WASCAL
West African
Science Service Centre on
Climate Change
and Adapted Land Use

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Meteorological and climate data analysis

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I- Spatial analysis of Climate data over West Africa

A- Climatology of temperature

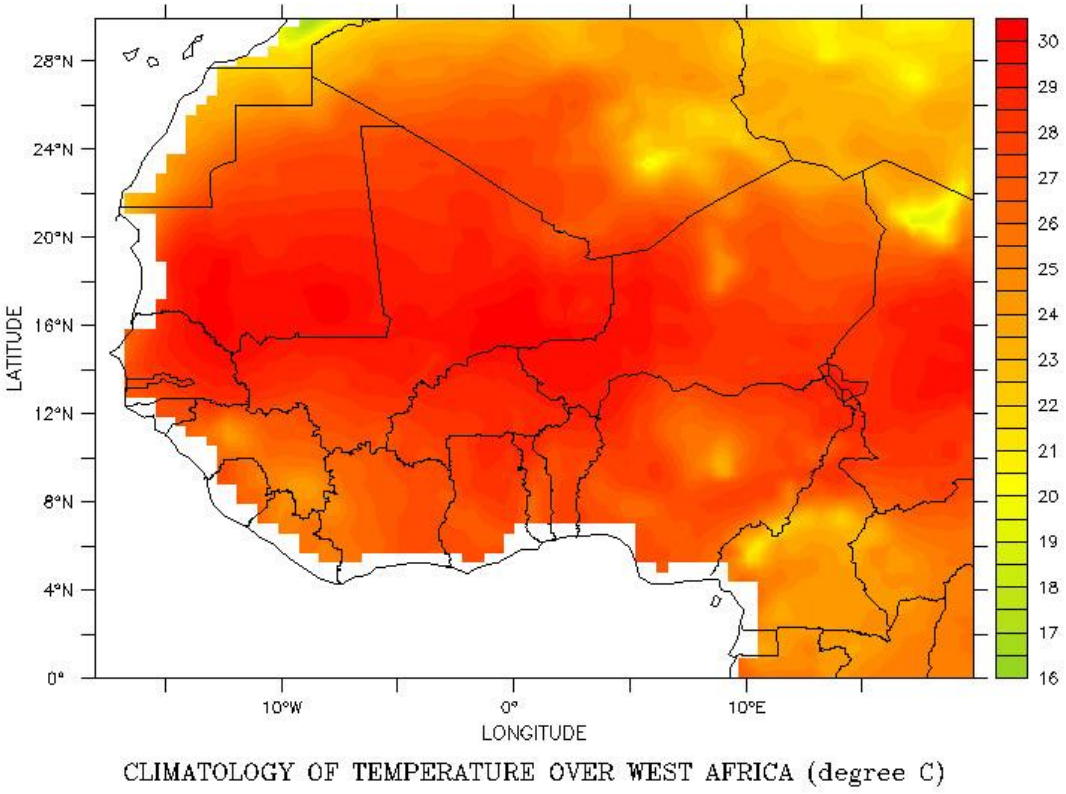

Figure 1

Comment:

The figure above is the climatology of the near surface temperature of West Africa. The reference period considered to compute the climatology is the WMO's one: from 1981 to 2010. This climatology varies from 16°C for the coldest areas to 30°C for the warmest ones. We can distinguish 3 main parts.

The highest values are observed in the Sahelian band more precisely between 12° and 16°N covering countries such as Mauritania, Mali, Niger and Chad.
About the lowest values, they are distributed on both sides of the first subregion, with a large part in the south Maghreb and a small part in Cameroon. Thus, the coldest areas are found in Morocco, Algeria, and Libya (for the Maghreb).

The last part is the one concerning the regions where the normal temperature tends to approximately 23-24°C approximately. This is the majority of a large part of the Gulf of Guinea concentrated between 4° and 10°N.

