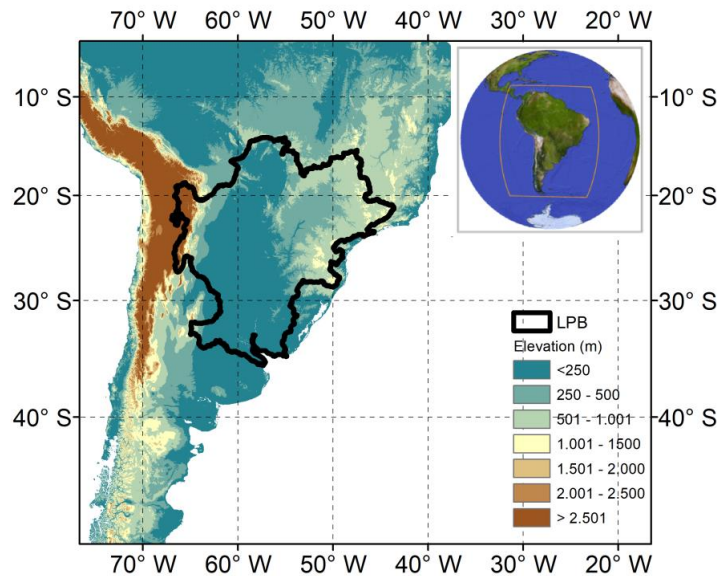
Vanesa Pántano - Alejandro Builes-Jaramillo

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Outline



Motivation:

- La Plata Basin represents the second largest hydrological basin in the world after Amazon basin
- Most of agro-industries of Argentina, Brasil and Uruguay are located, accounting for half of the GDP of the three countries.

Objective:

- 1) to study the ***representation of precipitation and evapotranspiration*** of the Regional Climate Model RCA4 v3 for South America domain ***in CORDEX in La Plata Basin.***
- 2) to analyze ***future projections.***

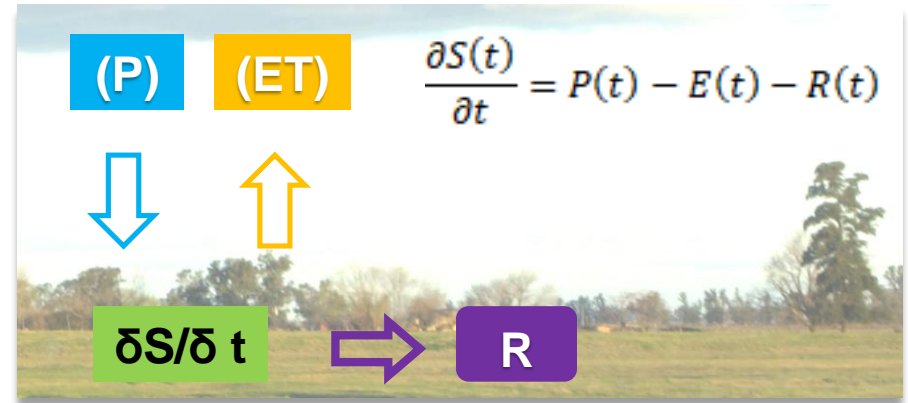
Monthly precipitation **(P)** and evapotranspiration **(ET)**

- **RCM RCA4 v3- CORDEX** driven by 9 Global Climate Models (CanESM2, CSIRO, ICHEC, IPSL, MIROC, HadGEM2, MPI, NorESM1, ESM2M)
 - *Historical* experiment, period 1986–2005
 - RCP8.5 emission scenarios, period 2065-2100
- Compared with **GPCC (P)** and **GLEAM (ET)**

Global Precipitation Climatology Centre Full Data Reanalysis v7 (Schneider et al., 2014)
Global Evaporation Amsterdam Model (Martens et al., 2017)

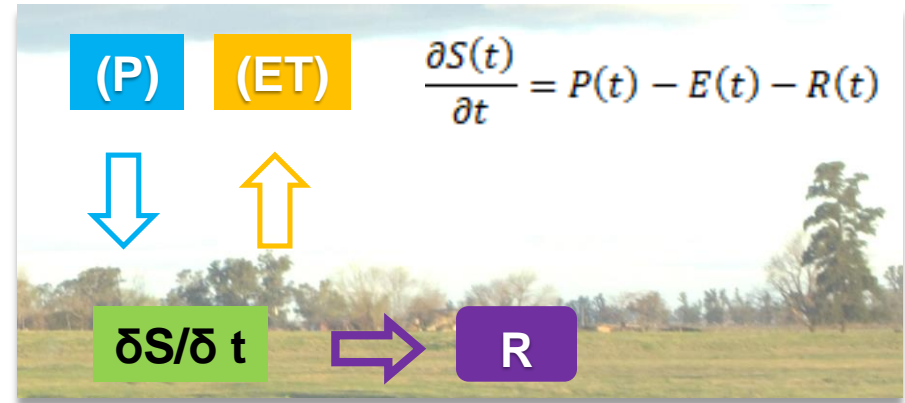
Surface water availability

The surface water or runoff produced by a river basin can be represented as the mass conservation over a control volume



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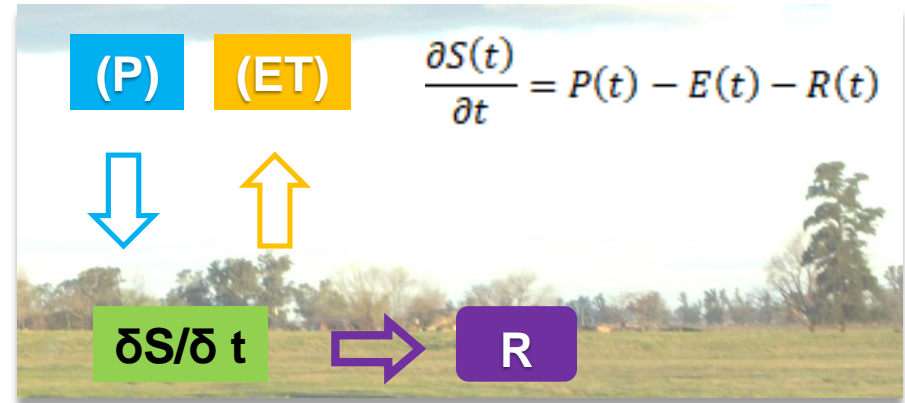


$$R = P - E$$

Indicator of the hydrological cycle, representing runoff of the basin.

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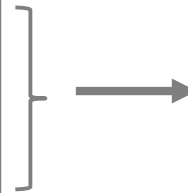


$$R = P - E$$

Indicator of the hydrological cycle, representing runoff of the basin.

1°) Representation of P and E:

