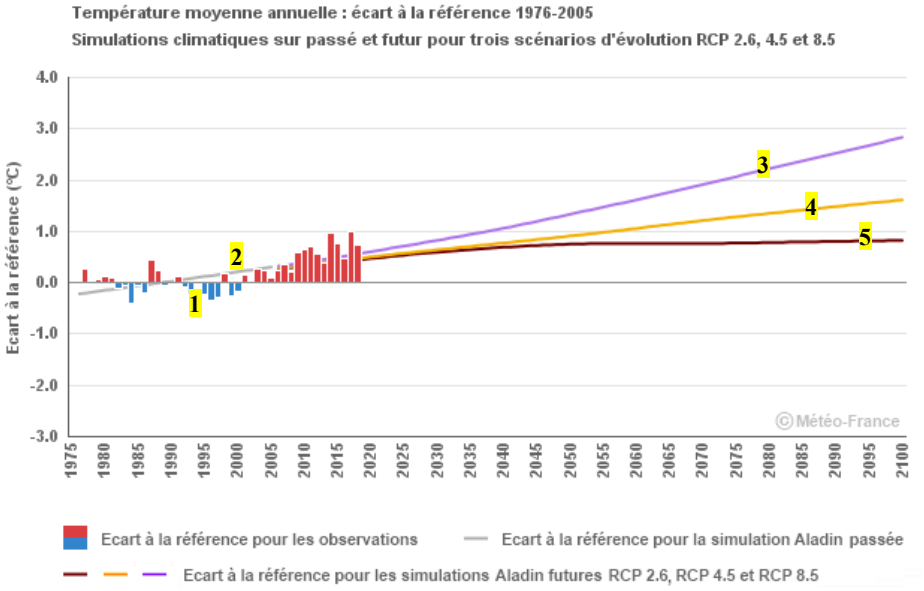
Evolution of annual/seasonal temperatures
Past and future climate - Reunion Island

1. Graph reading aid



5 data series are represented on the graph:

Series 1 'blue and red histogram':
Deviation from the reference average (over the 1976-2005 period) of the annual/seasonal average of observed daily average temperatures (see *§3.1 Observed data*).
Values below the reference average are represented in blue, those above in red.

Series 2 'grey curve':
Deviation from the reference average (over the 1976-2005 period) of the annual/seasonal average temperature simulated by the Aladin-Climat model (Météo-France) over the 1976-2005 period.

Series 3 'purple curve':
Deviation from the reference average (over the 1976-2005 period) of the annual/seasonal average temperature simulated by the Aladin-Climat model (Météo-France) for the RCP 8.5 scenario over the 2006-2100 period.

Series 4 'yellow curve':
Deviation from the reference average (over the 1976-2005 period) of the annual/seasonal average temperature simulated by the Aladin-Climat model (Météo-France) for the RCP 4.5 scenario over the 2006-2100 period.

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Series 5 'brown curve':
Deviation from the reference average (over the 1976-2005 period) of the annual/seasonal average temperature simulated by the Aladin-Climat model (Météo-France) for the RCP 2.6 scenario over the 2006-2100 period.

2. Definitions

Weather Seasons:
- January – March: austral summer (wet season)
- April – June: transition season into austral winter
- July – September: austral winter
- October – December: transition season into austral summer

Minimum/maximum/average temperatures:
- Daily minimum temperature (TNq) = minimum temperature observed between D-1 day at 7pm local time and D-day at 7pm local time
- Daily maximum temperature (TXq) = maximum temperature observed between D-day at 7am local time and D+1 day at 7am local time
- Daily average temperature (TMq) = (TNq + TXq)/2

Deviation from the reference average of the annual/seasonal average of daily average temperatures (observed or simulated):
- Annual/seasonal average TMs of daily average temperatures = annual/seasonal average of daily average temperatures TMq
- Reference average over the period 1976-2005 (Ref TMs) = average of the 30 TMs values
- Deviation from the reference average = difference between the annual/seasonal average (TMs) and the reference average (Ref TMs)

3. Data and methods

3.1 Observed data

Homogenized series:
Data series are not directly usable for analyzing climate change. They are affected by changes in measurement conditions over time, such as movements of the measuring station, or changes in sensors. These changes cause breaks, which can be of the same order of magnitude as the climate signal. Homogenization is a statistical treatment that consists of detecting and correcting breaks in measurement series in order to produce reference series adapted to quantify climate change.
In Reunion Island, for the average temperature, the homogenized reference series selected is the Gillot-Ste-Marie series since 1976.

3.2 Simulated data

Climate modelling:
Climate simulations are created from general circulation models, which take into account different reference scenarios of the evolution of radiative forcing called RCP (Representative Concentration Pathway). Compared to forecast models, an essential feature of climate models is that they do not need to be adjusted to observations. The climate system evolves completely freely; it receives energy from solar radiation and loses energy by infrared radiation emitted into space. The simulated climate (temperature, precipitation, etc.) is the result of this adjustment between received and lost energy. Energy conservation, and more generally energy exchanges, are therefore fundamental to a climate model, and their modelling is the primary concern of climate scientists.
These models allow to develop climate projections that are representative of different scenarios of climate evolution.

RCP scenarios:
3 RCP scenarios are considered:
- RCP 8.5, corresponding to a scenario without climate policy.
- RCP 4.5, corresponding to a scenario with climate policies to stabilize CO_2 concentrations.
- RCP 2.6, corresponding to a scenario with climate policies to reduce CO_2 concentrations.
The number following the acronym RCP is the radiative forcing for the year 2100 in Watt per square meter.

Climate projections used:
For Reunion Island, a single regional climate model (Aladin-Climat from Météo-France) was available for the 3 RCP scenarios. It was therefore not possible to proceed with a multi-model approach (like Euro-Cordex) with percentile calculation.
However, the regional Aladin-Climat model is very close to the average of the global models from the CMIP5 multi-model experiment, which allows a good evaluation of the average temperature evolution.
The data set for future climate was obtained by extracting data of the closest grid point to Gillot-Ste-Marie station from the Aladin-climat-Reunion grid, and then applying a quantile-quantile correction method with the historical series of observations from this station.

4. References

Drias, climate futures
www.drias-climat.fr

Observatoire National sur les Effets du Réchauffement Climatique (National Observatory on the Effects of Global Warming): French climate reports in the 21st century
http://www.developpement-durable.gouv.fr/Volume-4-Scenarios-regionalises.html

Euro-Cordex
http://www.euro-cordex.net