

Evolution of annual precipitation Past and future climate - Reunion Island

To evaluate the evolution of precipitation in Reunion Island in future climate, a set of simulations from global models (low spatial resolution) and simulations from the regional Aladin-Climat model with good spatial resolution are available.

However, the global models that can be used have a resolution that is too low to represent Reunion Island and its mountains. So, simulated rainfall amounts are not necessarily representative of those observed in Reunion Island.

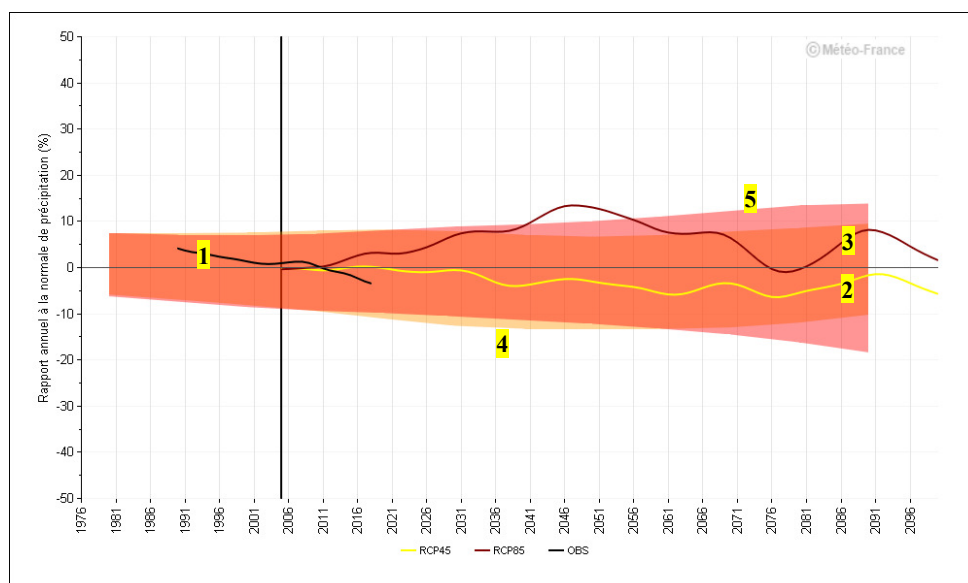
The regional Aladin-Climat model (Météo-France) allows to downscale to the island, but it does not allow to evaluate uncertainty on the basis of distribution products, which would require a set of regional models.

An aggregate precipitation indicator for the territory of Reunion Island in future climate was developed from Aladin-Climat simulations. The data series of this precipitation indicator for future climate was obtained by averaging 13 data series extracted to the closest grid points (from the Aladin-Climat Reunion grid) to the 13 stations distributed on Reunion Island. A quantile-quantile correction method has been applied on this precipitation indicator data series with the historical mean series of the 13 observations stations.

Contrary to the evolution of temperatures, the evolution of precipitation with this regional model alone is highly uncertain because:

- the high year-to-year variability may hide regional and seasonal contrasts.
- for the evolution of precipitation, the uncertainty due to physical modelling - and therefore the choice of the regional climate model - is more important than the choice of the RCP scenario (2.6, 4.5 or 8.5).
- some decades, sometimes wet, sometimes dry, well simulated by the model can disrupt trends depending on the period in which they are placed.

The graph below (Aladin-Climat regional simulations for RCP4.5 and RCP8.5 scenarios in Reunion Island and plume of the "Reunion" grid point of the global models) highlights these 3 points leading to a high uncertainty.



5 data series are represented on the graph:

Série 1 'black curve':

Ratio deviation between the annual observed rainfall amount and the reference average of annual rainfall amount (over the 1976-2005 period) simulated by the regional Aladin-Climat model (Météo-France), averaged over the last 30 years.

Série 2 'yellow curve':

Ratio deviation between the annual rainfall amount simulated by the regional Aladin-Climat model (Météo-France) for the RCP 4.5 scenario over the 1976-2100 period and the reference average of simulated annual rainfall amount (over the 1976-2005 period).

Série 3 'brown curve':

Ratio deviation between the annual rainfall amount simulated by the regional Aladin-Climat model (Météo-France) for the RCP 8.5 scenario over the 1976-2100 period and the reference average of simulated annual rainfall amount (over the 1976-2005 period).

Série 4 'yellow band':

Represents the most likely plume of the ratio deviation between the annual rainfall amount simulated by the different global models (from the CMIP5 multi-model experiment) for the RCP 4.5 scenario over the 1971-2100 period and the reference average of simulated annual rainfall amount (over the 1971-2000 period).

Série 5 'red band':

Represents the most likely plume of the ratio deviation between the annual rainfall amount simulated by the different global models (from the CMIP5 multi-model experiment) for the RCP 8.5 scenario over the 1971-2100 period and the reference average of simulated annual rainfall amount (over the 1971-2000 period).

The graph above shows that for Reunion Island:

- There is a slight decrease in precipitation over the past climate (serie 1).
- The curves of series 2 and 3, which are averaged over 30 years, fluctuate due to decadal variations simulated by *regional* Aladin-Climat model. It should therefore **not** be concluded, for example for curve 3, that precipitation will increase significantly around year 2050 and will return to normal by the year 2080.
- Considering the previous point, series 2 and 3 are not significantly different. Therefore the choice of the RCP scenario has little influence on the trend of future precipitation.
- The two plumes associated with RCP4.5 (series 4) and RCP8.5 (series 5) scenarios of the CMIP5 *global* models show little change in precipitation but an uncertainty that increases for RCP8.5 as the envelope expands.
- The RCP8.5 scenario of *regional* Aladin-Climat model is located in the upper part of the plume of the CMIP5 *global* models, while the RCP4.5 scenario is rather in the average of the plume.

The results from Aladin-Climat model are realistic since they are contained in the plume of global models.

It should therefore be noted that *annual* precipitation in Reunion Island will not change a lot for the future climate, although this trend is associated with high uncertainty.

At the seasonal scale:

- **same conclusion for *summer*** (or "wet season") precipitation, which is the main contributor to annual precipitation,
- **decrease in *winter*** (or "dry season") precipitation. This trend should have an impact on the drought issue.

Références

Drias, climate futures

www.drias-climat.fr

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<http://www.developpement-durable.gouv.fr/Volume-4-Scenarios-regionalises.html>

Coupled Model Intercomparison Project: CMIP5 Phase

<https://www.wcrp-climate.org/wgcm-cmip/wgcm-cmip5>