- mean fields and standard deviation
- annual cycle
- temporal variability

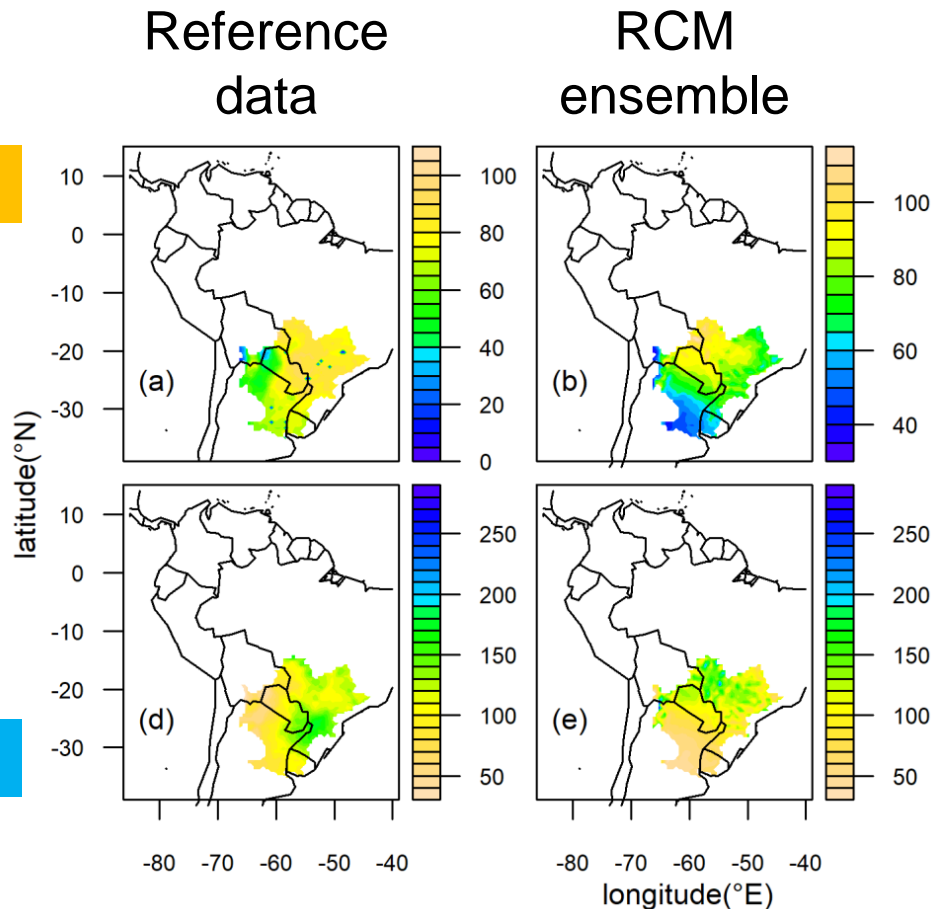


2°) Future projections:

- need of bias correction

Builes-Jaramillo & Pántano, in prep.

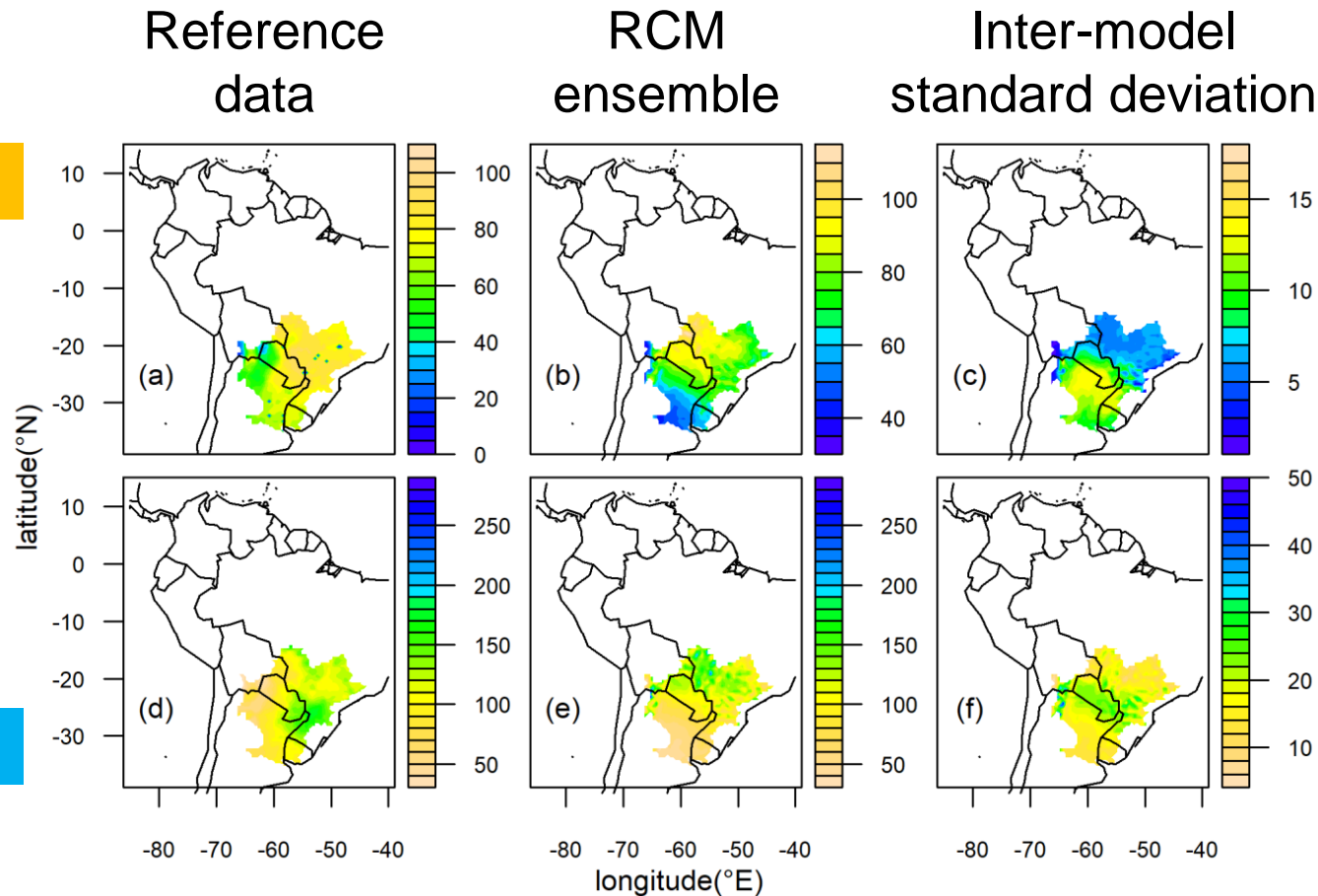
Results: mean fields



Overestimation over the Bolivian highlands and in northern Paraguay
Underestimation to the south

