

Some questions on future climate change in Rwanda

Dr. Timmo Gaasbeek

Embassy of the Kingdom of the Netherlands

Climate trends

According to Cole et al (2011)

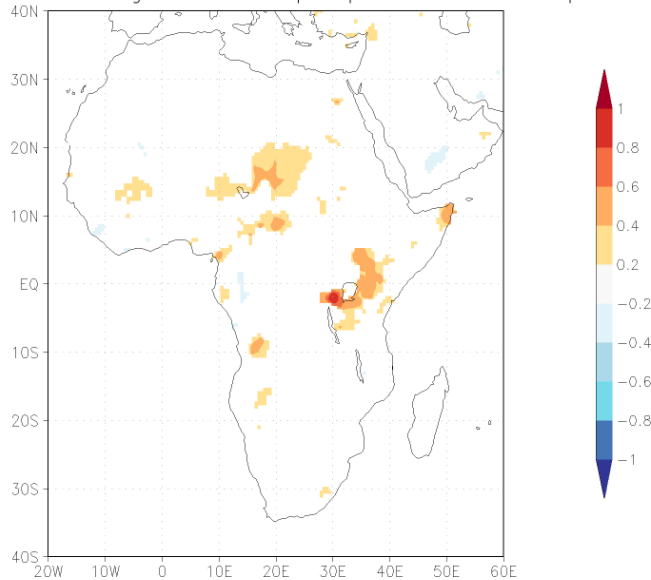
- Temperature increased by 1.4 °C since 1970, expected to increase
- Rainfall stable, expected to increase

Temperature trends

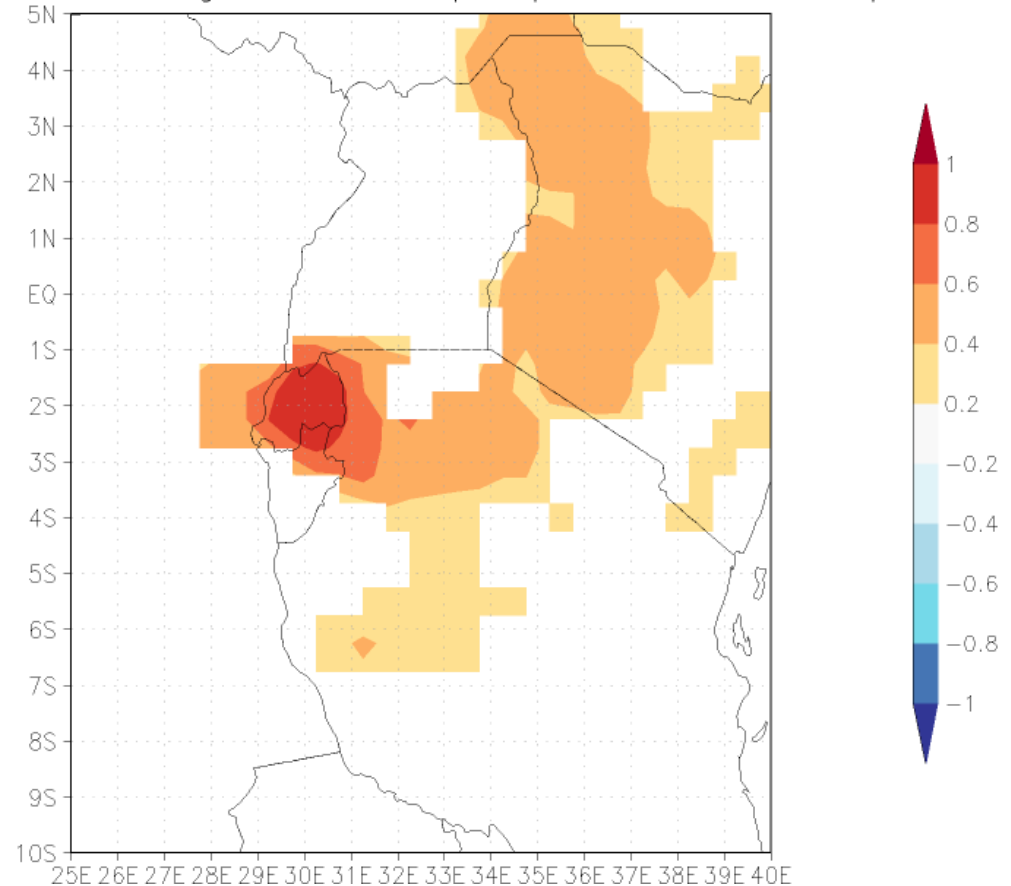
- Abnormal increase in temperature likely caused by deforestation and urbanisation
- Since about 2010, warming has slowed down
- **Different datasets give different pictures**
- Differential warming changes pressure, changes winds, could change rain?

Rainfall over Rwanda mostly correlates to rainfall over Rwanda

corr Jan-Dec averaged GPCC 0.5 precipitation 29-31E -2.5--1.5N mean
with Jan-Dec averaged GPCC 0.5 precipitation 1970:2016 $p < 10\%$



ec averaged GPCC 0.5 precipitation 29-31E -2.5--1.5N mean
Jan-Dec averaged GPCC 0.5 precipitation 1970:2016 $p < 10\%$



Most big showers come from Lake Victoria

- The following images are from www.accuweather.com, taken on 14 March 2019 between 02:55 and 14:55