B- Climatology of precipitation

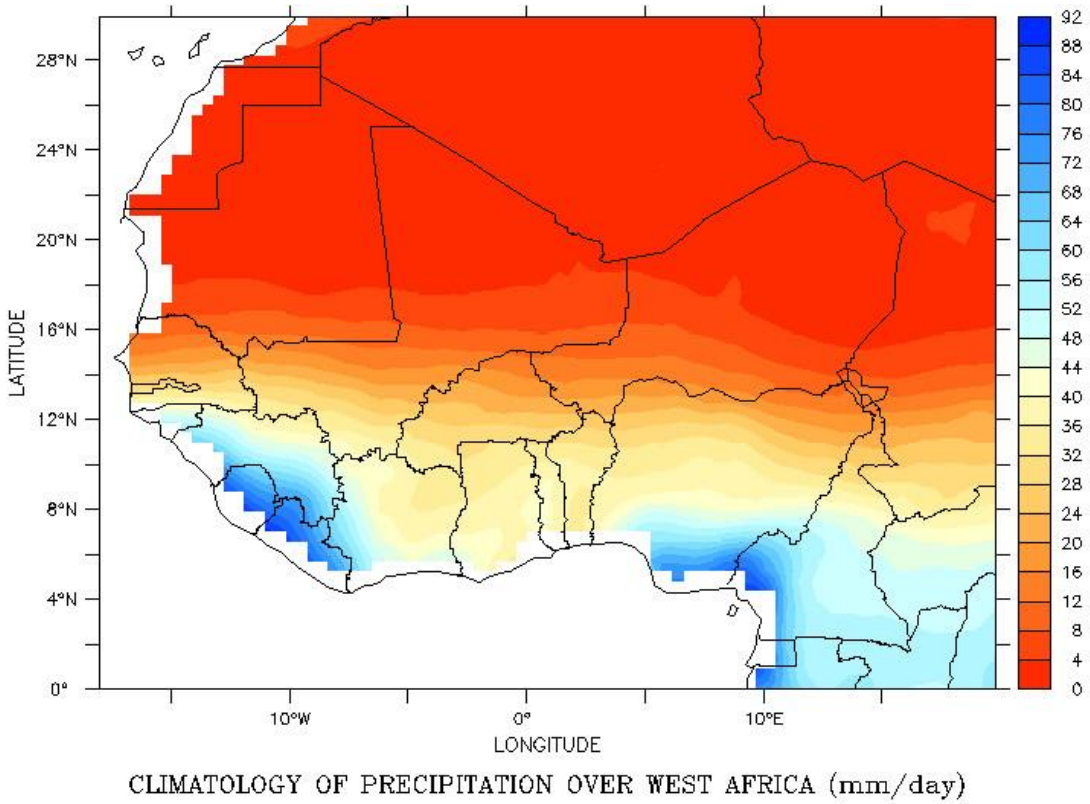

Figure 2

Comment:

The figure above shows the rainfall climatology over west Africa. The reference period is 1981-2010. The values range grows from 0 mm to 92 mm of rainfall per day. The observation here is that the further one moves away from the coastal zone by leaving the Atlantic Ocean (from the South) towards the Maghreb, rainfall becomes scarcer. We can observe a negative precipitation gradient from the coast to the north. We can distinguish 3 main regions according to the distribution of normal values.

The largest area is the one where the normal value has been relatively low during the 30 years considered. This zone extends from 14° to 30°N and includes countries such as Mauritania, Mali, Niger, Algeria and Chad. The values in this zone are around 12 mm per day.

Then, a less important area is the one where the rainfall values are around 36 mm per day during the considered period. This is the large part of the Gulf of Guinea (Cote d'Ivoire, Togo, Benin, Ghana, etc.), the South Sahel (Burkina Faso, South Mali, Gambia, South Senegal, etc.).