Overestimation to the north
Underestimation in the centre

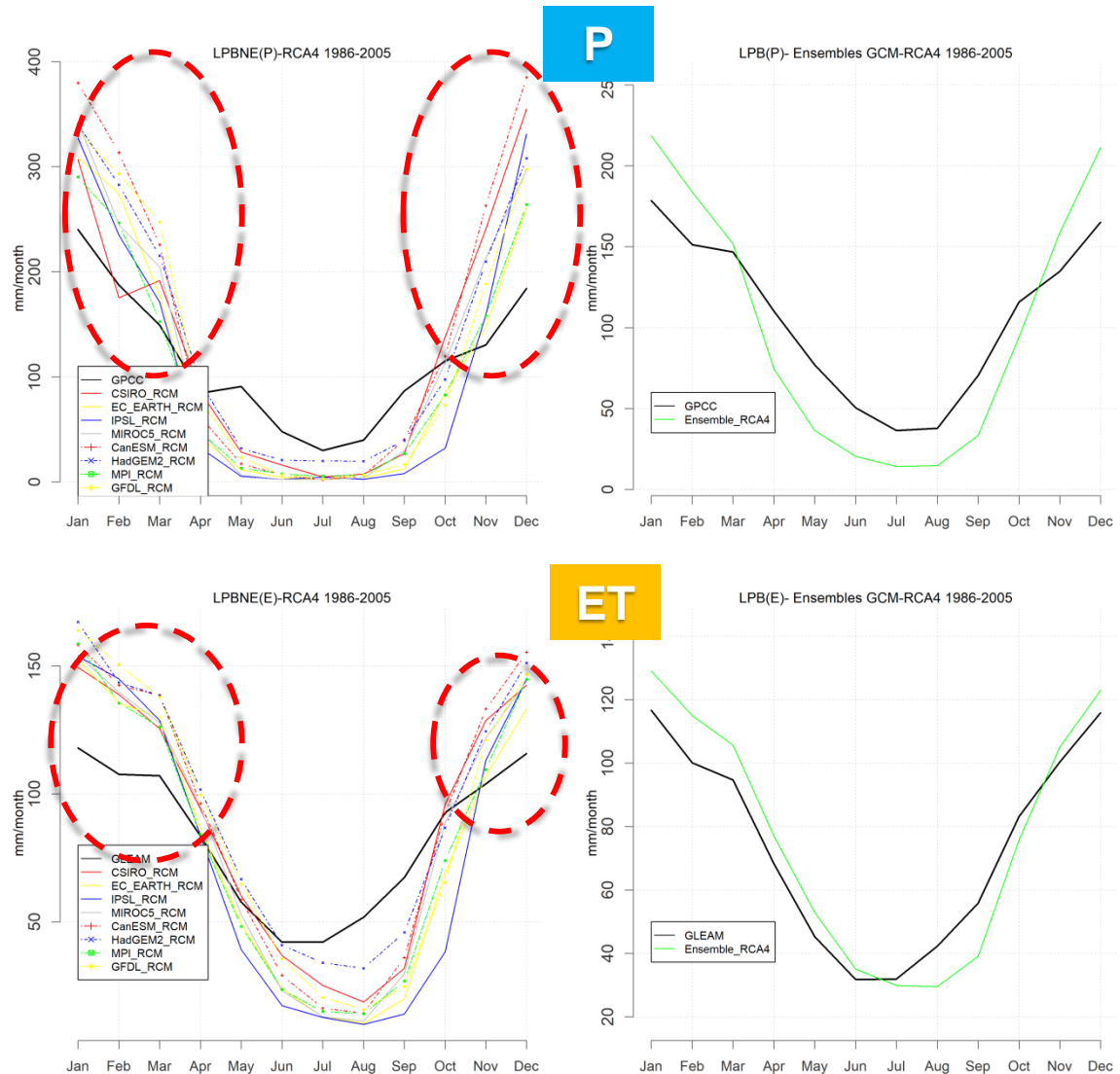
Results: mean fields



Results: annual cycle

The **general features** of the cycle are **well captured**.

Overestimation:
austral summer and autumn

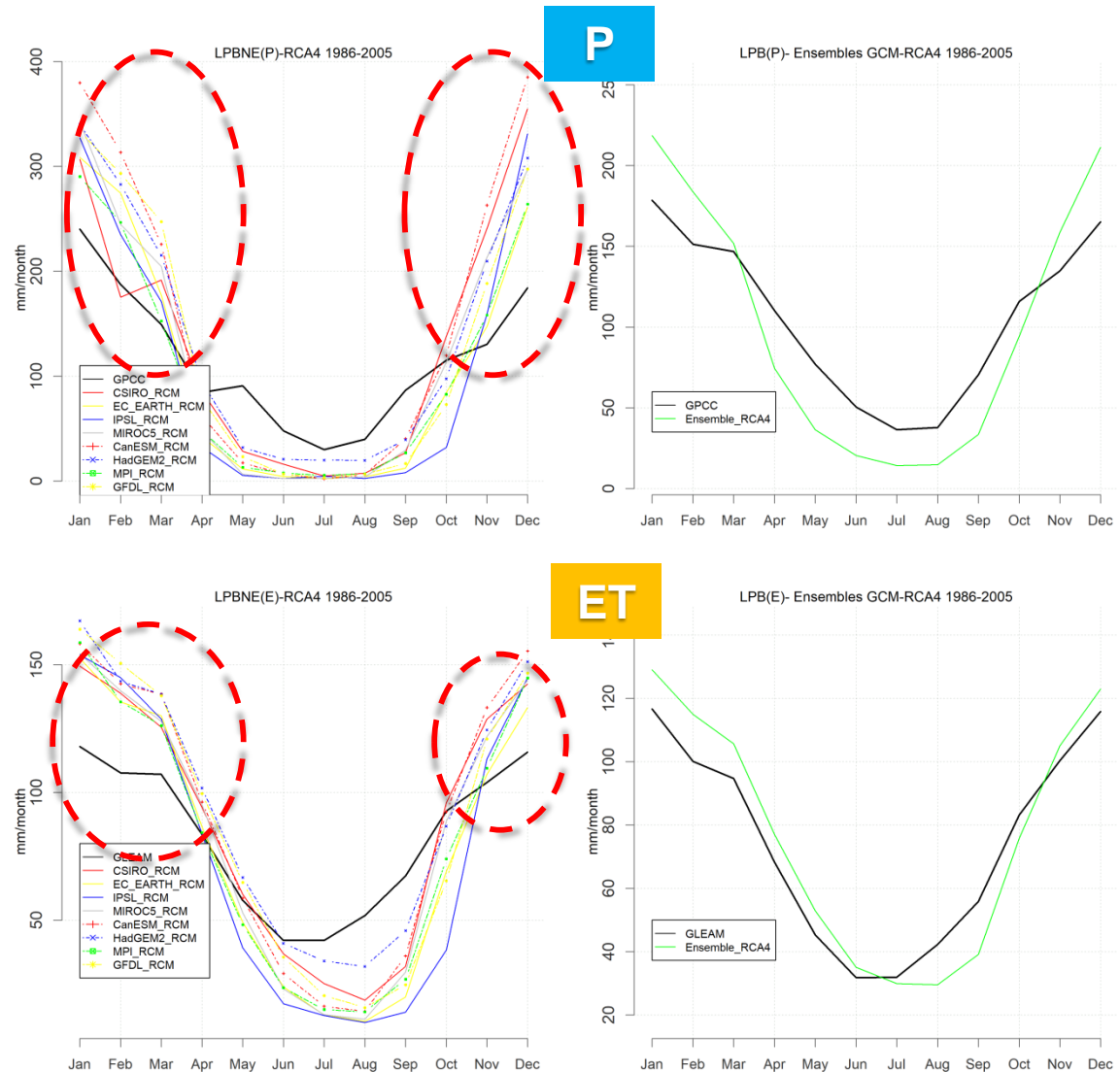


Results: annual cycle

The **general features** of the cycle are **well captured**.

Overestimation:
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P-E implies attenuation or reinforce of the hydrological limitation of summer crops due to high values of E during flowering–fructification stages.