Rwanda Satellite



PLAY ▶

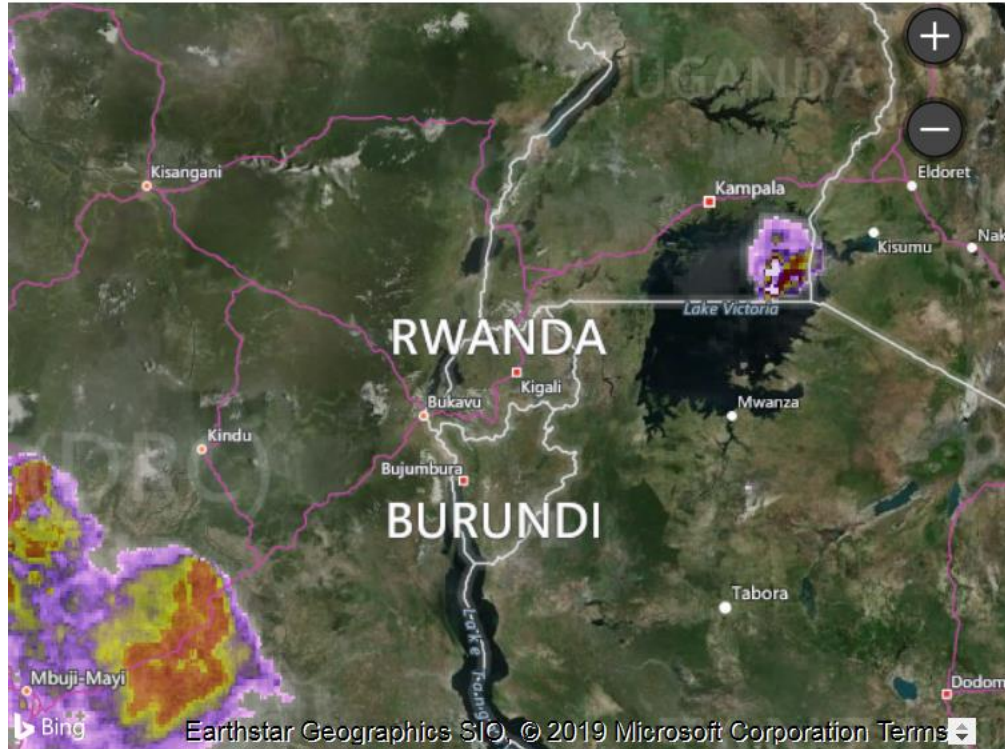
2:55

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6:55



Rwanda Satellite



PLAY ▶

2:55

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Rwanda Satellite



PLAY ▶

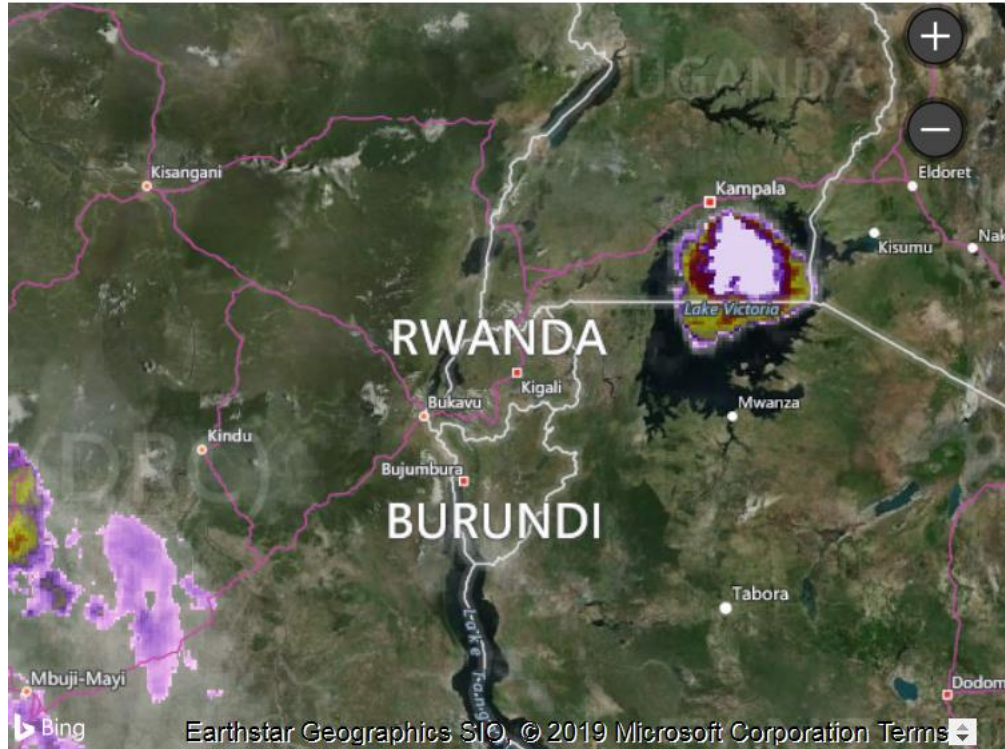
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Rwanda Satellite



