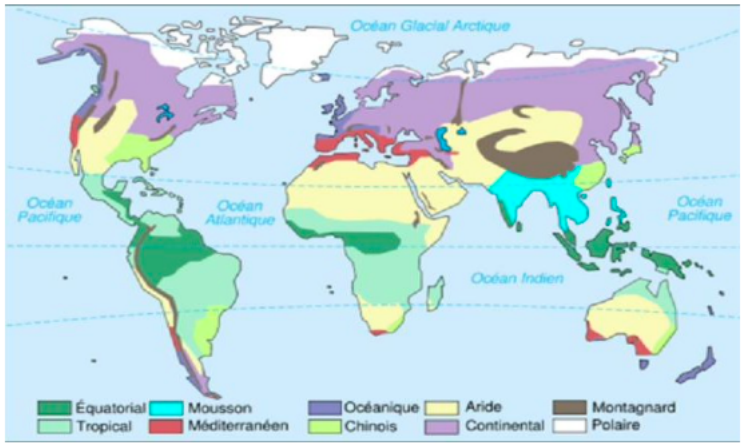
Climate change in Guadeloupe: What to expect?

Weather-France Antilles-Guyane
Meteorological Centre of Guadeloupe

General information:

What is the definition of climate?

- Average weather conditions observed in a location or region;
- Main meteorological parameters for characterizing climate;
- Average temperature;
- Annual precipitation;
- Humidity, cloudiness;
- Atmospheric pressure
- Wind regime;
- Seasonality;
- Components of the climate machine:
    - Solar radiation;
    - Ocean and atmospheric circulation;
    - Greenhouse effect;

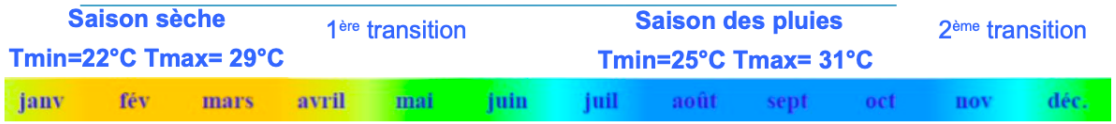


The climate of Guadeloupe is **tropical oceanic**

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The current climate in Guadeloupe:



- Steady and sustained wind.
- Dry and sunny weather during the day,
- frequent small showers at the end of the night.Cool night temperatures.
- Rainy situations are associated to the influence of the cold fronts circulating north of the West Indies bow.

- More frequent showers alternate with embellished.
- Sometimes heavy rains, often stormy, are demonstrate between late April and early May
- Rising temperatures, especially the minimal nocturnal.

- Hot and humid weather.
- Episodes of heavy rain, even affect the archipelago, associated with waves from the East or the more or less direct influence of cyclones tropical.
- Often, the weakness of the trade winds

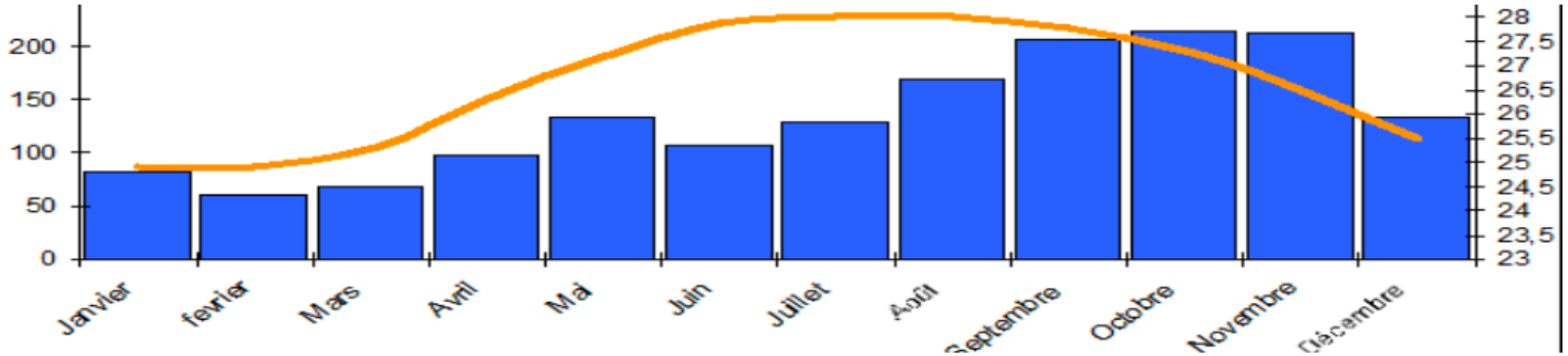
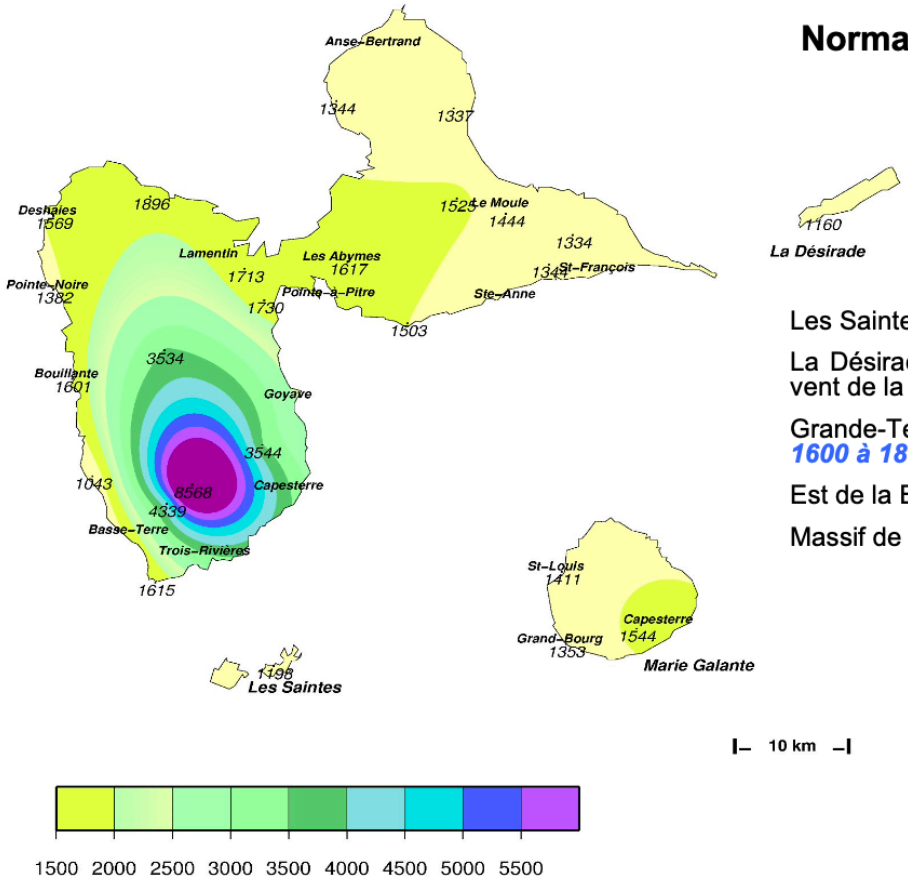


Diagramme ombrothermique du Raizet (normales 1981-2010)

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The current climate in Guadeloupe: Rains



Normale des précipitations annuelles 1981-2010

Les Saintes : ***1000 à 1200 mm/an***

La Désirade, Marie-Galante, Grande-Terre (est et nord) et côte sous le vent de la Basse-Terre : ***1300 à 1500 mm/an***

Grande-Terre(Grands-Fonds et région pointoise), nord Basse-Terre : ***1600 à 1800 mm/an***