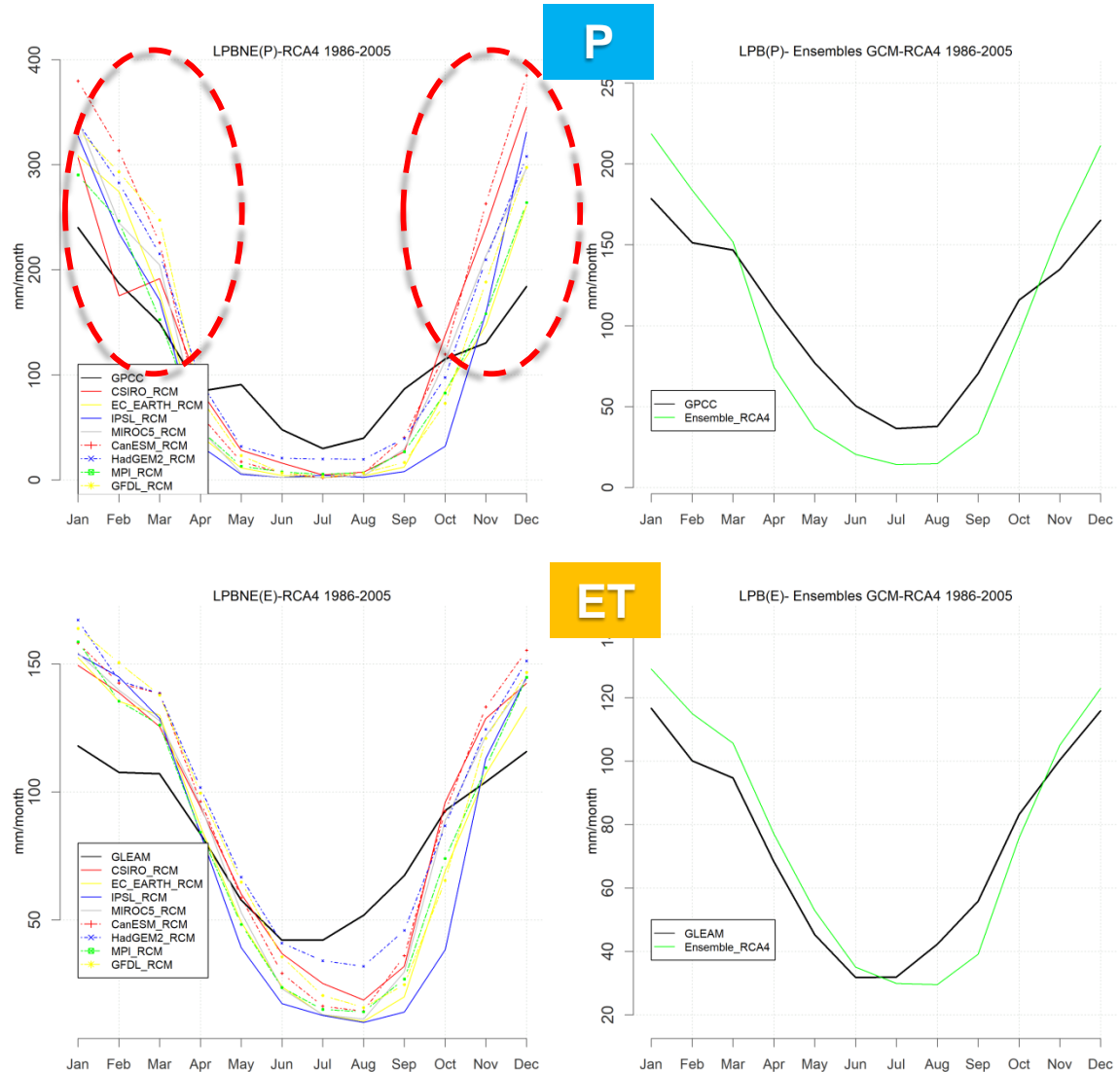


Results: annual cycle

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Overestimation:
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This implies underestimation of soil water recharge for winter crops during autumn months

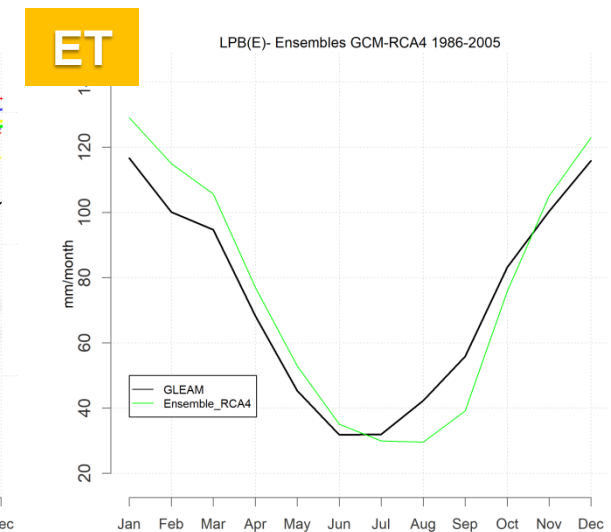
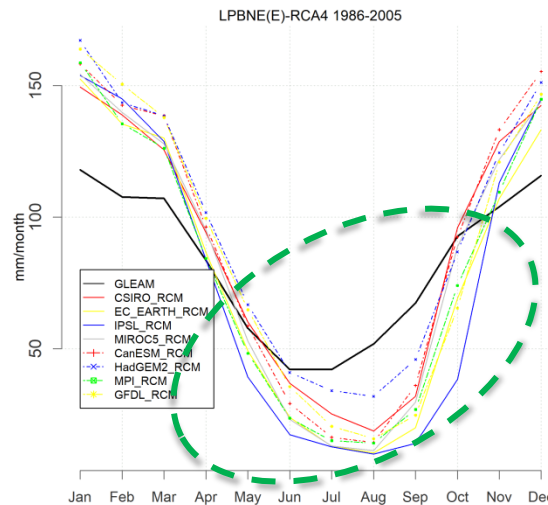
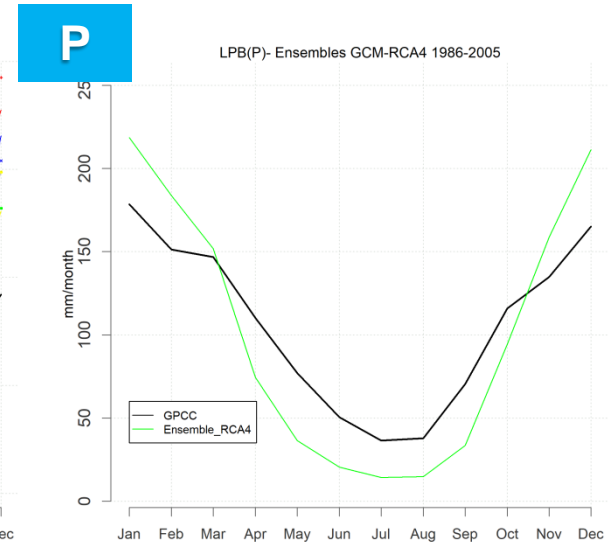
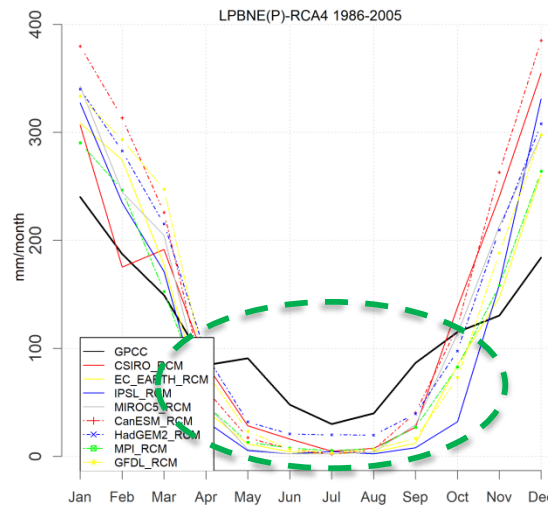


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Underestimation:
austral winter and spring