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Rwanda Satellite



PLAY ▶

2:55

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6:55



Clouds

Low

High

Rwanda Satellite



PLAY ▶

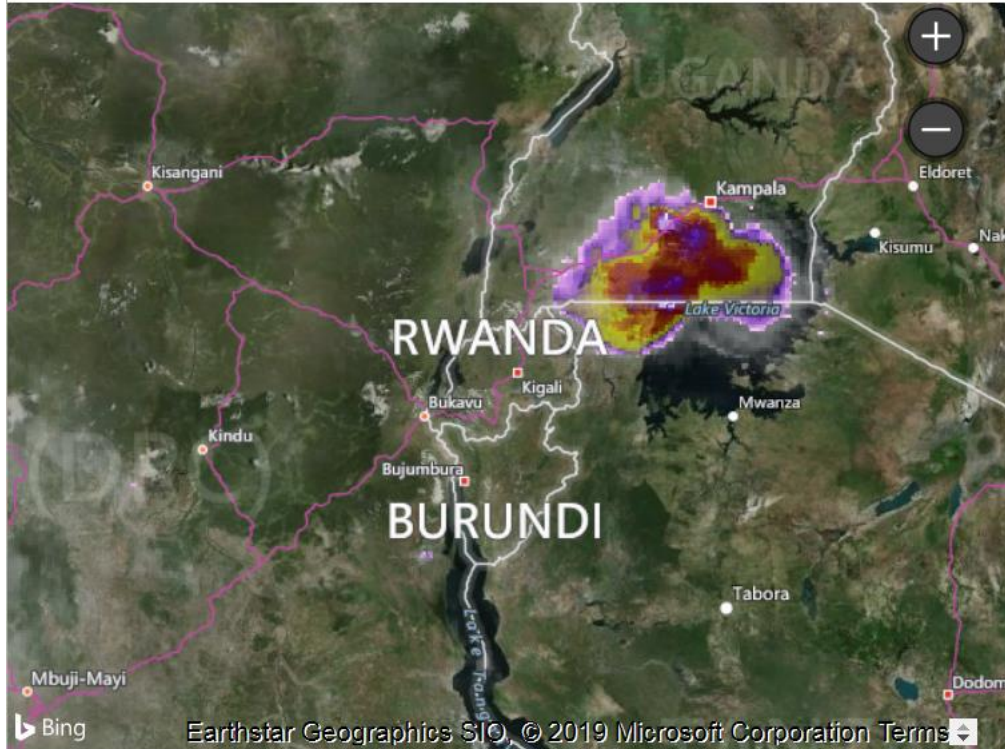
7:55

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Clouds

Low

High

?

7:55

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Rwanda Satellite



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Earthstar Geographics SIO, © 2019 Microsoft Corporation Terms

Clouds

Low

High

Rwanda Satellite



PLAY ▶

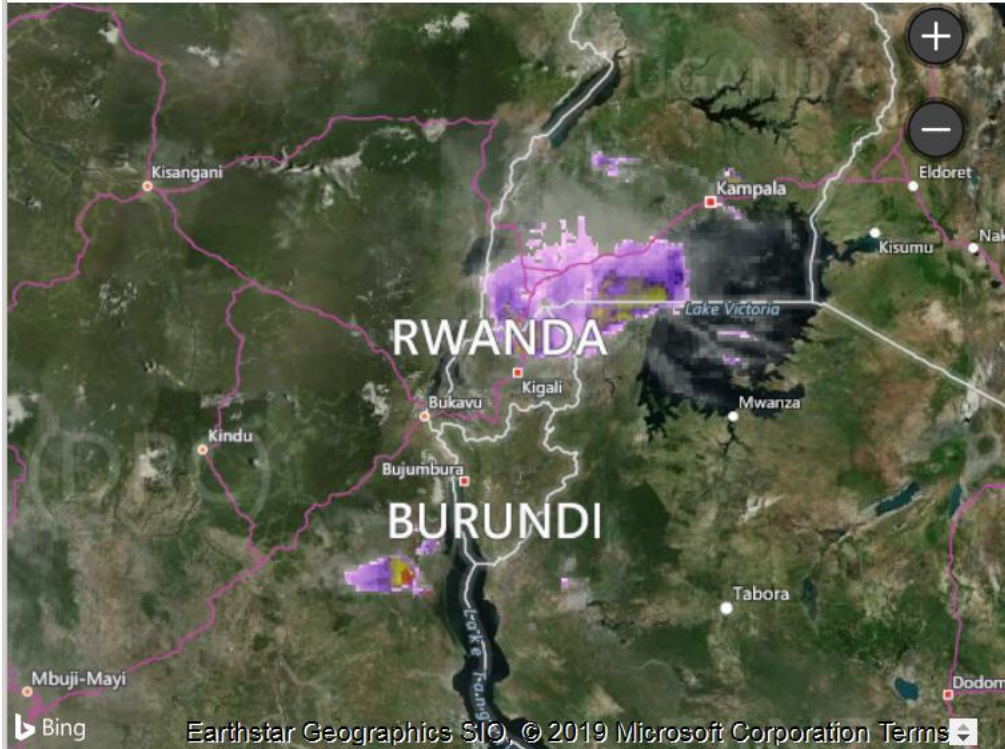
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Earthstar Geographics SIO, © 2019 Microsoft Corporation Terms