Est de la Basse-terre (en-dessous de 600 m) : ***1600 à 3500 mm/an***

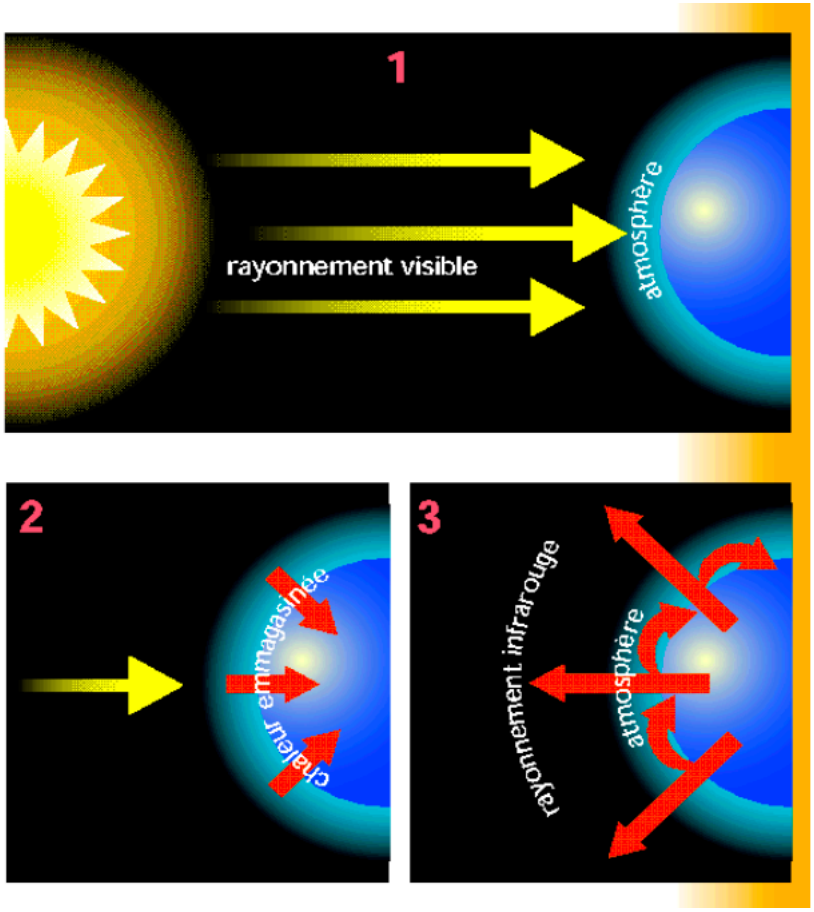
Massif de la Soufrière : ***3500 à 10 000 mm/an***

Climate change: Greenhouse effect

1- Solar radiation is the only source of energy for the earth

2 - Solar energy is stored by the surface

3 - Stored energy is returned as infrared radiation



Greenhouse gases in the the atmosphere (water vapour, carbon dioxide…) return some infra-red towards the surface

Without atmosphere the average temperature on Earth would be -19°C instead of 15°C



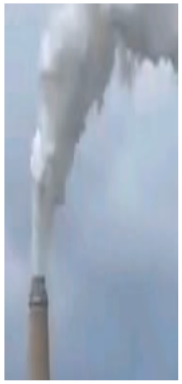
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Climate change: Additional gaz effect

To compare the GHGs between them, we calculate their Global Warming Supply by to that of the most abundant of them, CO2

Gaz	GWS/CO2 (on 100 years)
Carbon gaz	1
methane	25
nitrious oxide	298
halocarbon	120 to 14800



60 %

FOSSIL FUEL:S
coal, oil,
natural gas



20 %

METHANE (CH4):
Rice Fields,
ruminants,
discharges



14 %

Halocarbons:
Cold industry,
aerosol cans



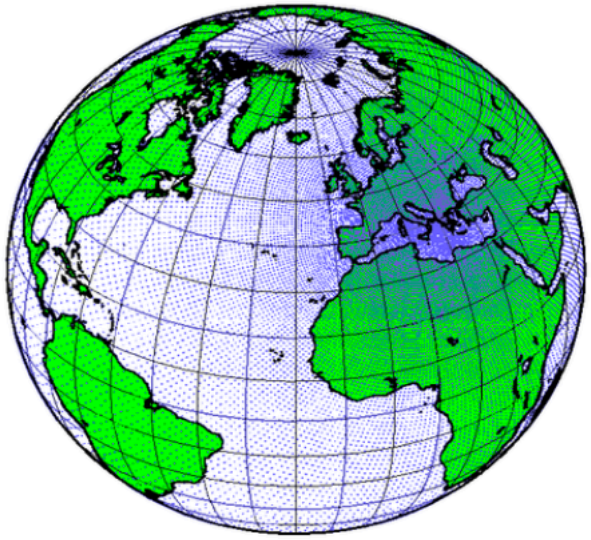
6%

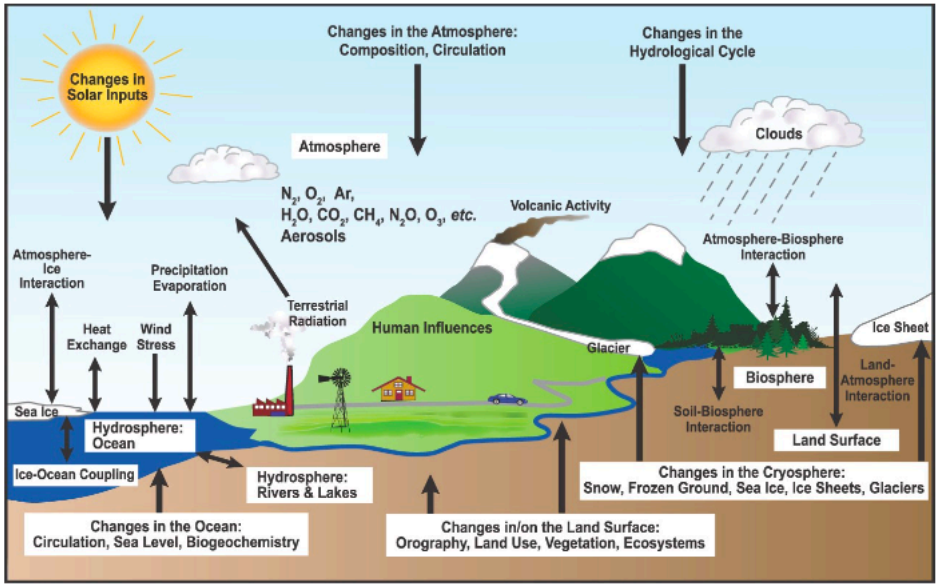
OXIDE NITROGEN
(N2O):
Agriculture, fertilizers...

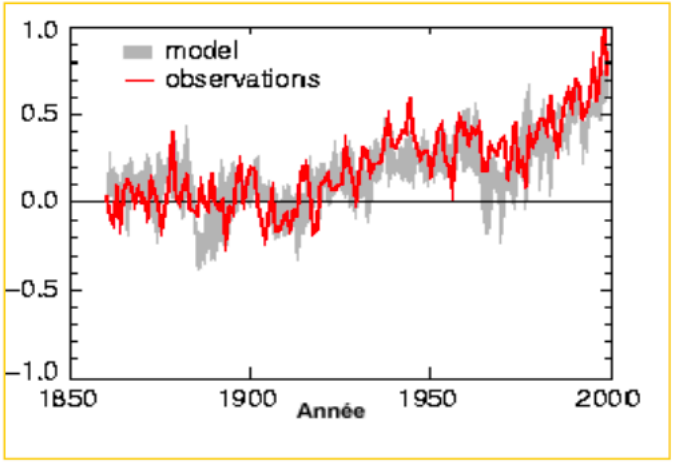
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In search of the future climate: global climate models







- Represent the equilibria and climate variability on long time scales
- Main difficulties:
  - Quantify the overall energy balance.
  - Take into account long-term variability modes, which integrate many time and space scales.
  - Take into account factors that are difficult to predict (evolution demographic, social development, change in technology, environmental policies,.