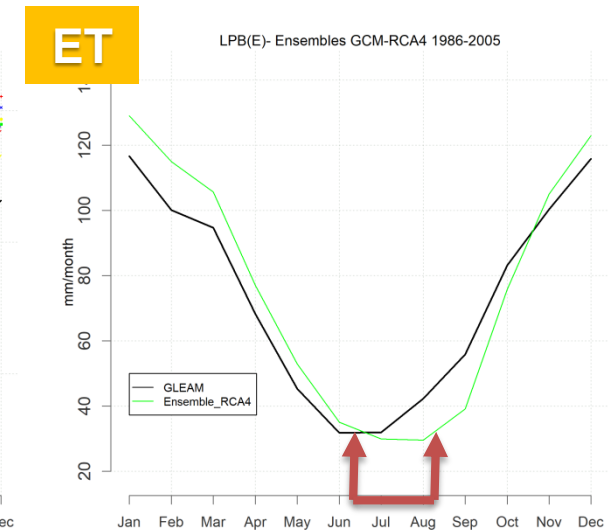
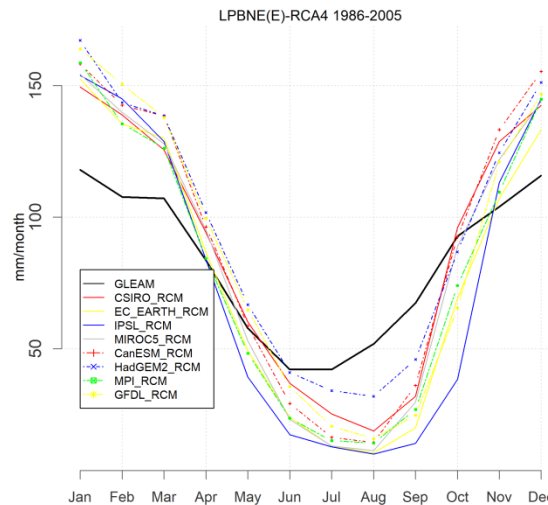
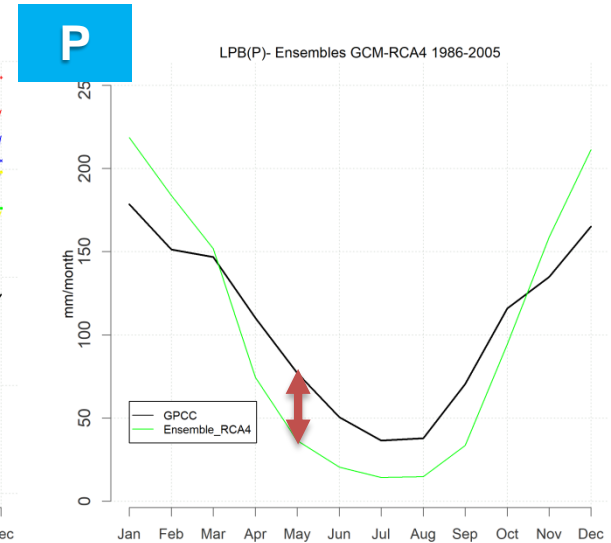
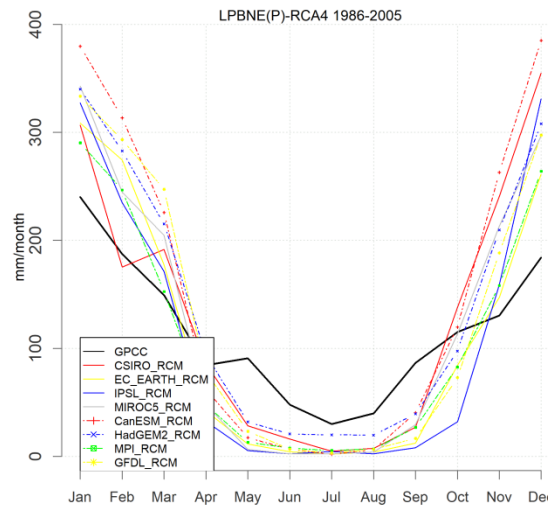
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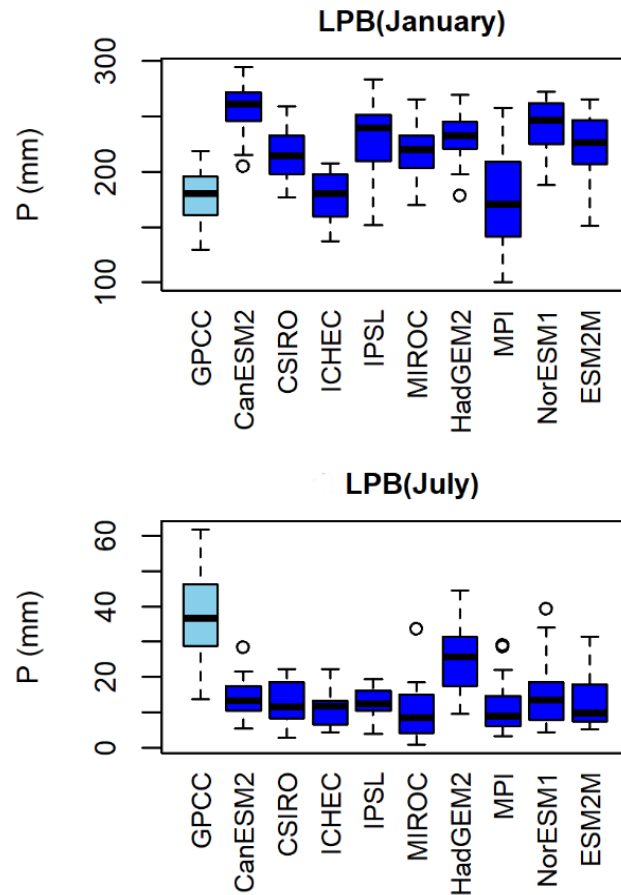
RCM ensembles present monthly values closer to the reference values due to compensation of positive and negative biases of individual models.



Results: temporal variability

P

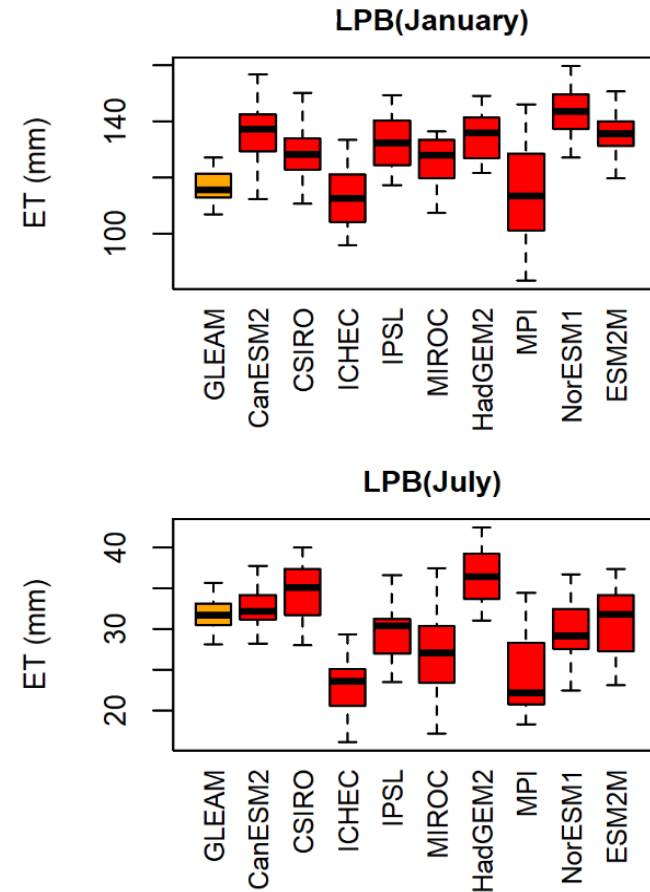
Overestimation during January
and underestimation during July



The inter-member spread is smaller during July

ET from GLEAM lies within the inter-member spread

ET



Results: future projections

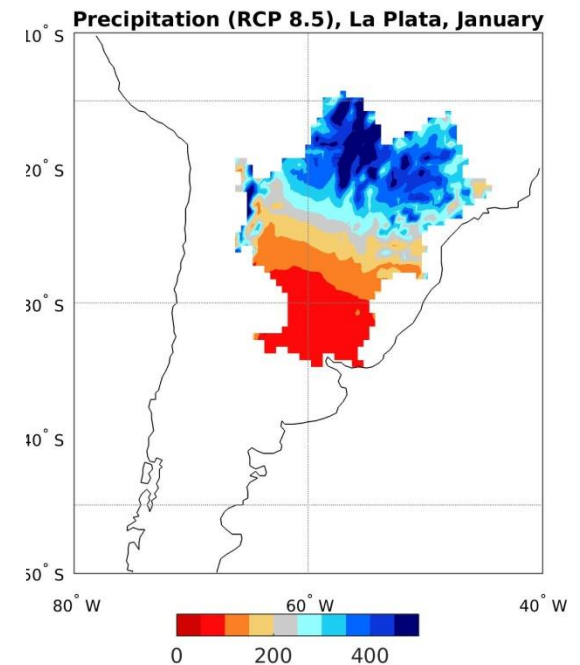
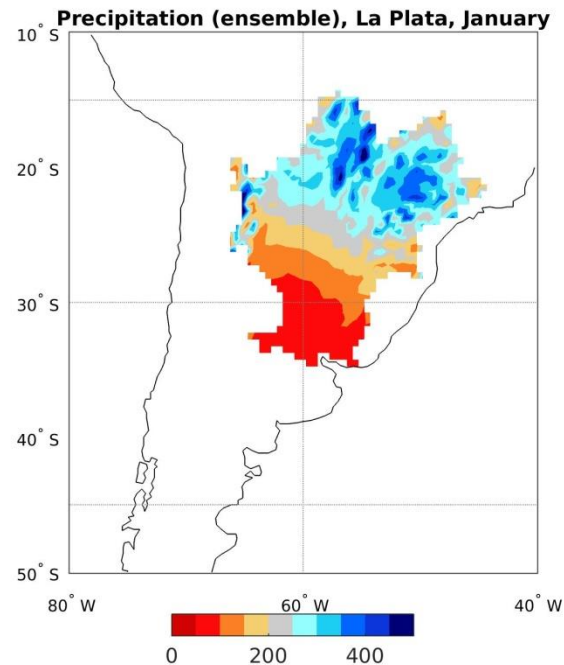
P

January

Increase in the northern part
Northern displacement of low values in the southern part

