CPA Climate change hazard assessment

Methodology

Two main themes:

1. Land-based hazards
    1. Heat
    2. Heavy rainfall & Wind
2. Marine hazards
    1. Sea-level rise
    2. Storms and tropical cyclones

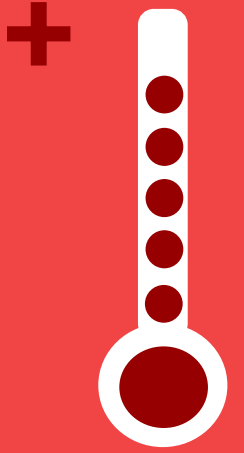
Rapid Hazard assessment

Identifying past trends and future projections, using **best-available** data

2050

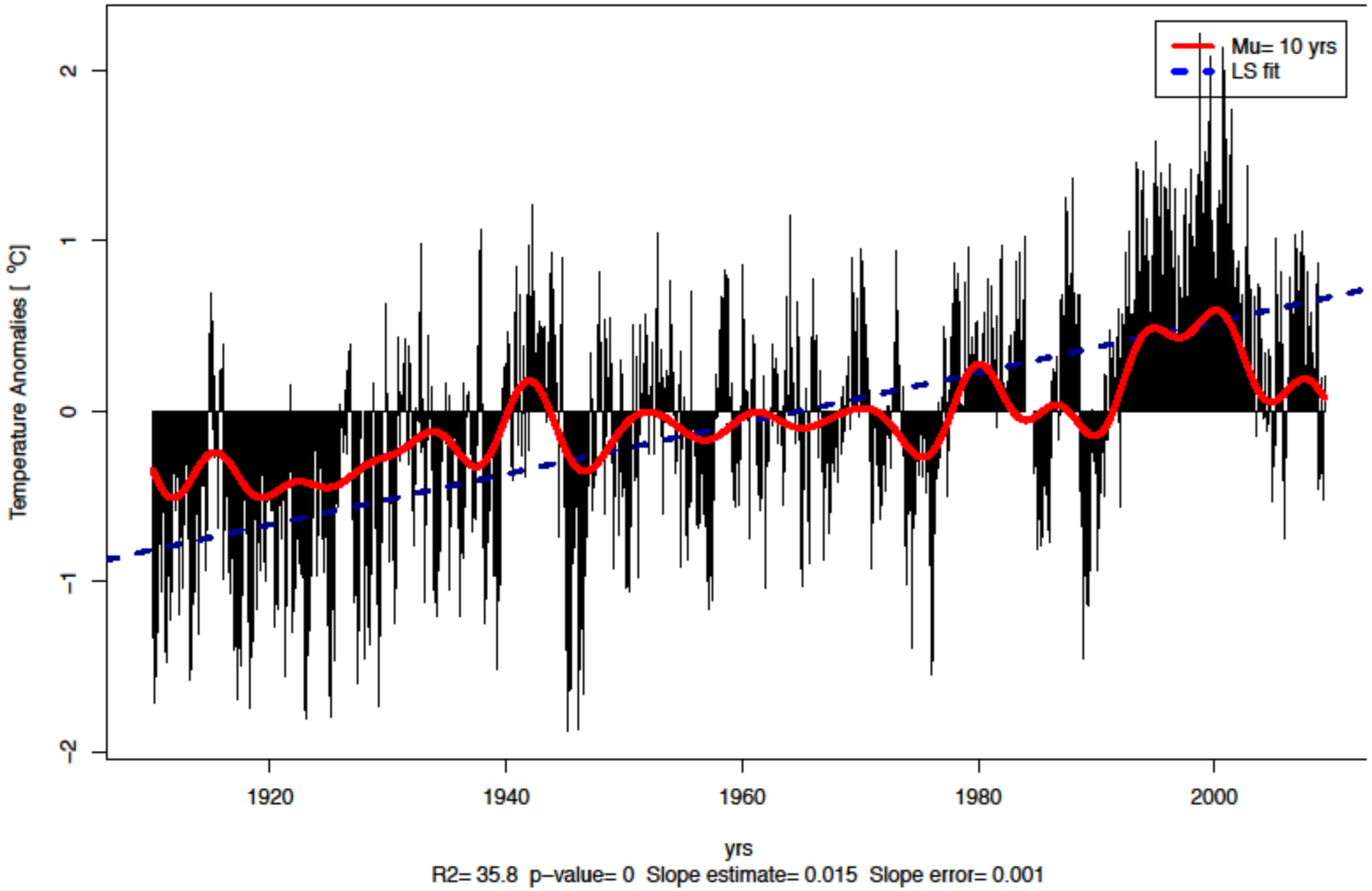
Seasonal change in temperature

Dec – Feb	27 + 1.9°C
Mar – May	28 + 2°C
Jun – Aug	29 + 2°C
Sep – Nov	29 + 2.1°C



* For a high emissions scenario (RCP 8.5)