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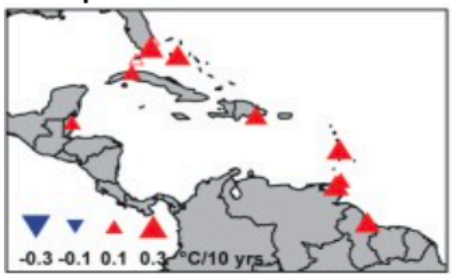
Climate change in Guadeloupe: What are we looking at?

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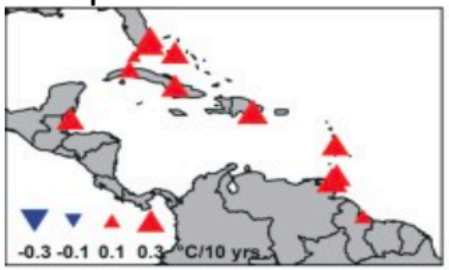
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Trends in the Caribbean: Evolution of temperatures

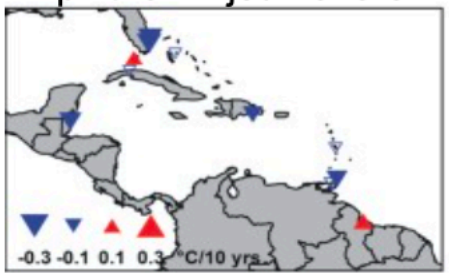
Temp. diurnes



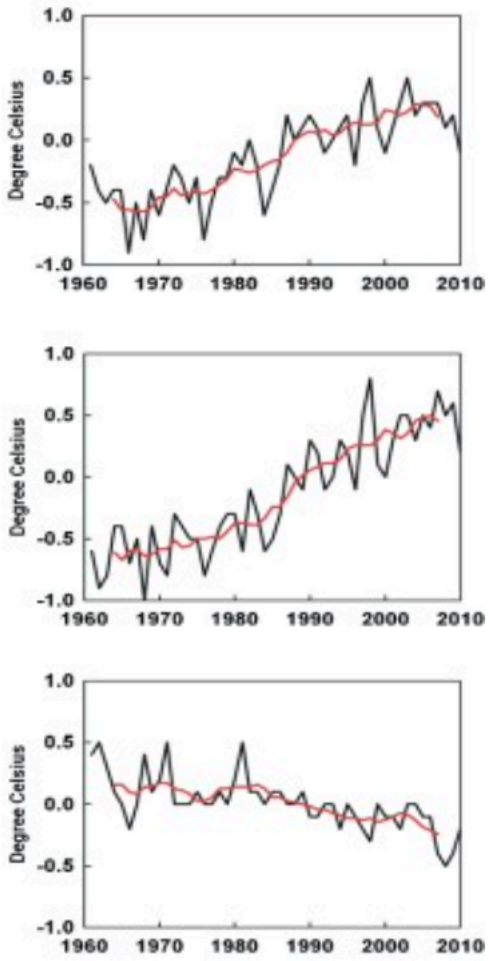
Temp. nocturnes

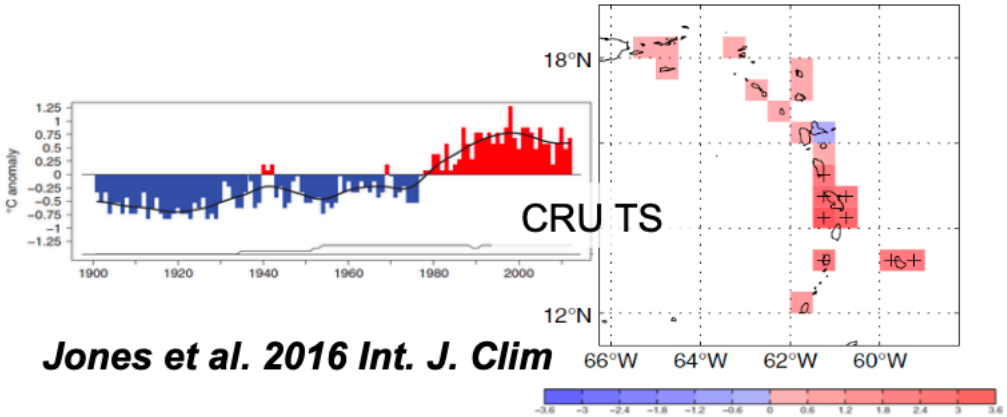


Ampl. therm. journalière



Stephenson et al. 2014 Int. J. Clim





Jones et al. 2016 Int. J. Clim

Tendances des températures. **moy** (°C/déc.) en 1979-2012

Min & max temperature increase

Diurnal T: +1.0°C in 50 years

T. nocturnal: +1.4°C in 50 years

Reduction of amplitude day-night

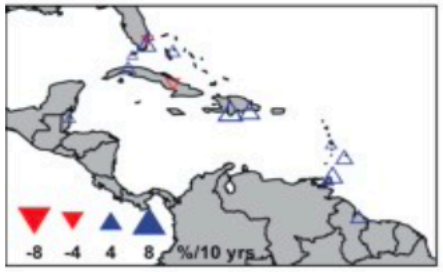
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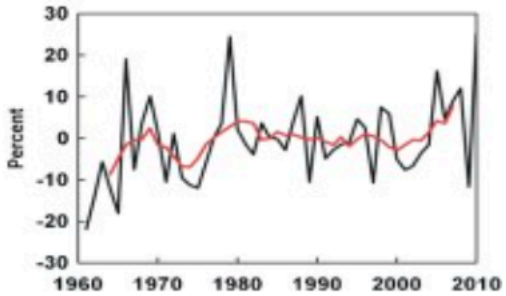
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Trends in the Caribbean: Evolution of rainfalls

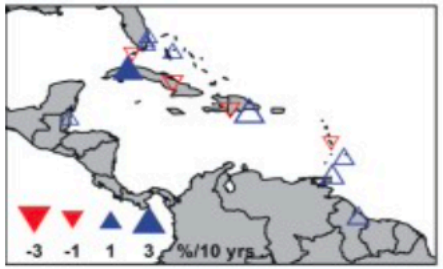
Stephenson et al. 2014 Int. J. Clim

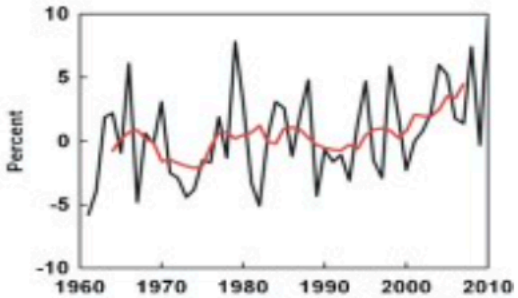
Cumuls annuels



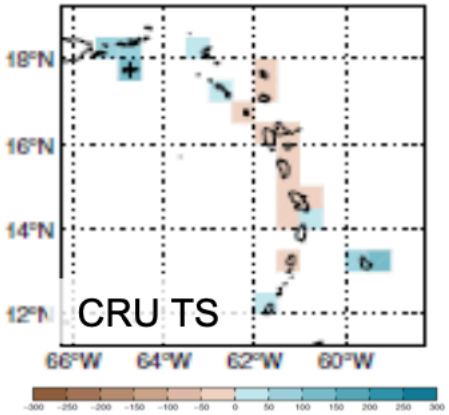


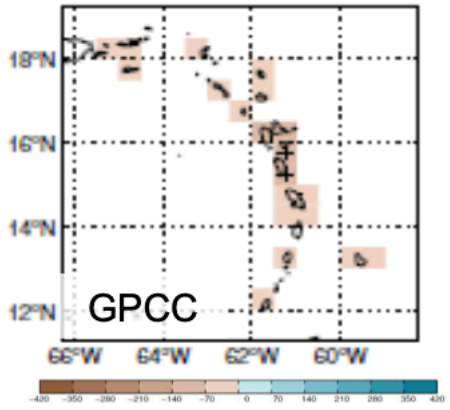
Pluies extrêmes (Q95)