Historical

RCP 8.5



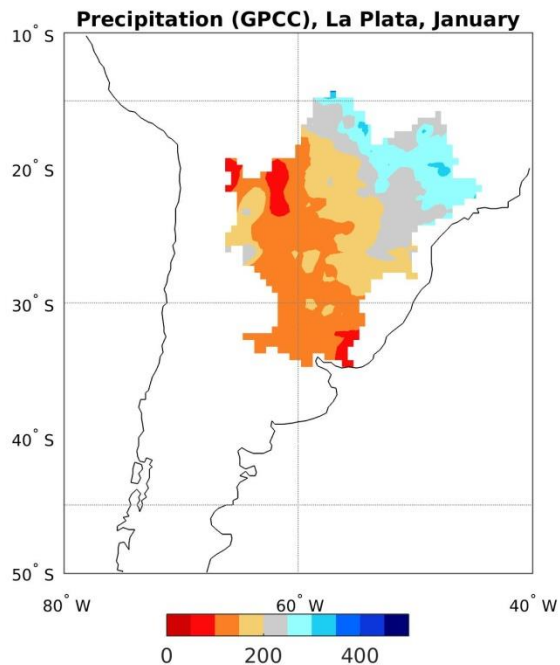
Results: future projections

P

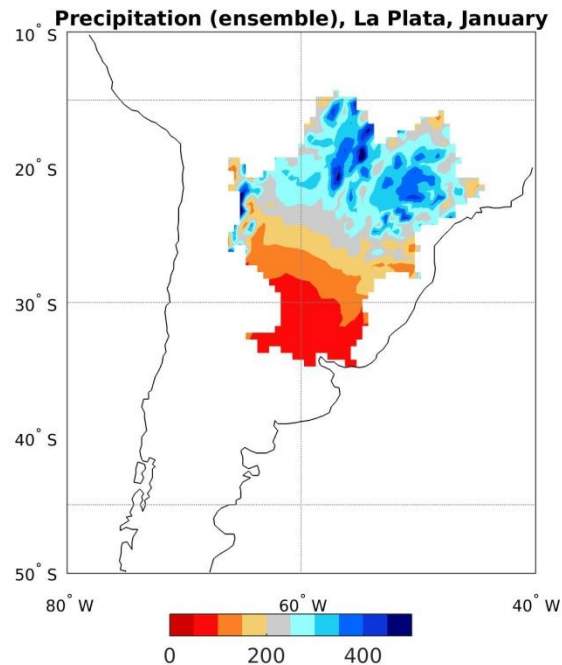
January

need of bias correction

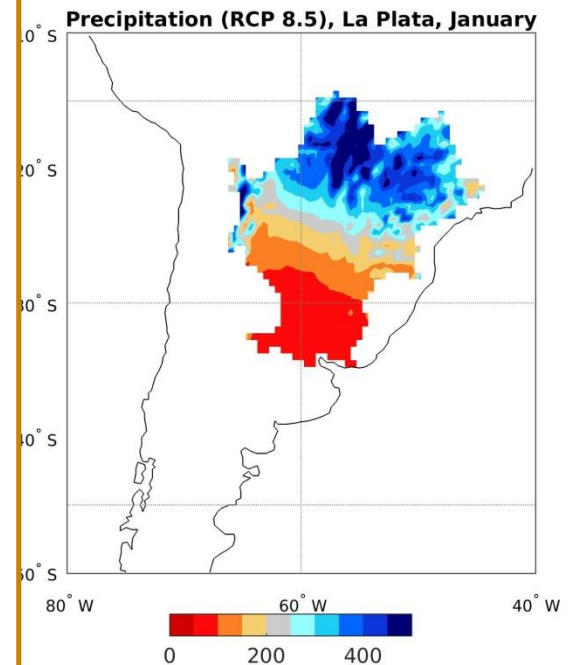
GPCC



Historical



RCP 8.5



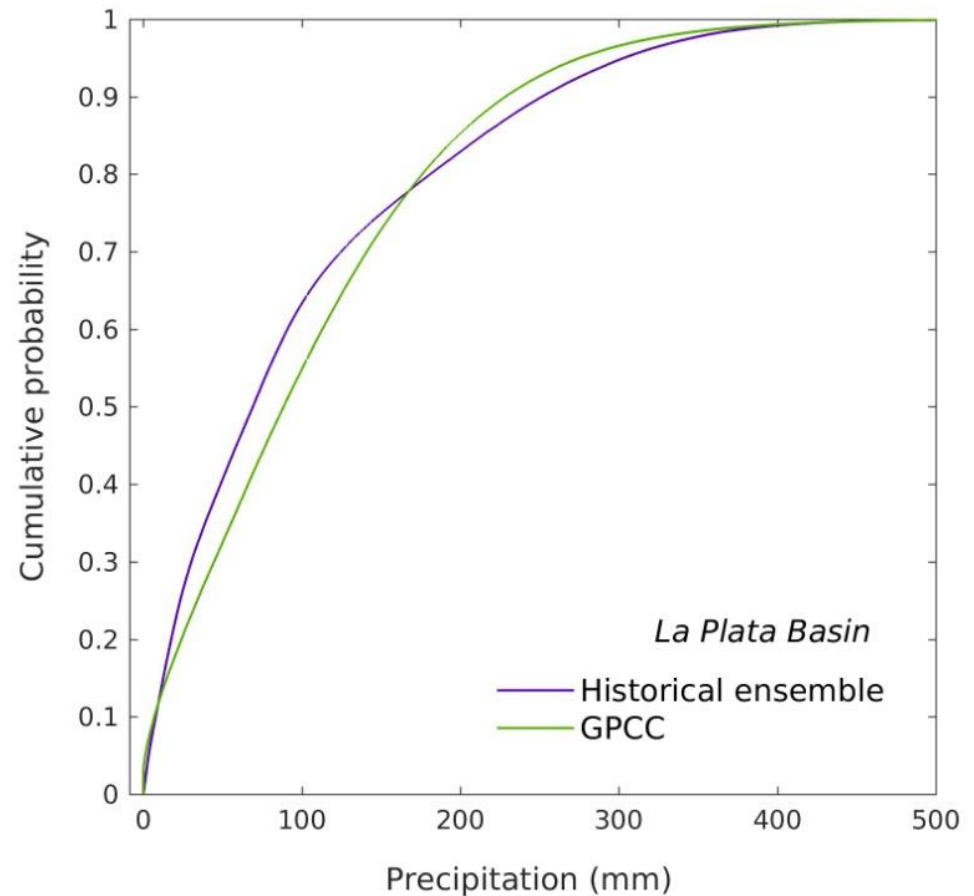
Results: bias correction

Systematic errors in P and E were corrected through **quantile-based bias correction** (Wood et al., 2002).

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1°) Fitting the empirical frequency distribution of observations and the RCMs' ensemble, for each grid and month.