Average temperature change



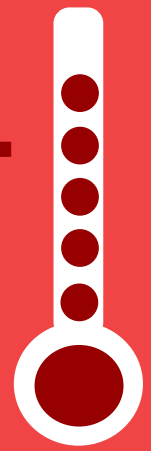
Historical:

- Measurements from Kas chikitu and Hato

Future:

- Average temperatures increase with **about 2 C° by 2050**[1]

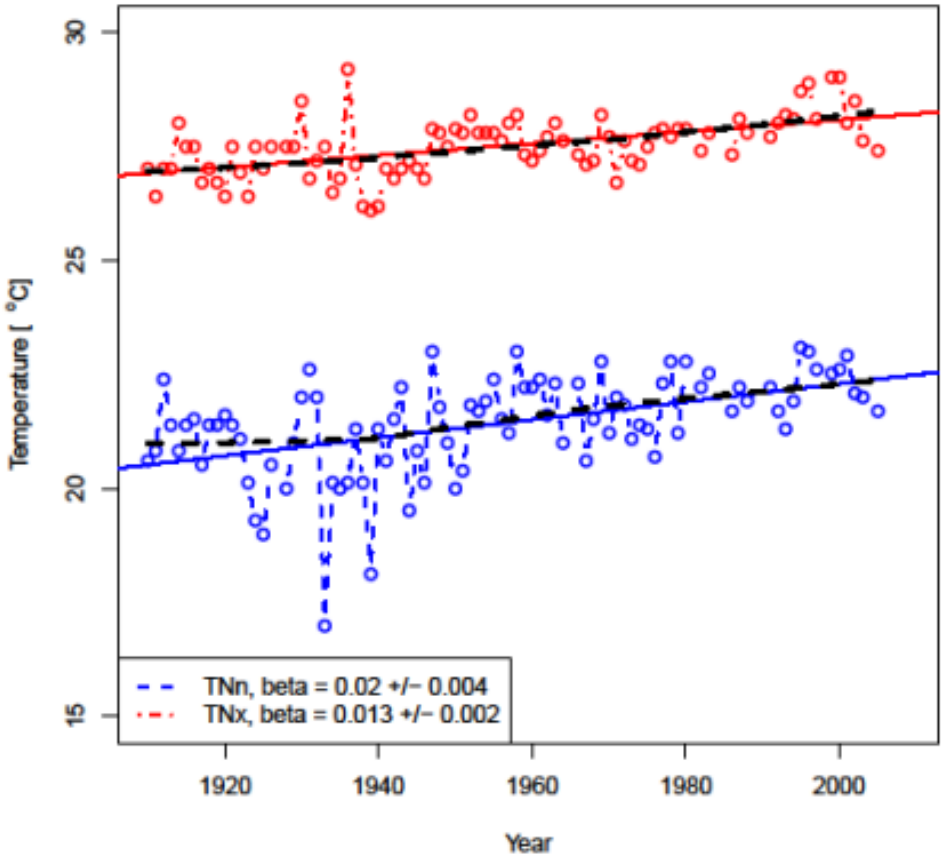
[1]*CMIP5 regional projections, CORDEX Central America Bias-adjusted*

	NOW	2050
Maximum temperature		+ 
Yearly	32.8°C	36°C
Record	38.3°C	42°C

* For a high emissions scenario (RCP 8.5)