Rwanda Satellite



PLAY ▶

7:55

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Clouds

Low

High

Rwanda Satellite



PLAY ▶

10:55

11:55

12:55

1:55

2:55



Clouds

Low

High

Rwanda Satellite



PLAY ▶

10:55

11:55

12:55

1:55

2:55



Clouds

Low

High

Rwanda Satellite



PLAY ▶

10:55

11:55

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2:55



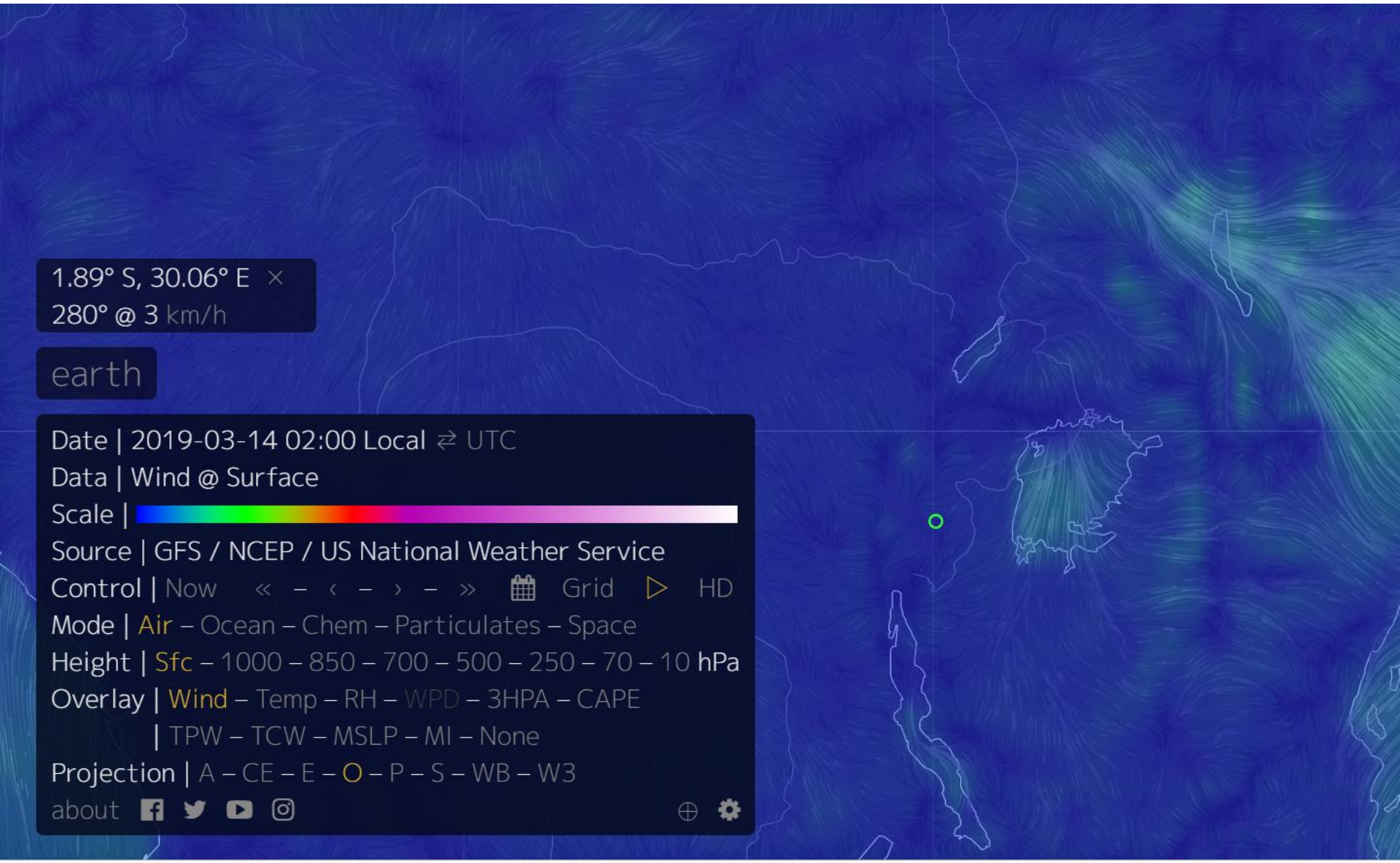
Earthstar Geographics SIO, © 2019 Microsoft Corporation Terms

Clouds

Low

High

Surface winds in the night



High level winds in the day

1.89° S, 30.06° E ×
95° @ 16 km/h

earth

Date | 2019-03-14 11:00 Local ⇌ UTC

Data | Wind @ 700hPa

Scale | 

Source | GFS / NCEP / US National Weather Service

Control | Now << < > >>  Grid  HD

Mode | Air – Ocean – Chem – Particulates – Space

Height | Sfc – 1000 – 850 – 700 – 500 – 250 – 70 – 10 hPa

Overlay | Wind – Temp – RH – WPD – 3HPA – CAPE

| TPW – TCW – MSLP – MI – None

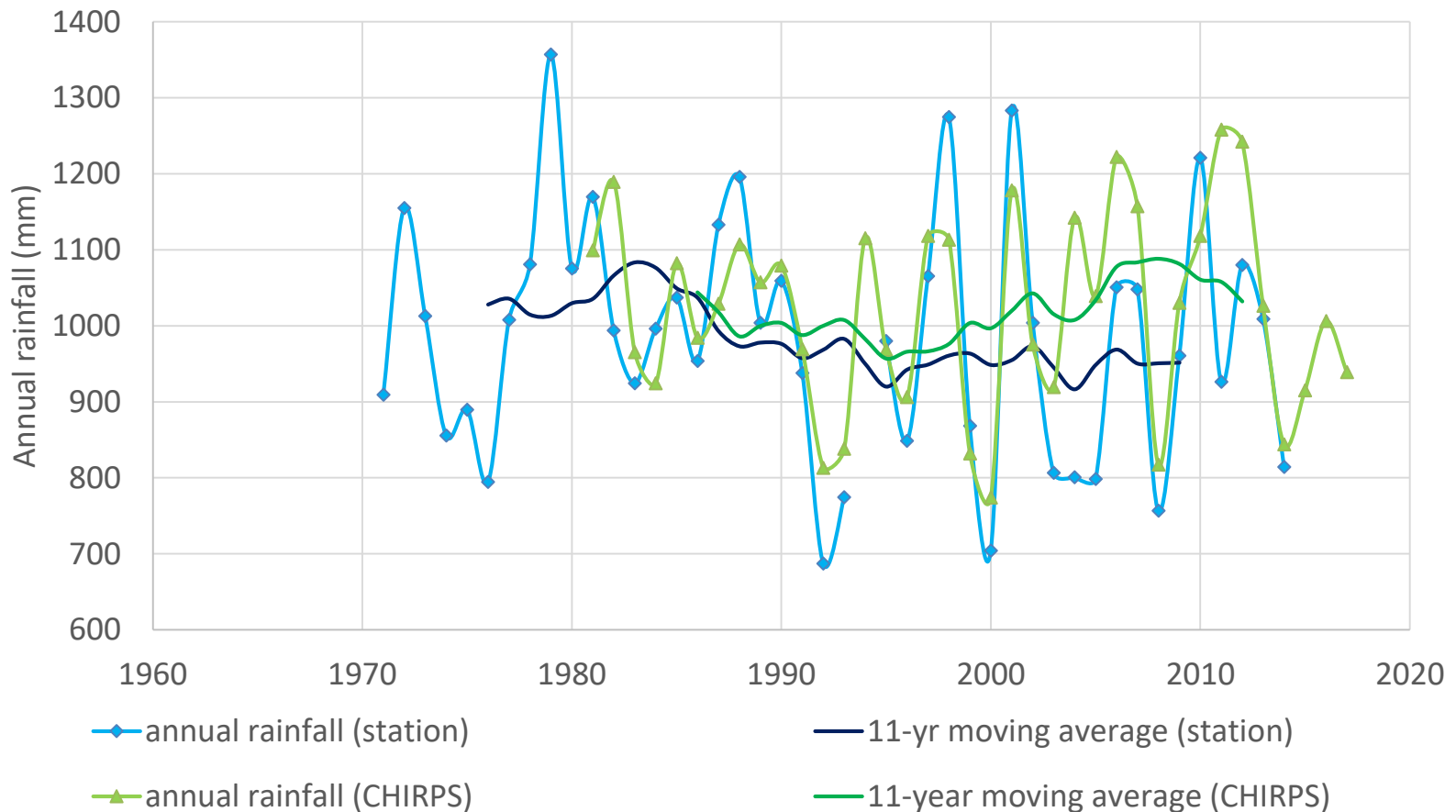
Projection | A – CE – E –  – P – S – WB – W3