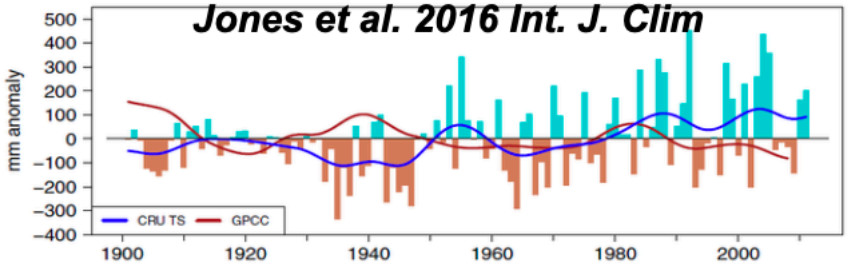




Tendances des **precipitations moy. & extrêmes** (%) en 1961-2010







Tendances **précipitations en NDJFMA** (mm/déc.) en 1979-2012

No significant trend in average rainfall
No significant trend in extreme precipitation
Too short series? Ten-year variations?

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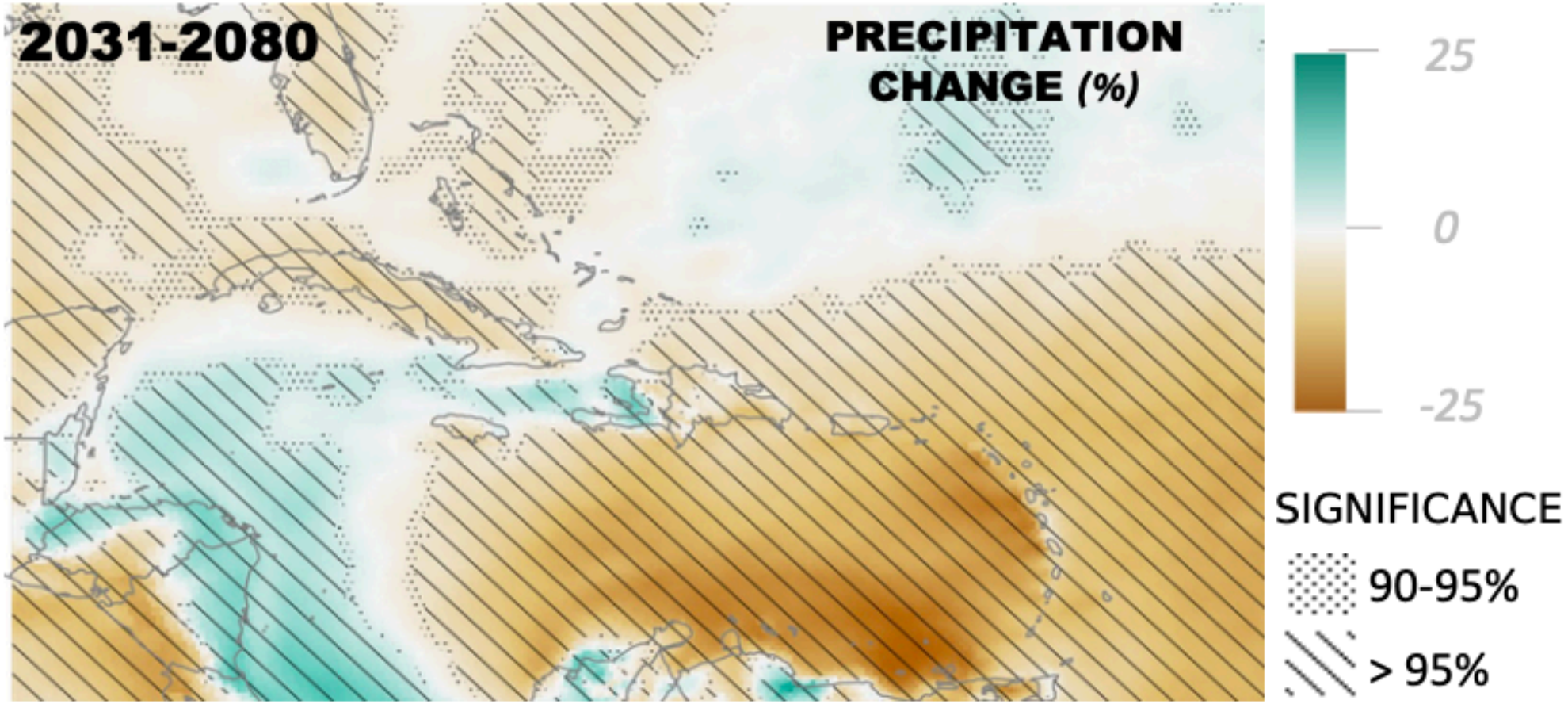
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Climate change in Guadeloupe: What is it?

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Climate projections (temperature and precipitation)