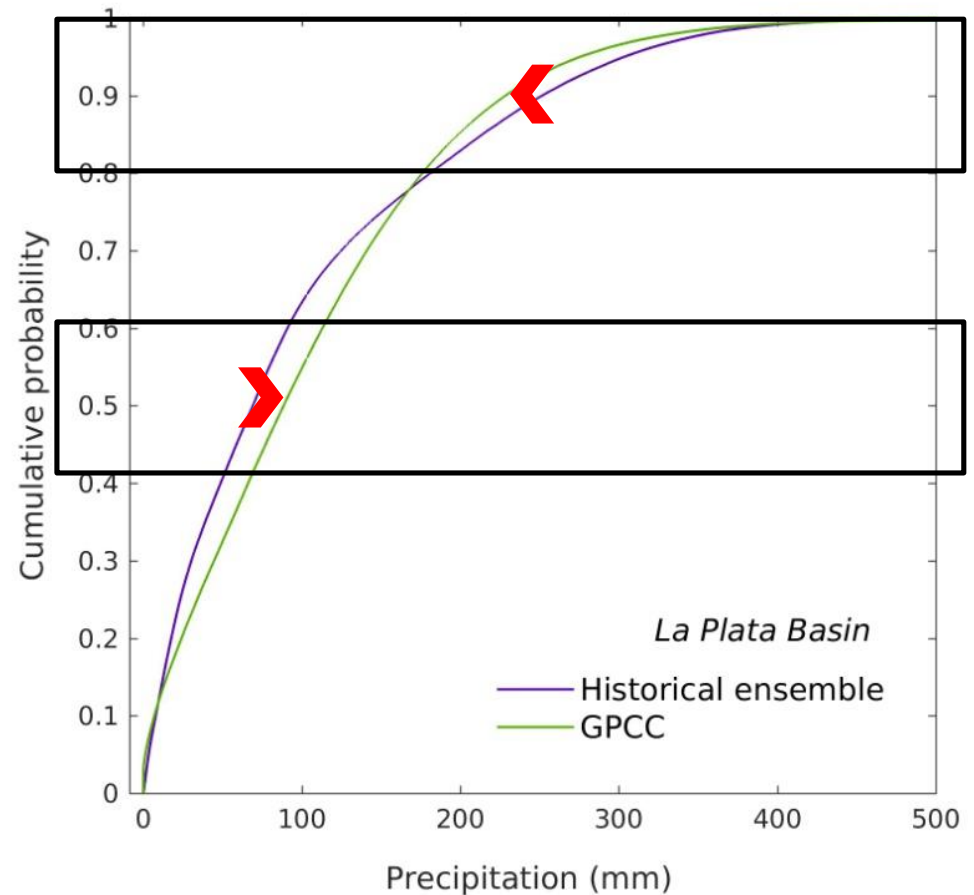
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2°) Factor of correction for each range of percentiles

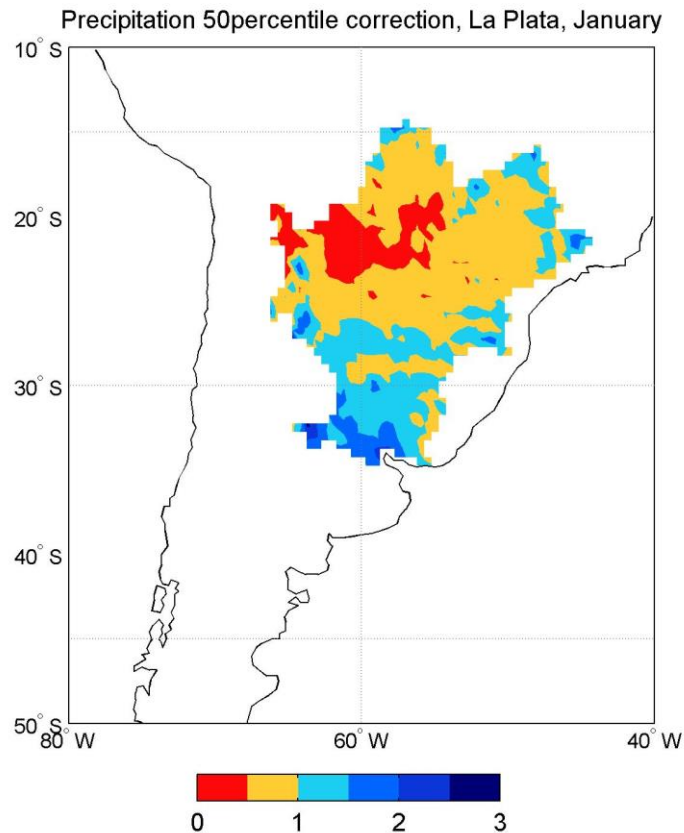
$$\frac{\text{Percentile (P}_{\text{GPCC}})}{\text{Percentile (P}_{\text{historical}})}$$



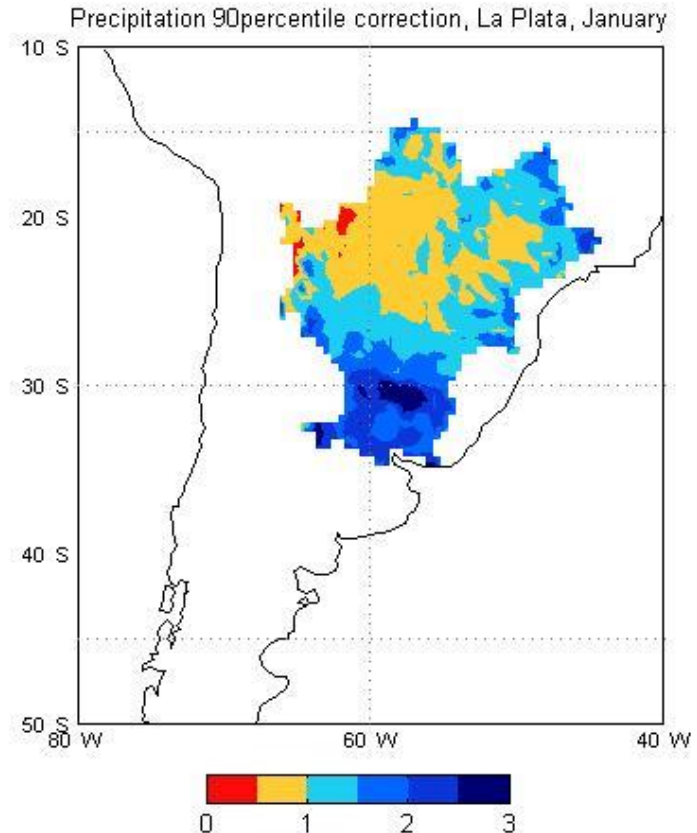
Results: bias correction

Factors of correction:

Percentile 50th



Percentile 90th



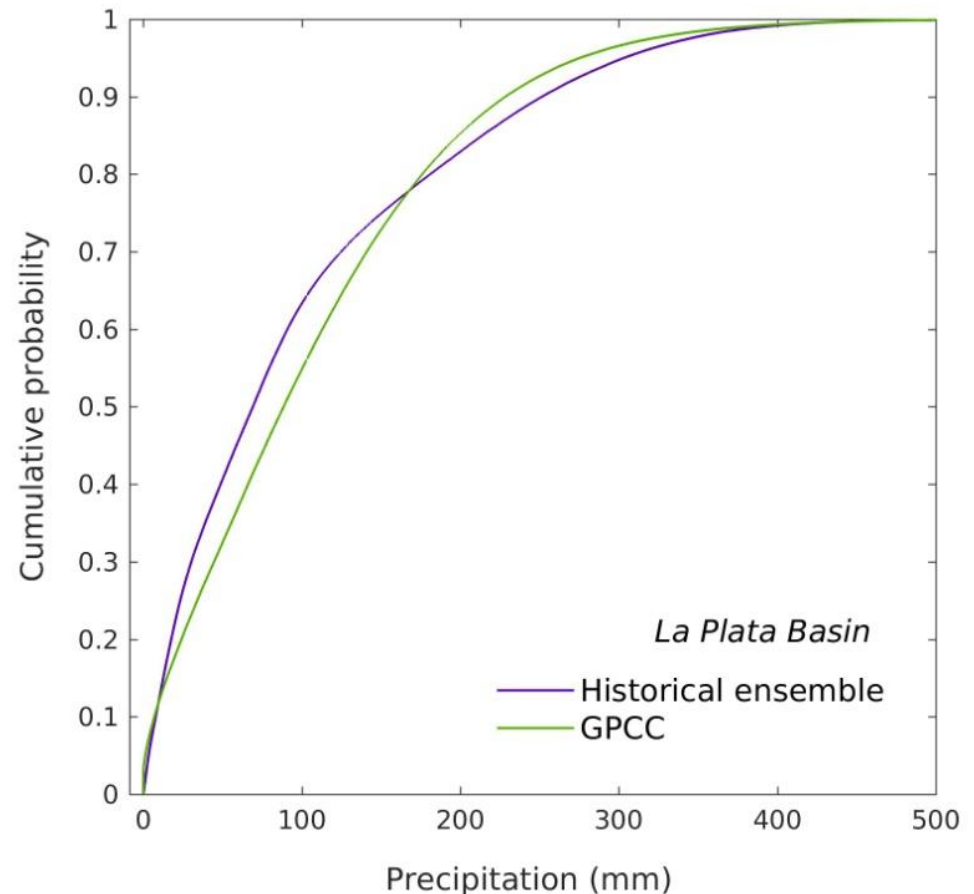
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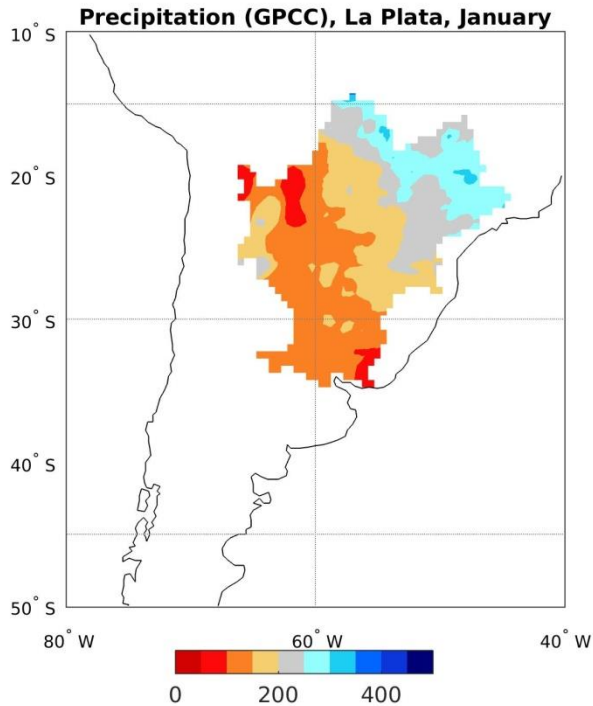
2°) Factor of correction for each range of percentiles