about    



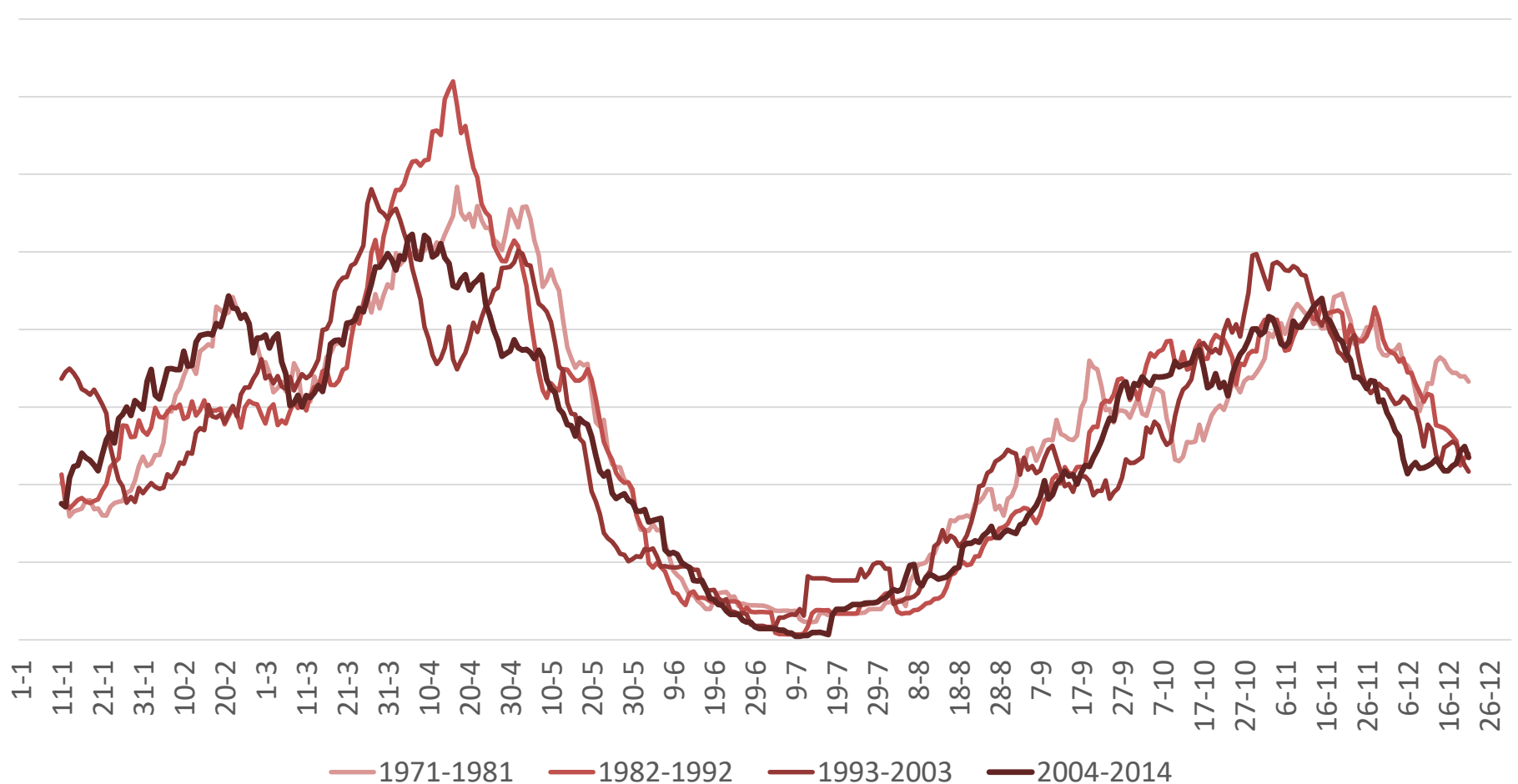
Rainfall trends

- Rainfall fluctuates from year to year
- Station data indicates decline, CHIRPS indicates stable trend