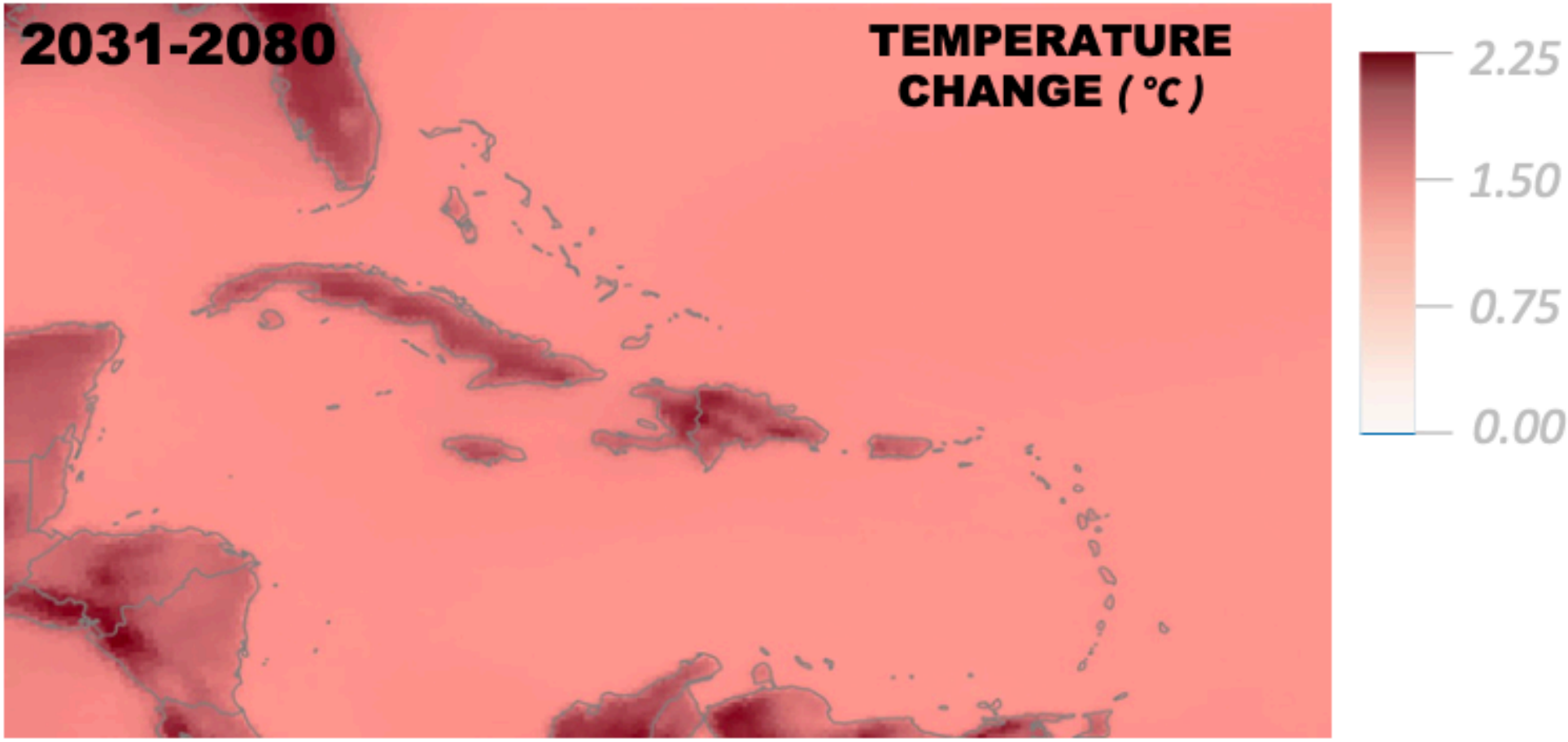


Drying

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Climate projections (temperature and precipitation)

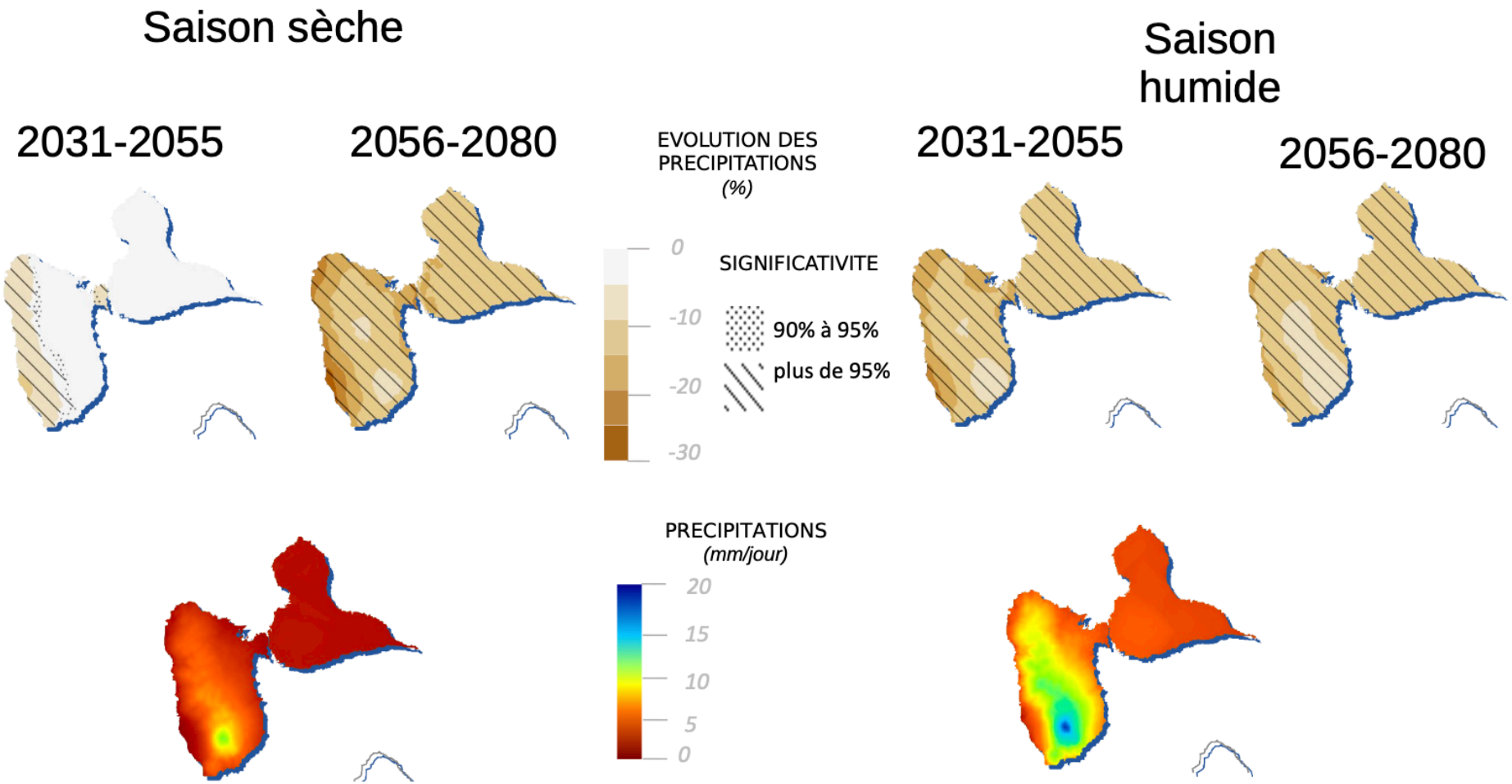


Drying & Warming

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The projections of precipitation



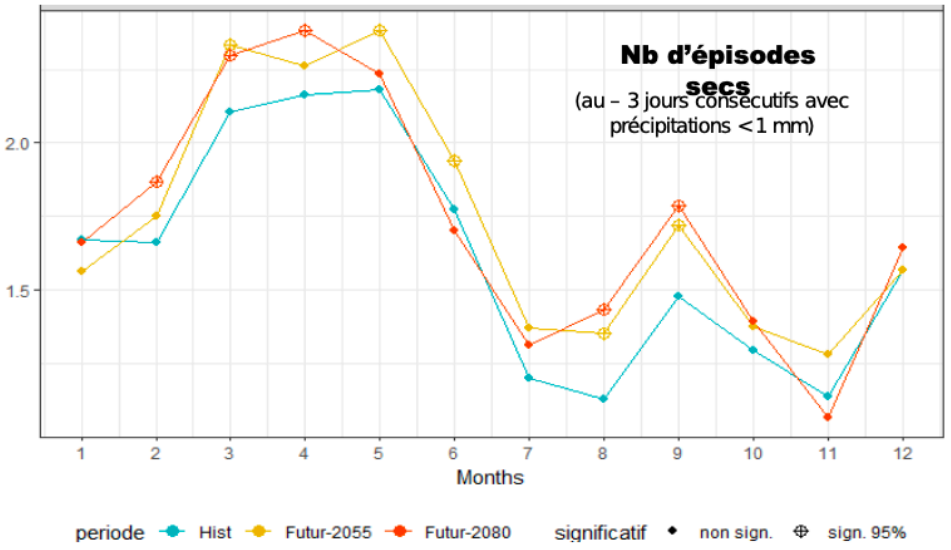
Climate projections (temperature and precipitation)