Day and night time temperature change

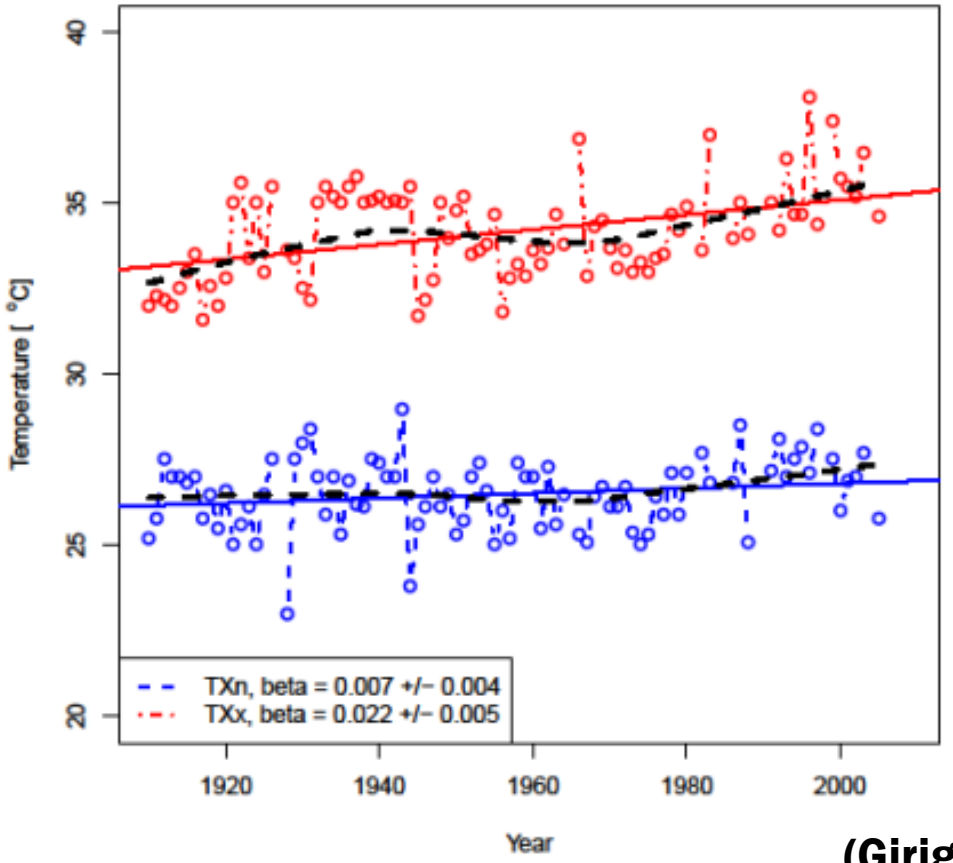
Warmer Nights



Max in year

Min in year

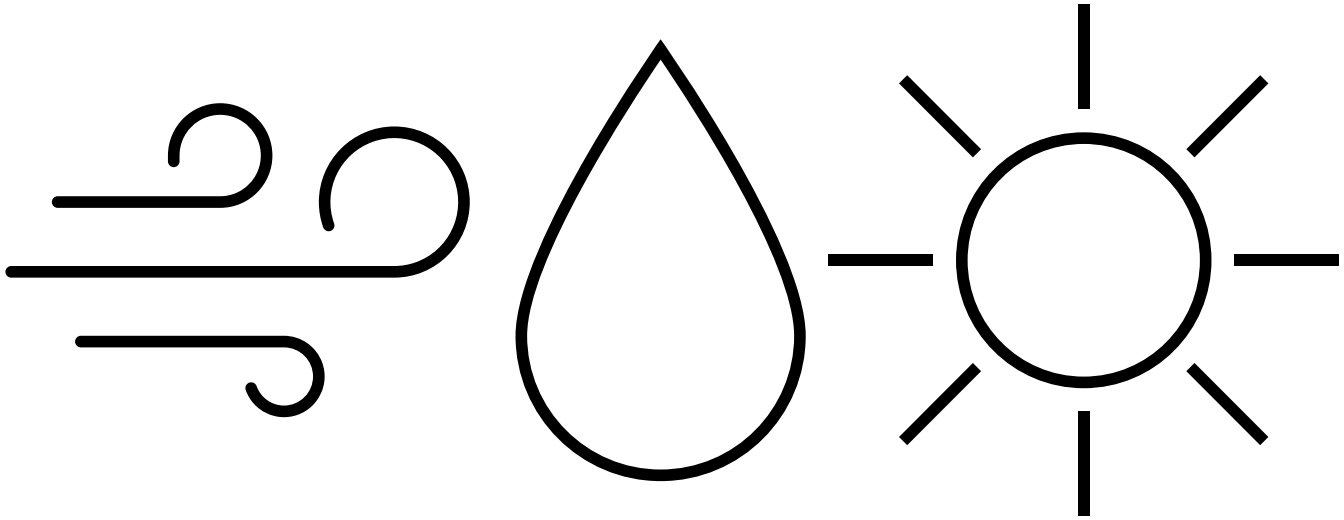
Warmer Days



(Girigori, 2011)

Heat index

Temperature is not the ‘how it feels’ temperature
-> Heat index can show this
First exploratory assessment showed a decline in the heat index due to a decline in relative humidity
This assessment does not yet include wind
Requires further study and validation
Is for Hato; can locally be different
Gap: spatial differentiation