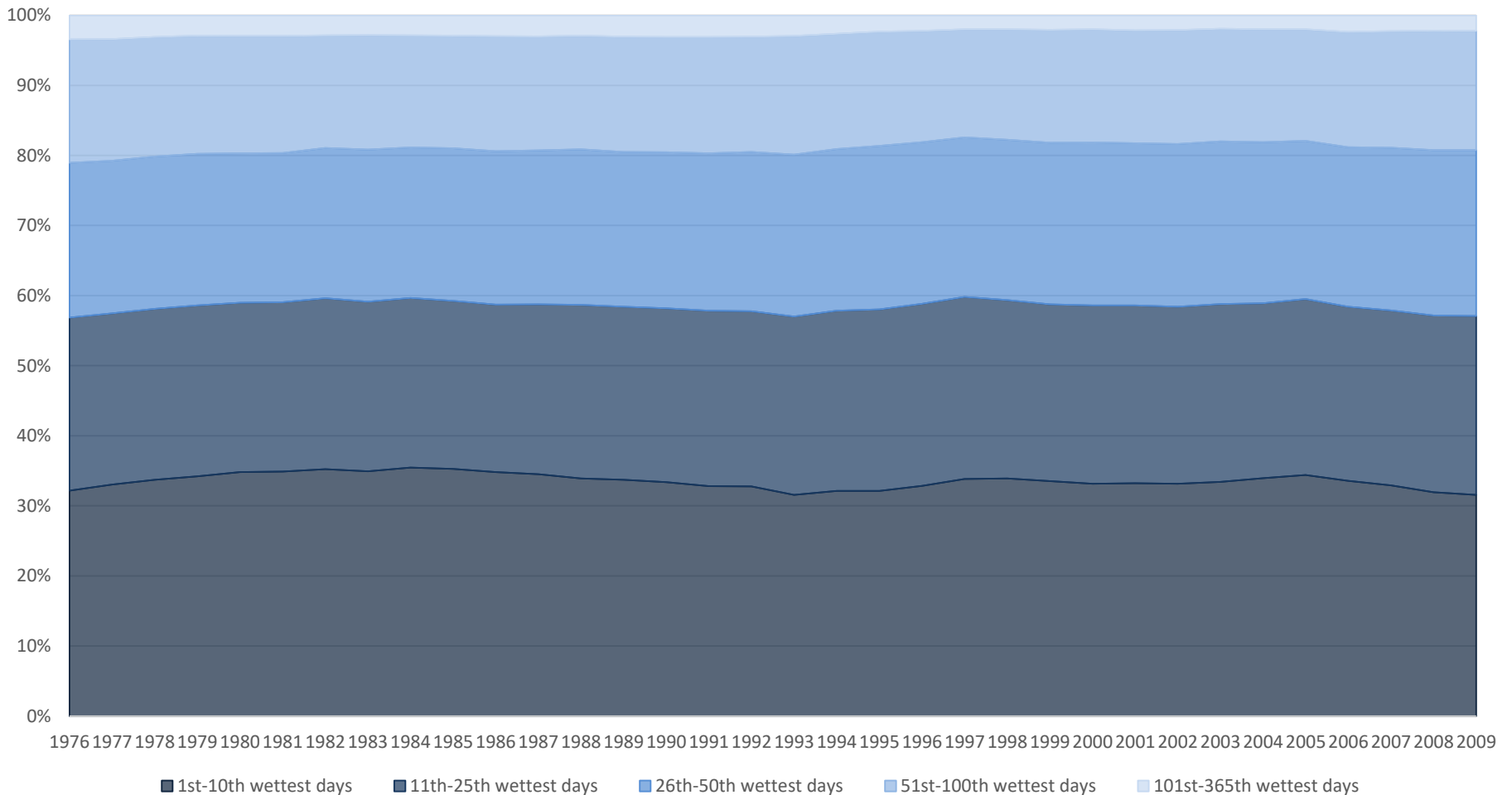
Changes within the year

21-day moving average rainfall (mm/day) over time



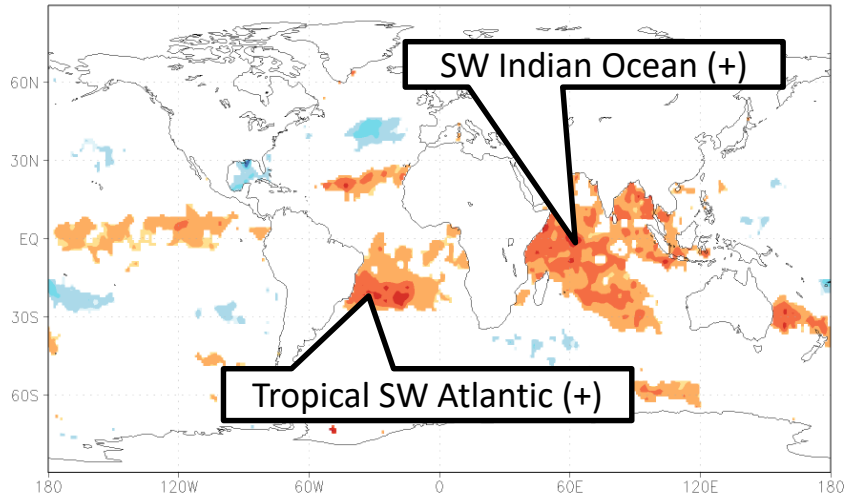
Peak rainfall has not changed despite substantial warming

11-year moving average percentage of annual rainfall (Kigali station)