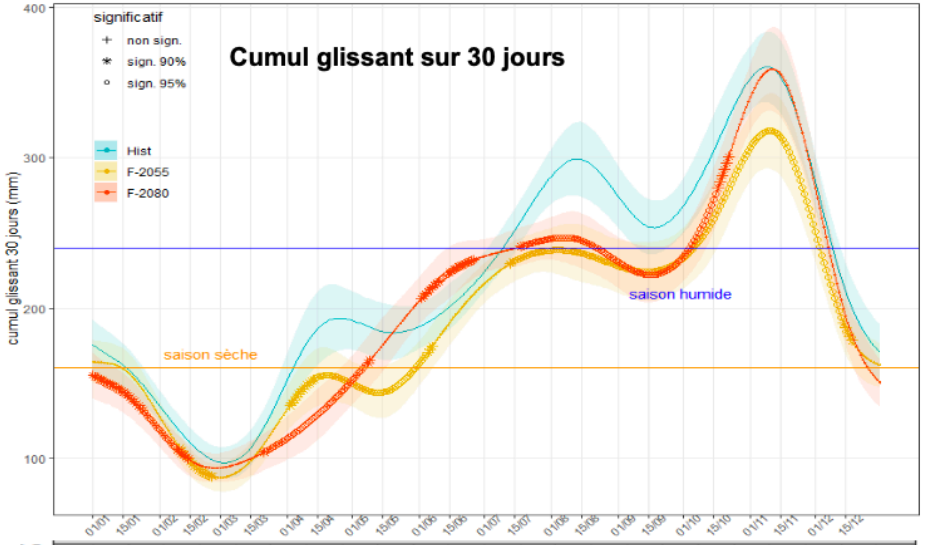
Cantet et al. 2014 *Tellus A* => quantile-quantile corrections with long station data

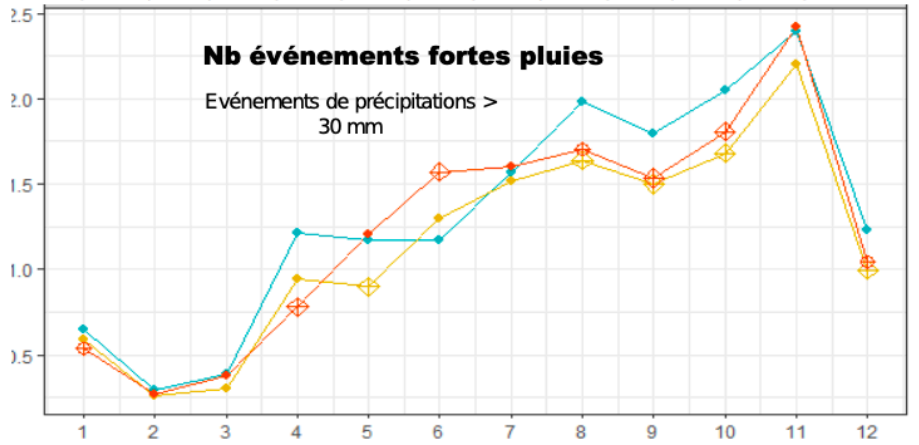
Assèchement surtout en saison humide :

- Saison humide retardée jusqu'à 7 semaines (2030-2055)

- Saison sèche étendue de 3 à 4 semaines (2056-2080)







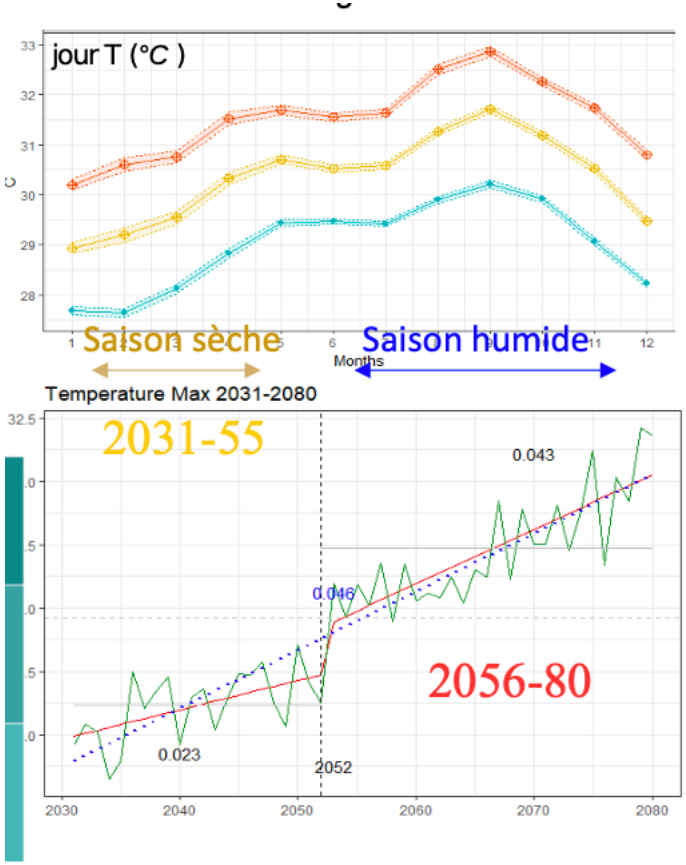
Extreme precipitation events should be less frequent (August, Sept, Oct & Dec).

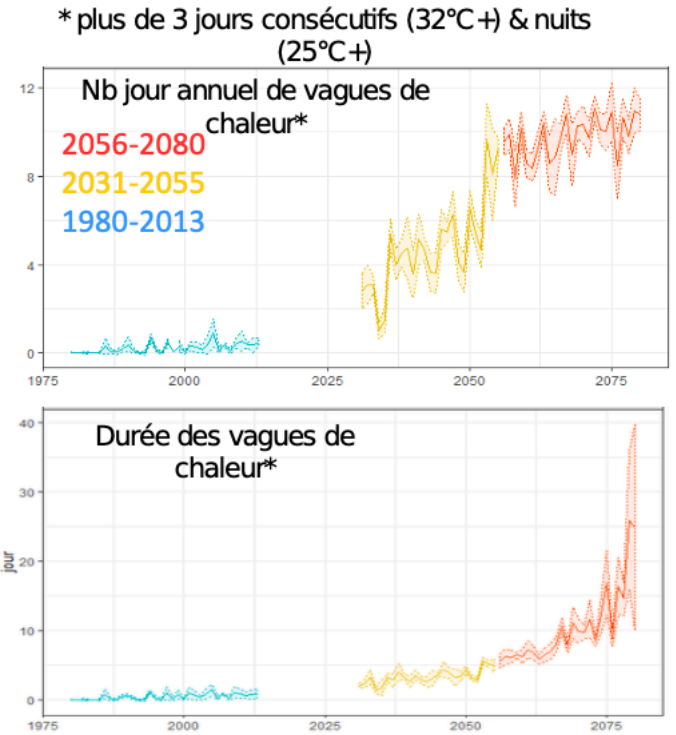
Trends in the Caribbean: Projections of the temperatures

Annual warming for the whole island:

- Stronger and faster after 2055
- Stronger at night in season wet

Evolution / 1980-2013	T jour	T nuit
2030-2055	+1°C	+1,5°C
2056-2080	+2°C	+3°C



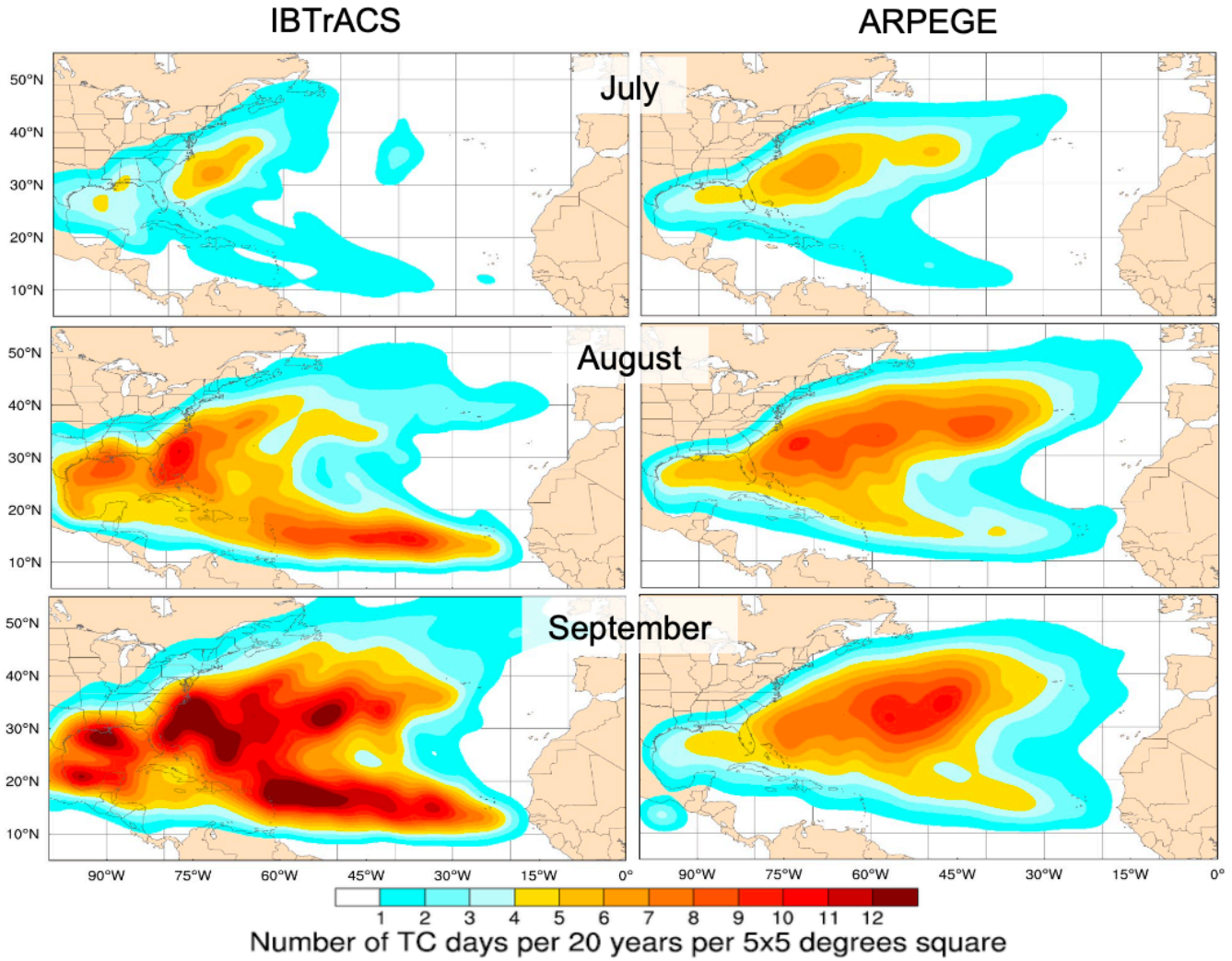


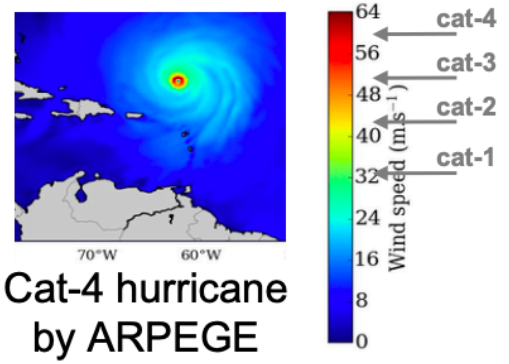
Heat waves more frequent and longer

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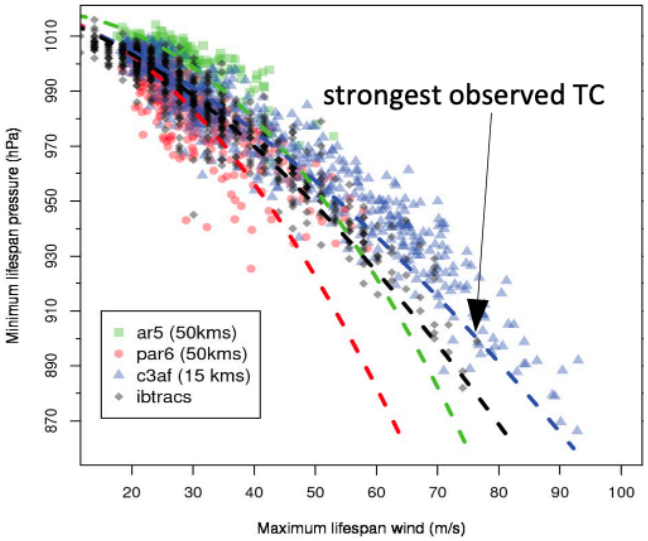
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Trends in the Caribbean: Tropical hurricanes