Record

Trend

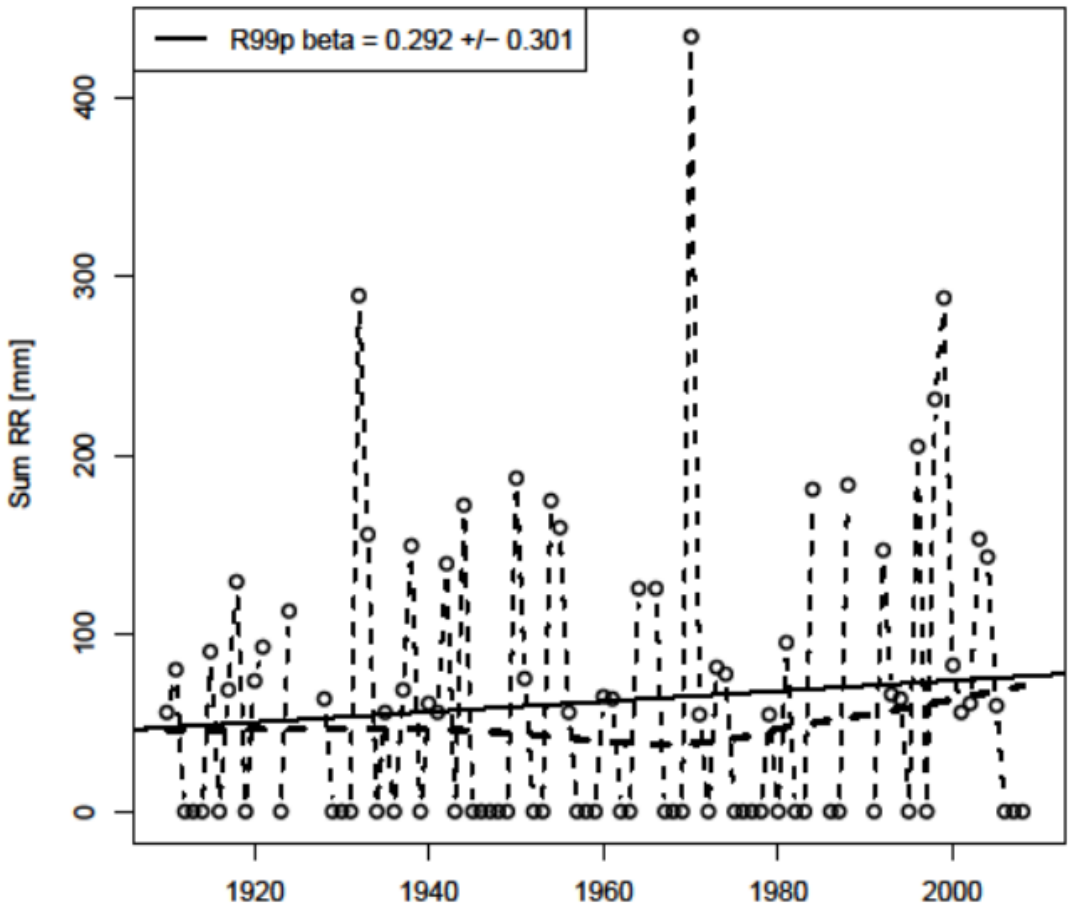
Maximum rainfall in 24h

117.8 mm

+ increase in intensity

Heavy rain

Historical trend in R99p (Girigori, 2011):



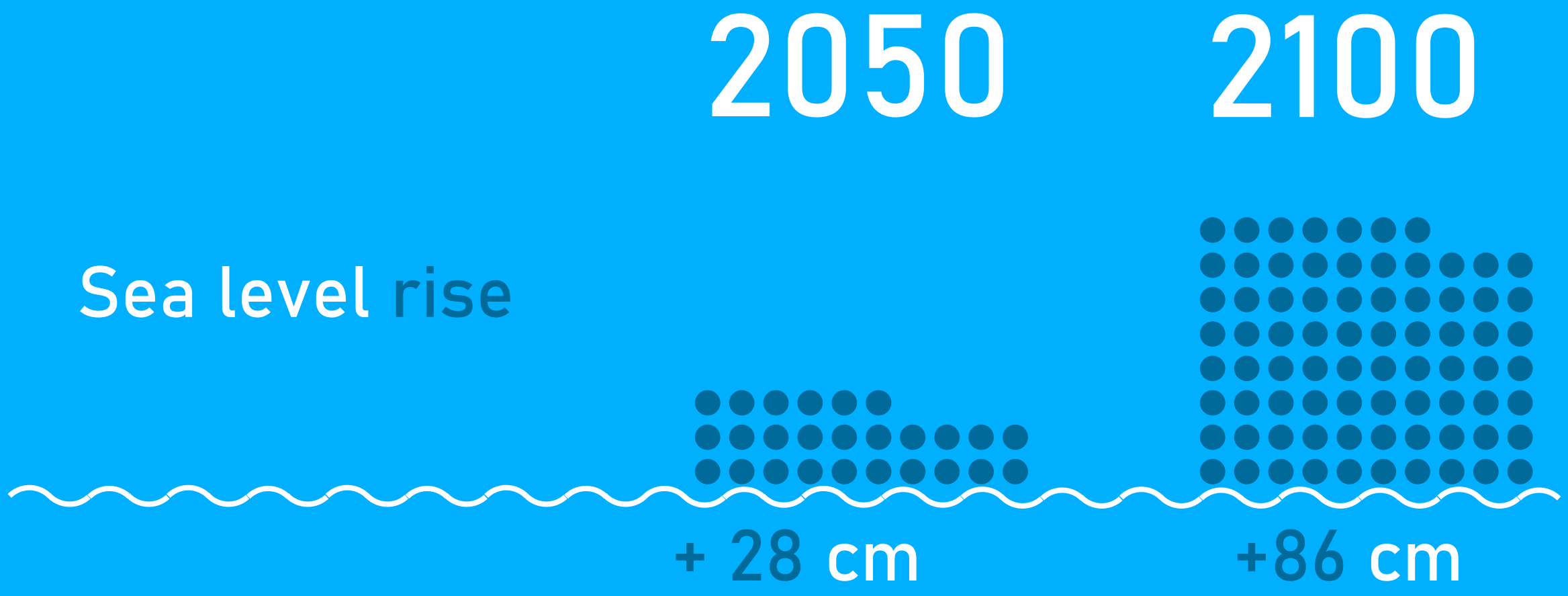
Future projections:

- More extreme precipitation from tropical cyclones
- For the future trend we mostly rely on the historical information
- Spread in future projections is large

-> Related to tropical Storm, such as Tomás in November 2010, which led to 106.8 mm in 24h. Maximum: 117.8 mm. The highest number of wet days for Curaçao was recorded in 1988, a strong La Niña year, and totaled 117 days.