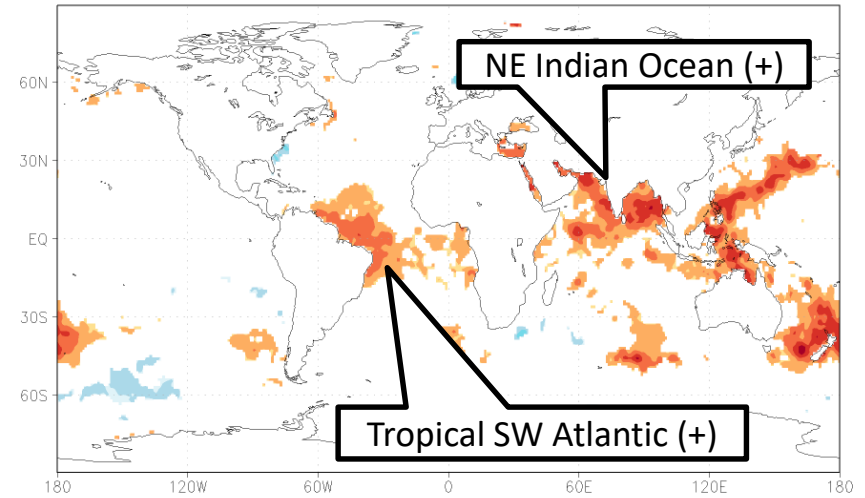


SST correlations Feb-May

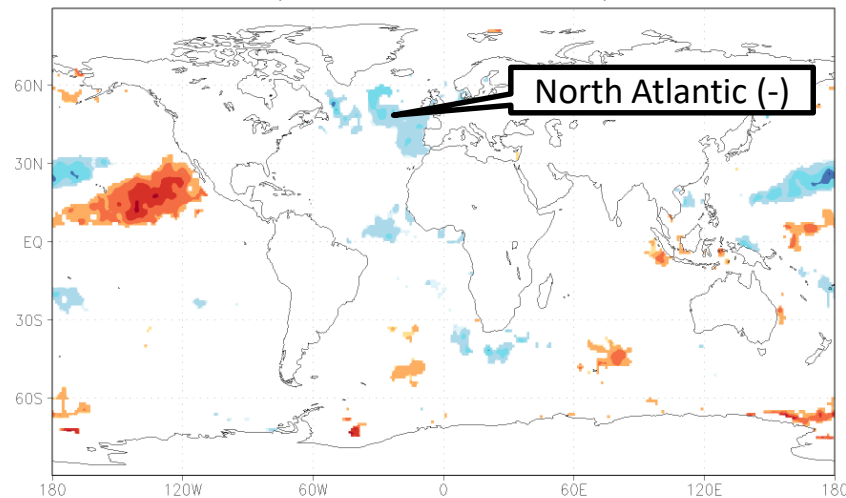
corr Feb CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Feb HadISST1 SST 1982:2018 $p < 10\%$



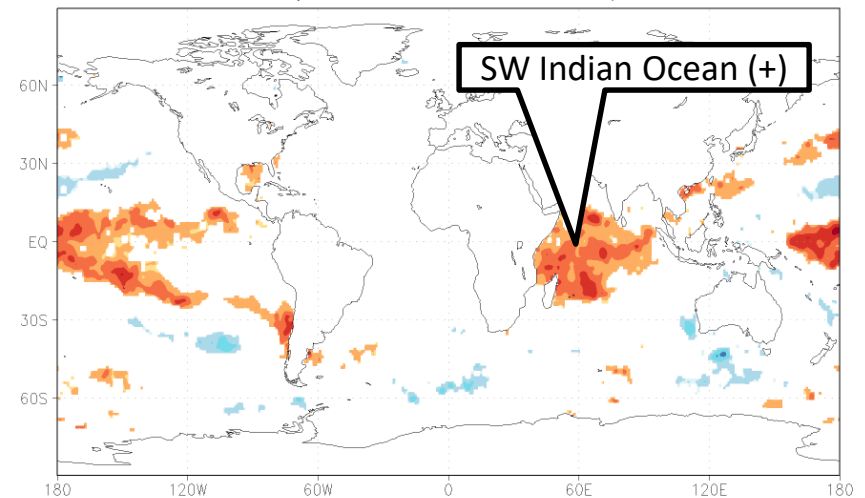
corr Mar CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Mar HadISST1 SST 1982:2018 $p < 10\%$



corr Apr CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Apr HadISST1 SST 1982:2018 $p < 10\%$

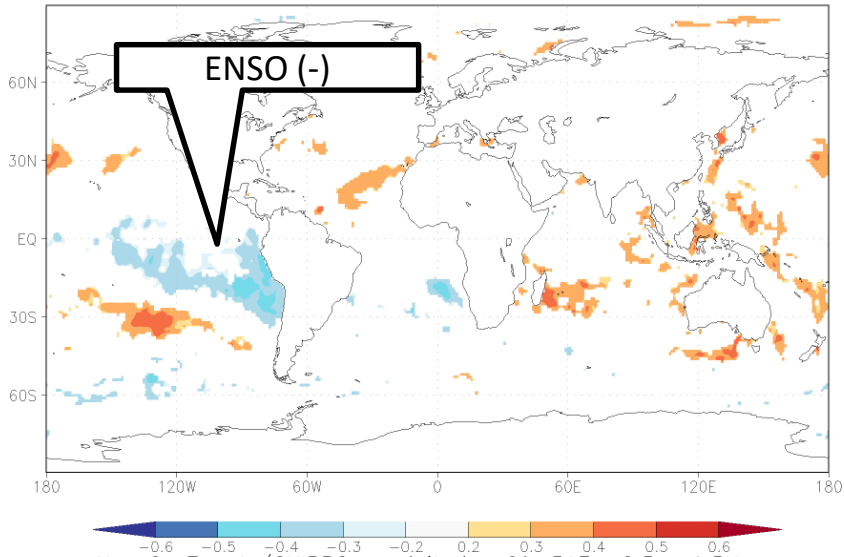


corr May CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with May HadISST1 SST 1982:2018 $p < 10\%$