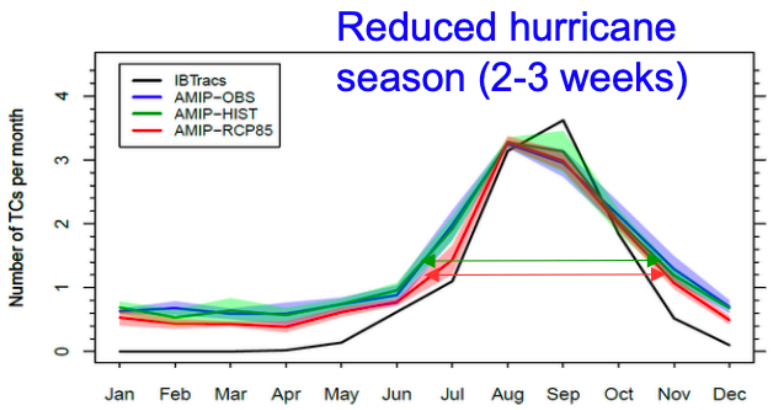
Cat-4 hurricane by ARPEGE

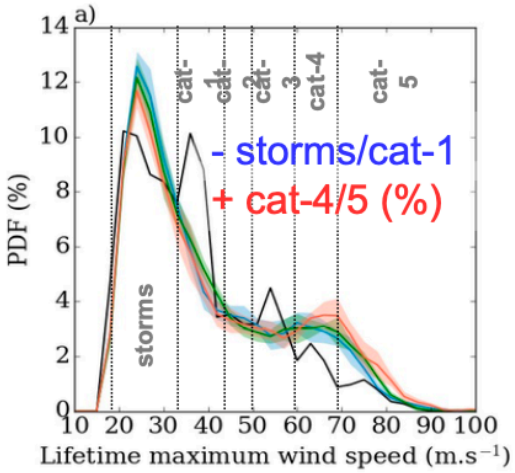


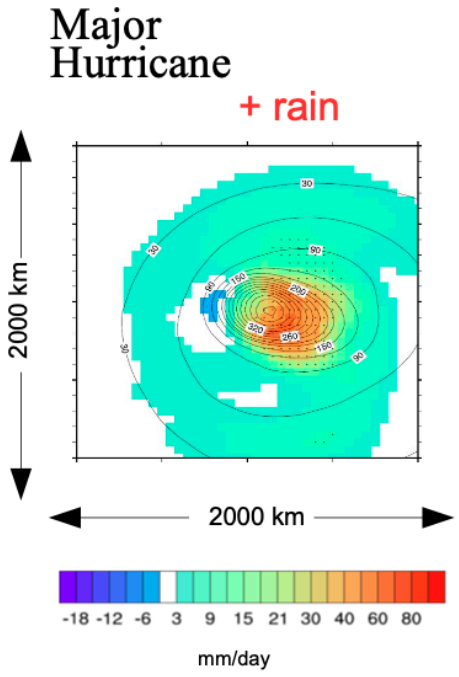
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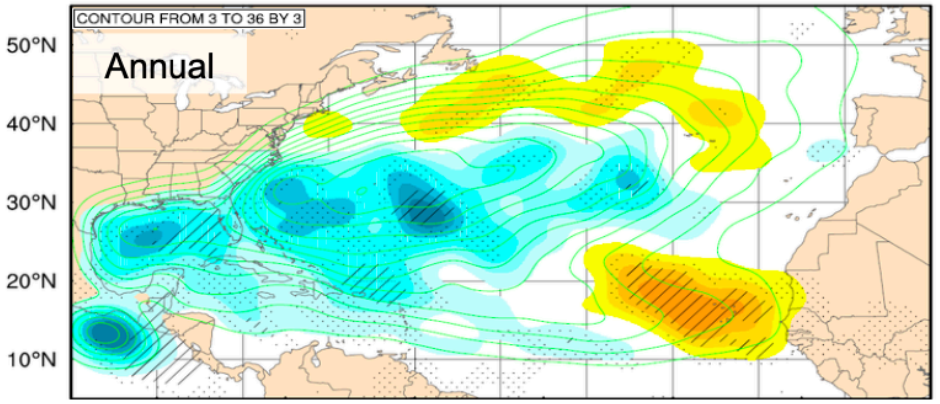
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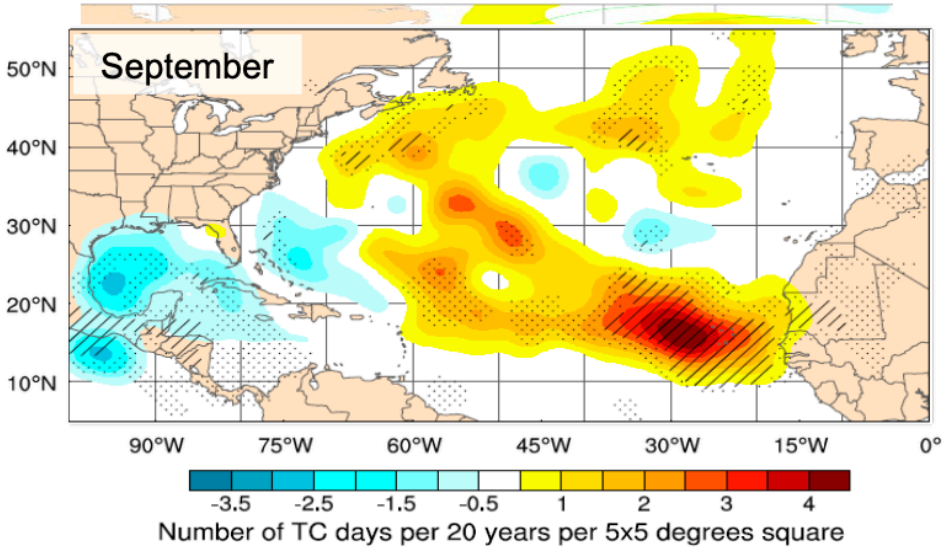
Trends in the Caribbean: Tropical hurricanes











Projection du changement climatique (scénario RCP 8,5) dans les Antilles et focus sur la Guadeloupe (horizon 2080)

+ 3°C sur l'année(diurne)

+ 3,5°C sur l'année (nocturne)

-10 à -15 % de précipitations en moyenne sur l'année dans la Caraïbe

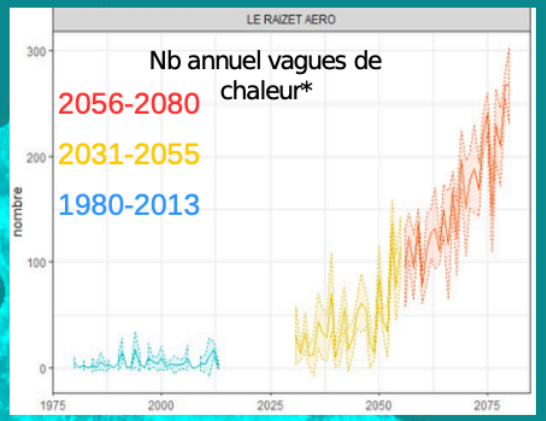
Baisse légère des Alizés (**< -5%**)

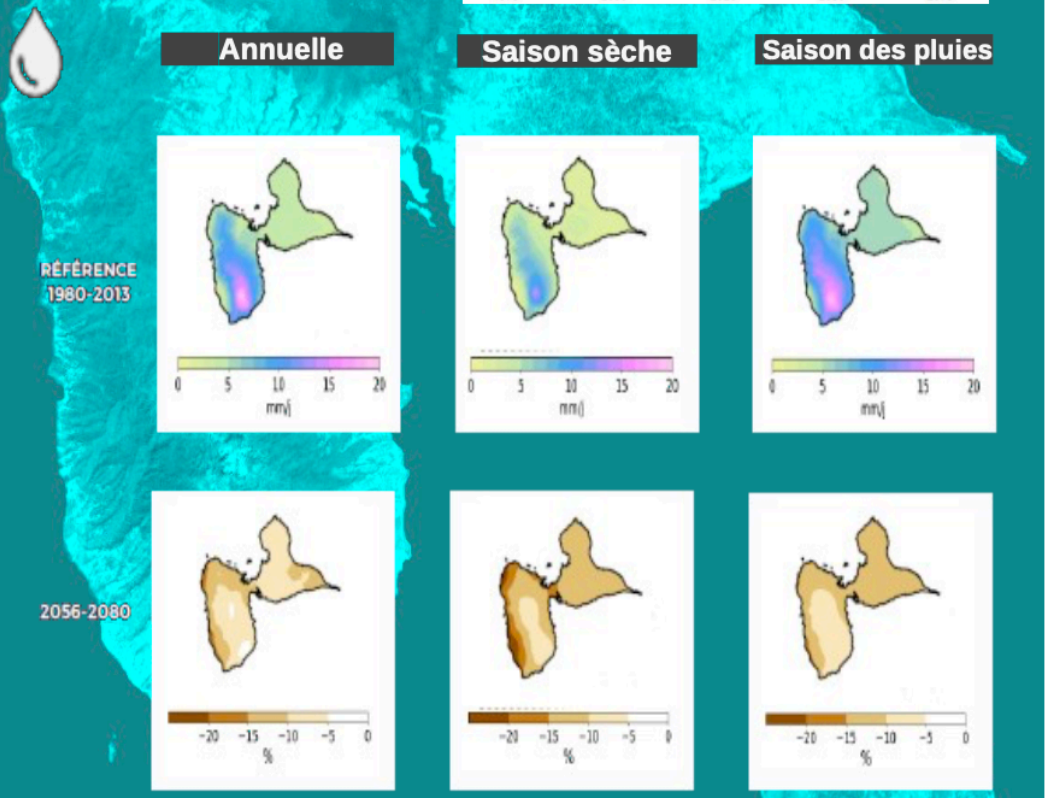
-5 à -10 % de la hauteur moyenne des vagues
+50cm de hauteurs des vagues extrêmes

Augmentation du nb de cyclones de **cat. 4 et 5**
-10 à -15 % de cyclones dans l'Atlantique Nord
+ 35 à 40 % au Cap-Vert
Trajectoire + Nord
Augmentation des pluies cycloniques (en mer)

+ 3,0°C sur l'année (réchauffement plus rapide après 2055)

* +3 jours ou nuits chaudes consécutives





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THANKS!

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