Wind

From our session with experts, we conclude that, at this moment, it is not possible to deduce a trend in historical data or future projections. Historical data might suggest a decrease in average wind speed and a change in wind direction, but this needs to be quality checked.



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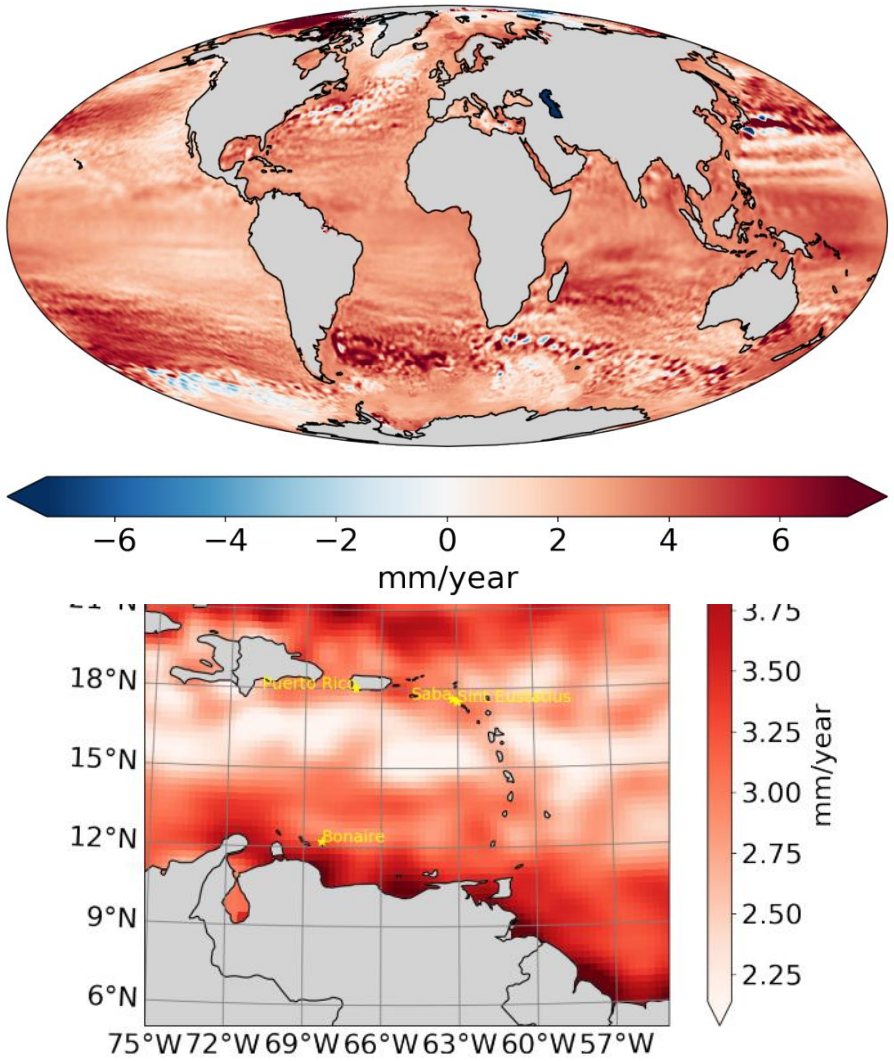
Sea-level rise: historical trend from satellites