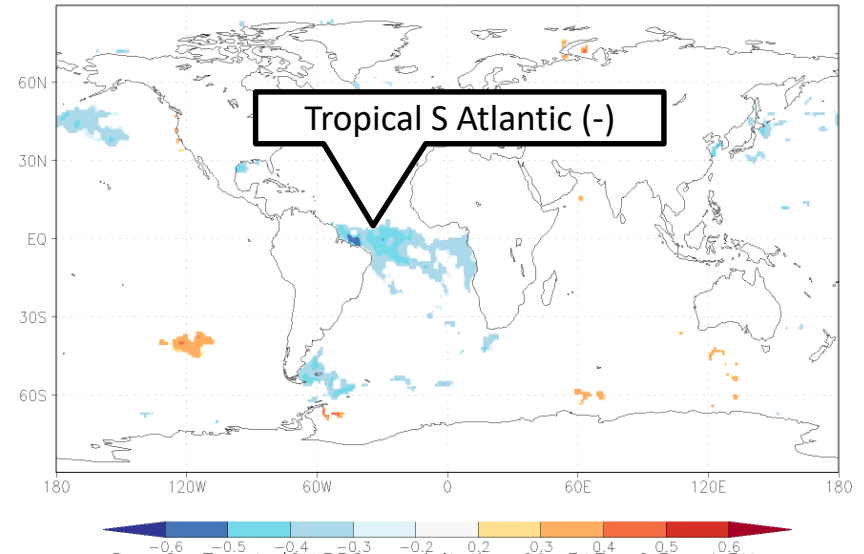


SST correlations Sep-Dec

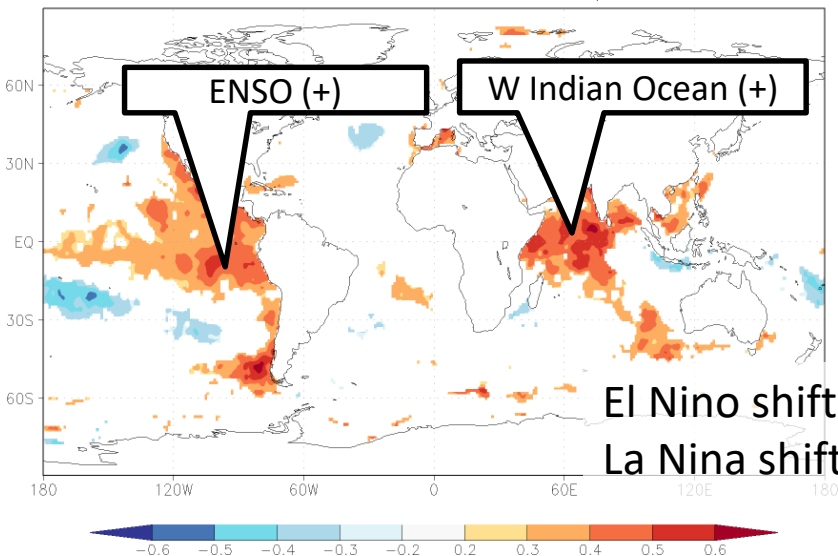
corr Sep CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Sep HadISST1 SST 1982:2018 $p < 10\%$



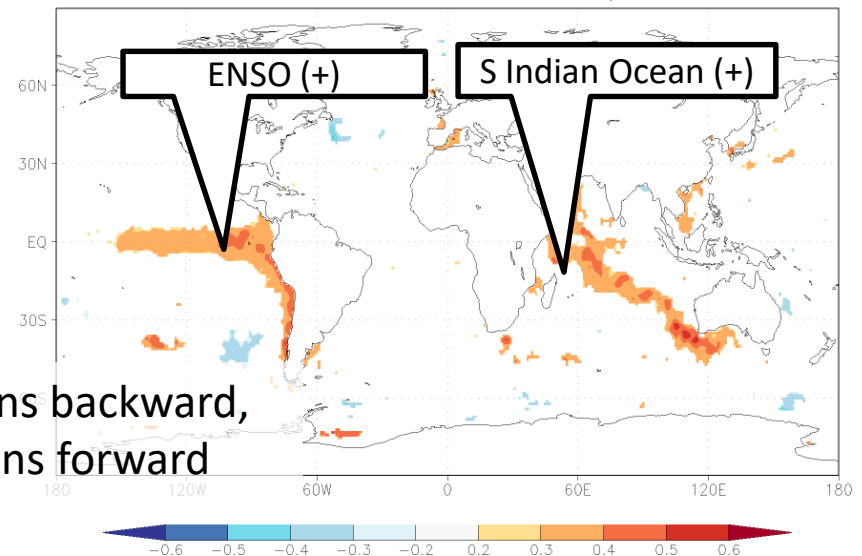
corr Oct CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Oct HadISST1 SST 1982:2018 $p < 10\%$



corr Nov CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Nov HadISST1 SST 1982:2018 $p < 10\%$



corr Dec CenTrends/CHIRPS precipitation 29–31E –2.5––1.5N mean
with Dec HadISST1 SST 1982:2018 $p < 10\%$



El Nino shifts the rains backward,
La Nina shifts the rains forward

Questions for further study

- Which datasets are reliable?
- What do these data tell us about regional changes?
- What else explains rainfall variability?
- Can we quantify the effect of land use change (and landscape restoration)?
- What does all this mean for future expectations?