3°) Future projections are multiplied by the factor of correction, according to their range of percentile.

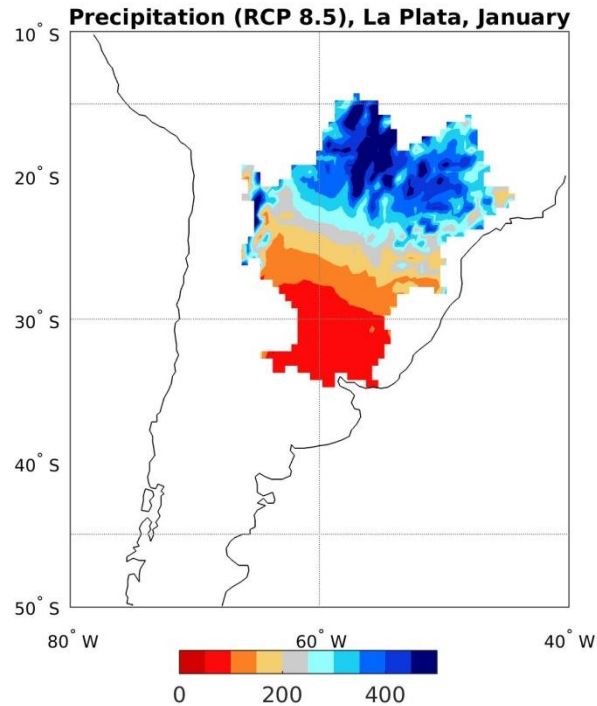


Results: future projections corrected

GPCC

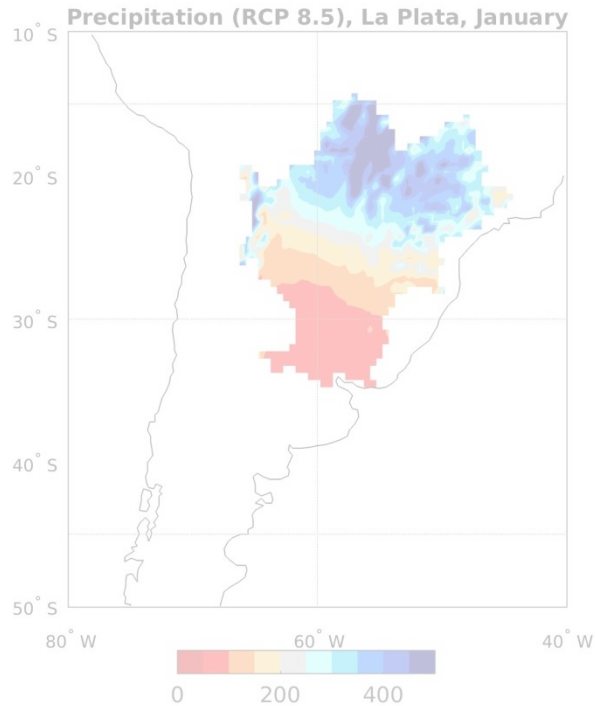
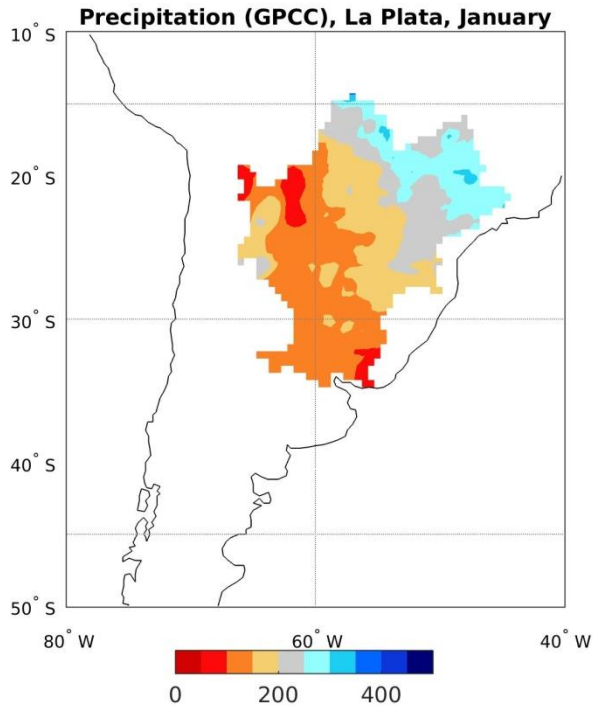


RCP 8.5

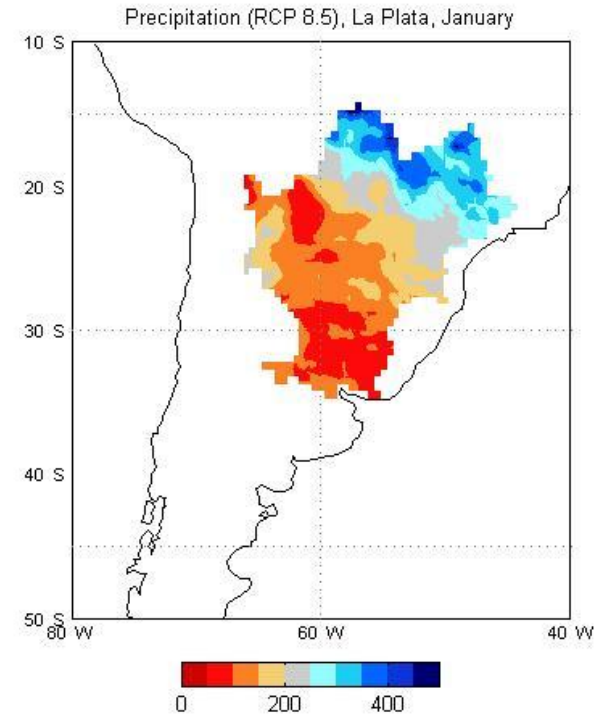


Results: future projections corrected

GPCC



RCP 8.5, corrected



Changes in the outline of:

Increased precipitation in the northern region

reduced precipitation in the southern region

Change in patterns of change in western region (from increasing to reducing)

Concluding remarks

RCA4 v3 is able to capture annual cycle and the main features of P and ET spatial distribution.

The ensemble presents monthly values closer to the reference values (GLEAM and GPCC) due to compensation of positive and negative biases of individual models.

However, because of the bias, we suggest the application of a bias correction methodology to adequately evaluate future responses.



Improvement in projected P-E analysis, contributing to adaptation strategies in agriculture production at regional scale.

Thank you for your attention!

Questions?