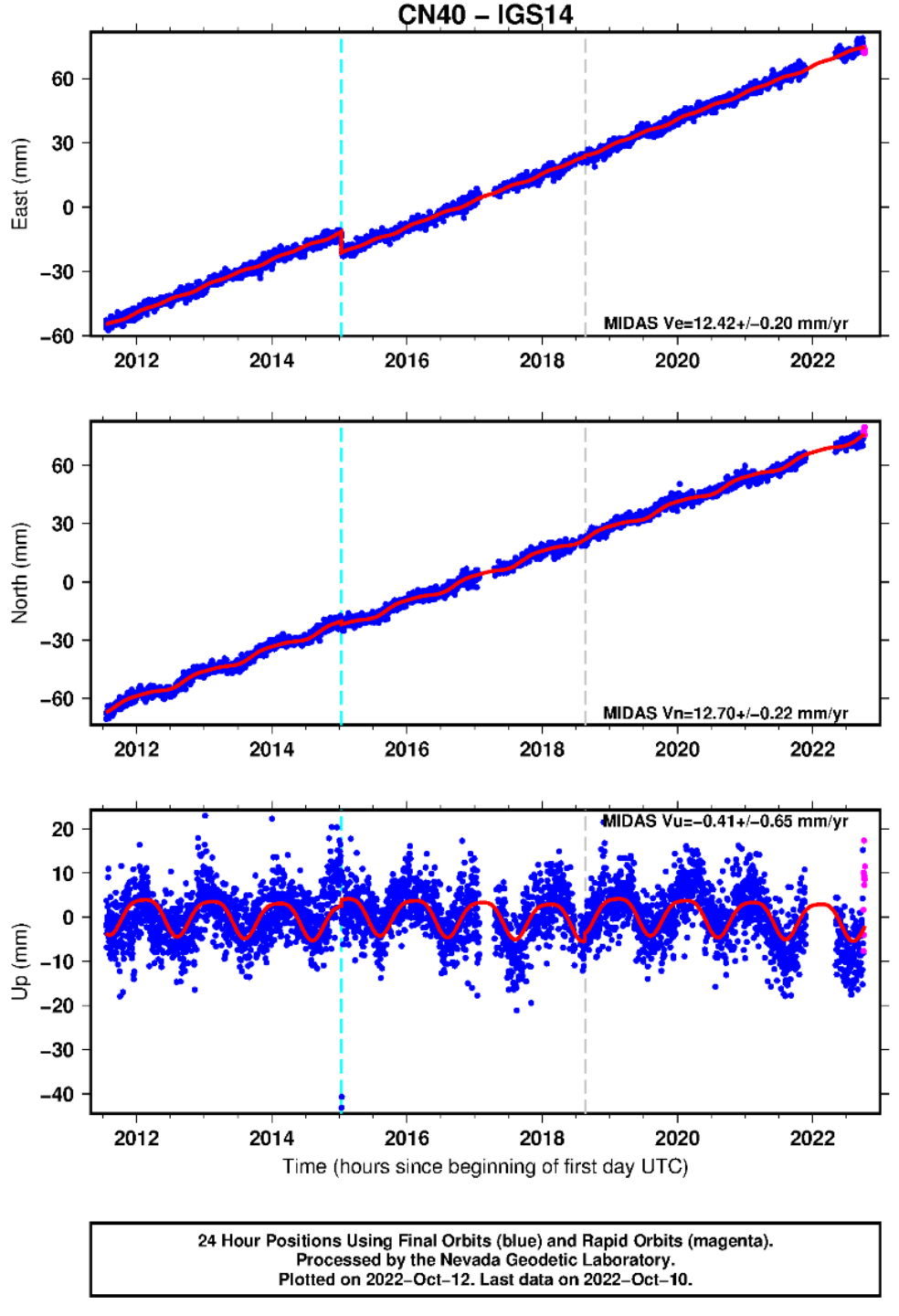


Results (Le Bars, 2022):

- Over the last 3000 years global sea level rose at a slow rate of between 0 and 0.2 mm/yr
- From beginning of 20th century this relatively slow rate accelerated to a larger rate of over 1 mm/yr
- Since 1992 satellite altimetry is available: 3.1 mm/yr
  - Is not confirmed by land stations
- Local differences are mostly due to a change of the ocean circulation associated with salinity and temperature changes. When water becomes warmer or fresher (e.g. less saline) it expands and locally sea level rises.
- In the tropical Atlantic, the rise has been relatively uniform and close to the global mean
- There is a difference of up to 2 mm/yr between the north of the Caribbean Sea and the coast of Venezuela and Guyana.
- Trend is **3.3 ± 0.4 mm/yr at Bonaire** but the sea level can **vary by up to 4 cm** from one year to the next due to a variability of the Caribbean current.

Sea-level rise: plate tectonic movement

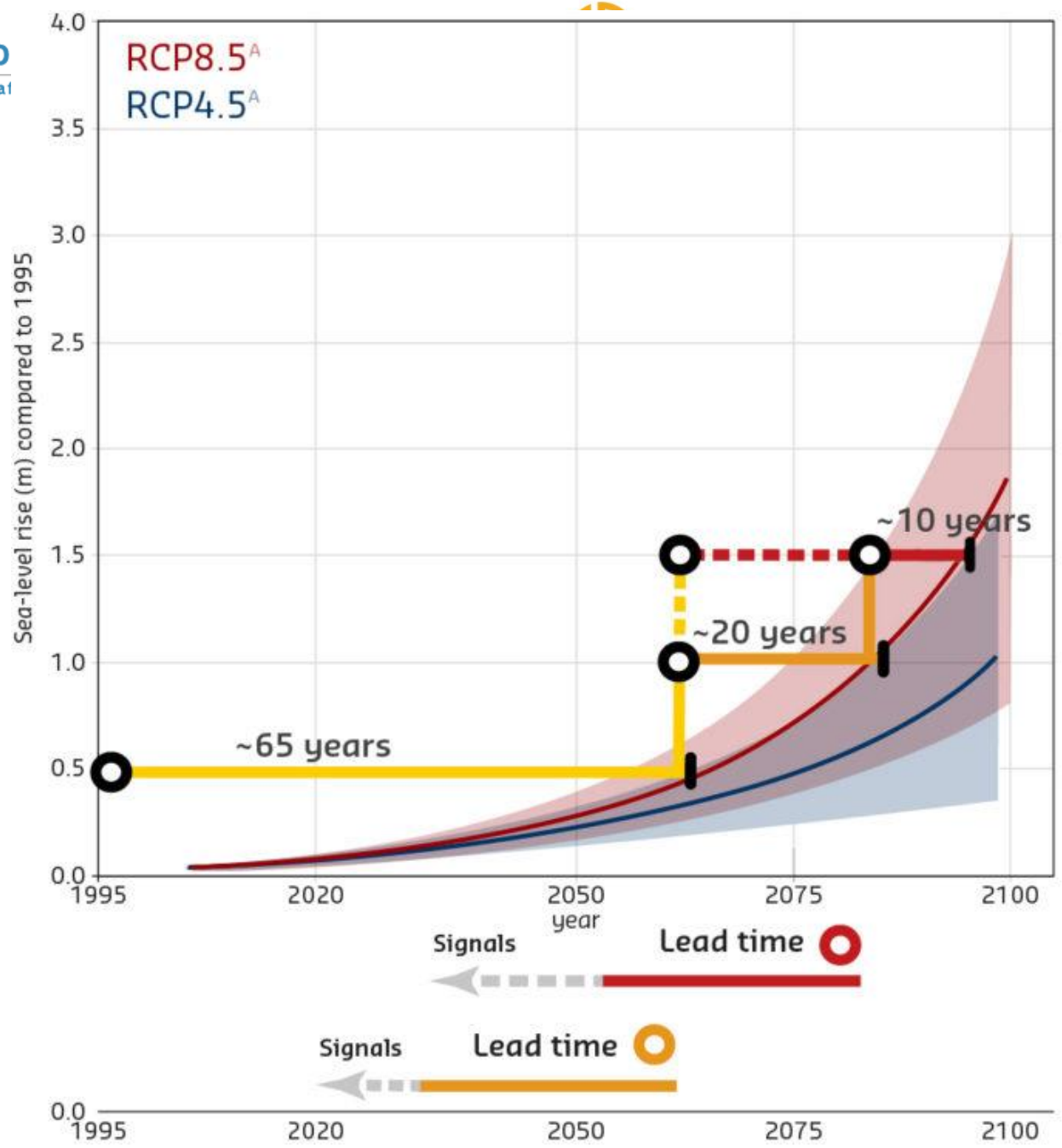
Plate tectonic movement is an important factor.
Curacao **moves north-east** (top and middle panels) but **vertical movement is limited** with no clear long-term trend (bottom panel).
Long term data and spatial information is a gap.



- **Sea-level rise: future projections**

The rate of sea level rise will **be higher towards 2050** than it was in the last decades, and the sea level will **rise even faster towards 2100**.

- long-term planning may be useful to evaluate adaptation options with respect to a rising sea level

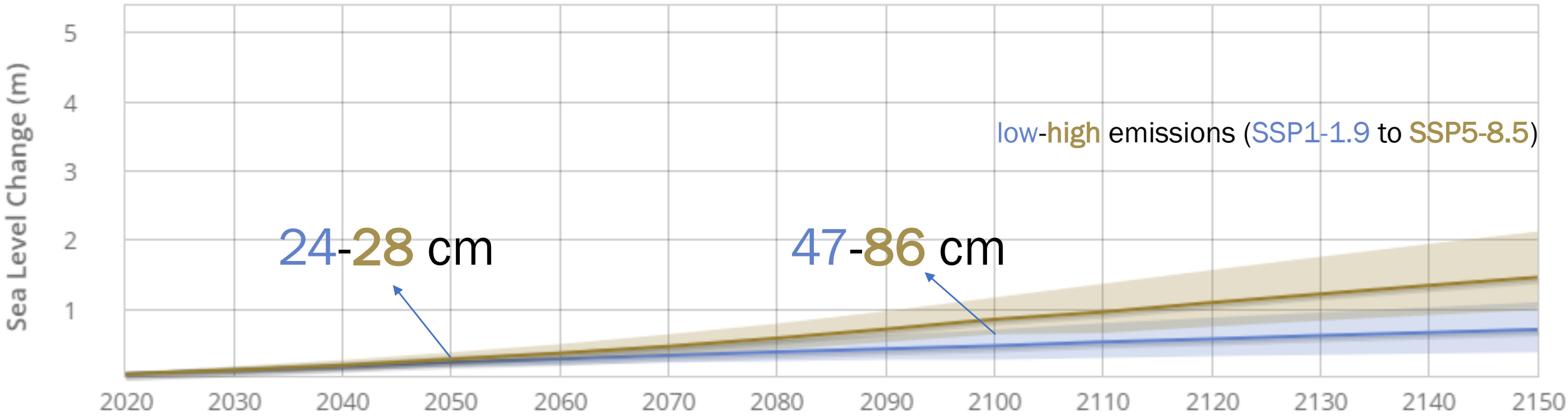


Global mean sea level rise and its possible impact on coastal adaptation.

Deltares, 2020

- **Sea-level rise: future projections**

Sea level projections low-high emissions (SSP1-1.9 to SSP5-8.5)
24-28 cm in 2050 to 47-86 cm in 2100



Sea-level Rise 2050 & 2100

2050 low-high emissions are similar (24-28 cm)
2100 low-high emissions show different flooded areas (47-86 cm)

Gap: Elevation map is old

Storms and tropical cyclones

Now

1/100 years causing severe damage

2100

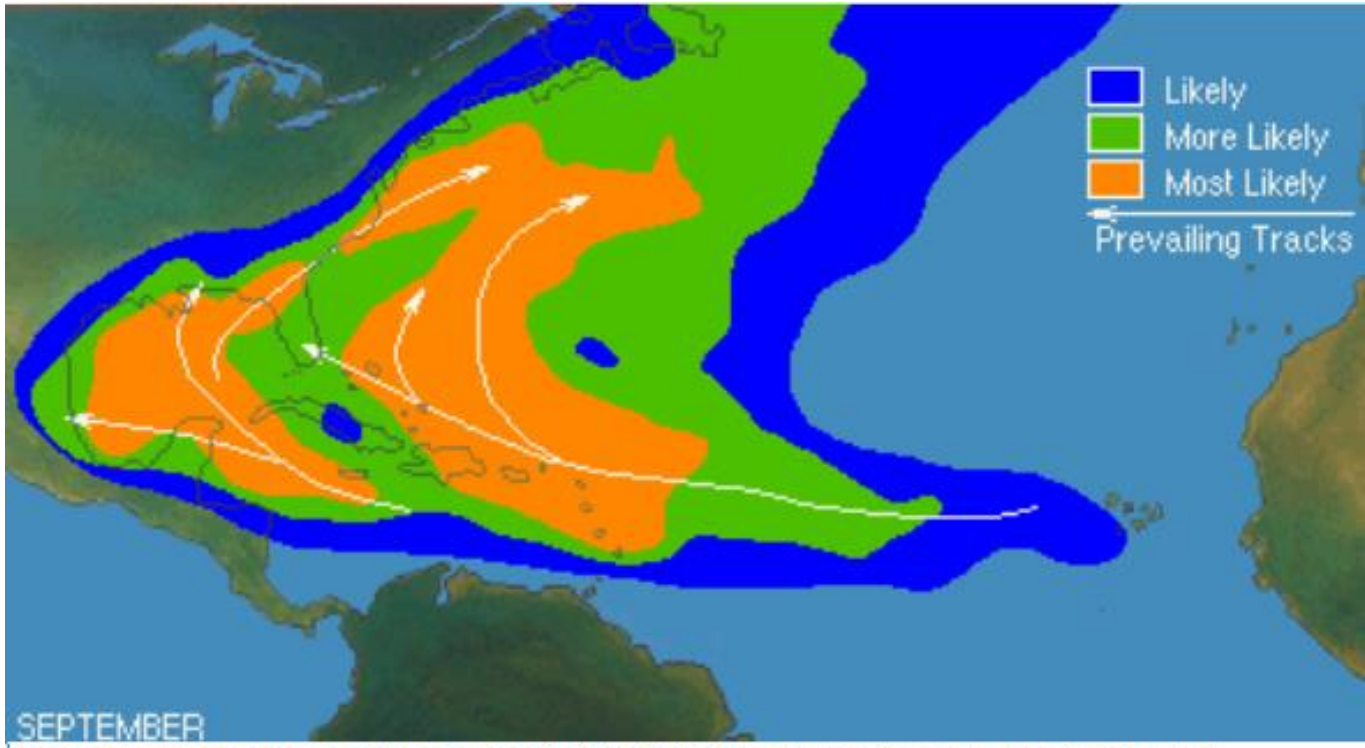
+ more intense with more rainfall

Tropical cyclones

Historical analysis:

- **Once every four years** a tropical cyclone occurs within a radius of 150 kilometers, but mostly passing to the north of the islands **without causing severe weather**.
- Roughly once **every 100 years**, **considerable damage** is experienced by tropical cyclones passing over or just south of the islands.

Projections: more intense **with more rainfall**
- Uncertain change in frequency and no expected change in movements (tracks) near Curaçao



Area of origin and general movement of Atlantic tropical cyclones during September

Storm surge

Now	2100
~0.50 meters	~ 1.50 meters

Storm surge 2100

At present: ~50-75 cm surge setup
2100 surge mainly **related to sea level rise**
It shows the area with **temporary floods**
Gap: Elevation map is old