Finally, the smallest zone, corresponding to the one where the precipitation has been sufficiently abundant during the considered period. It includes disparate countries such as Guinea, South Nigeria, Cameroon, West Gabon and North West Congo. Here, the values can grow up to 92 mm per day as in the case of Liberia and West Cameroon.

II- Climate trend and Signal analysis

A- Temperature anomaly

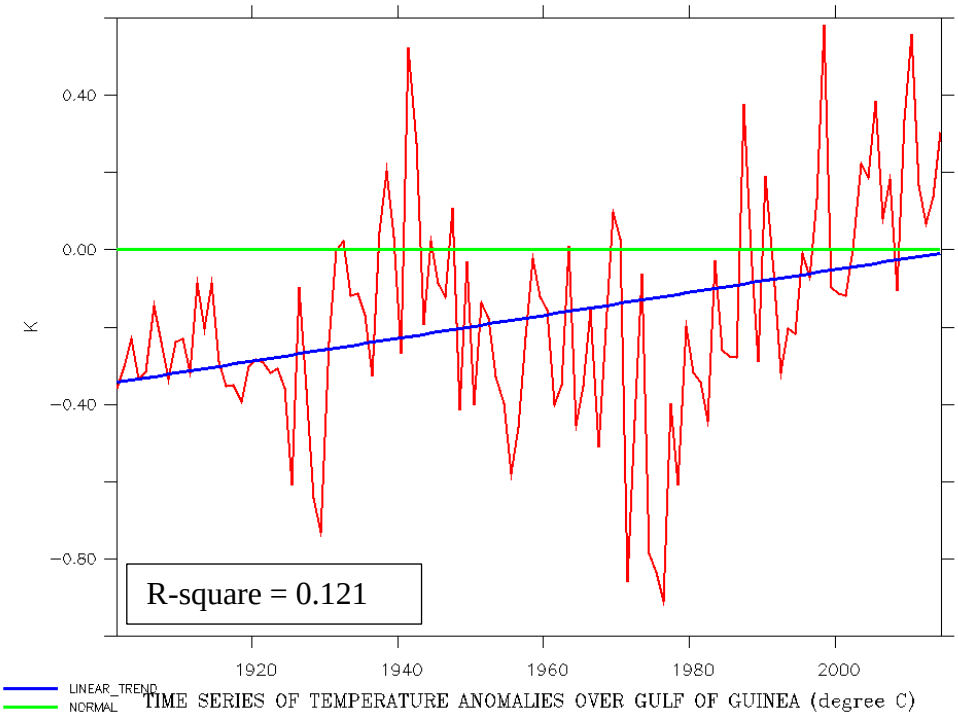

Figure 3

Comment:

The figure above is the plot of the (non-standardised) annual anomalies of near surface temperature of the Gulf of Guinea, analysed on time series from 1901 to 2014. It is the deviation (difference) between the annual observed values and the climatology. The considered period to compute the climatology is 1981 – 2010. We have anomalies growing from -0.90° to +0.60°C.

The first observation is that the general trend is going upward as demonstrated by the drawn linear regression (positive slope). This involves the years are going warmer in the Gulf of Guinea.

Taking in account the distribution on both sides of the normal value, we can make a second observation by dividing the whole timeseries in 4 subperiods:

- **From 1901 to 1938:**

During this period, we have negative values of anomalies up to -0.70°C (1930). That means that the observed values were less than the normal value (0-line). Thus, it was a cold regime.

- **From 1938 to 1950:**

During this this period, we have positive values of anomalies up to +0.50°C (1943). That means that the observed values were greater than the normal value. Thus, it was a hot regime.

- **From 1950 to 1988:**

This period was characterized by a cold regime. The values decrease down to -0.90°C (1975). That implies that the observed values were less than the normal value.

- **From 1988 to 2014:**

The values grow up to +0.60°C (1998) in this period. Thus, we have a hot regime since observed values were greater than the normal value.

Conclusion (About the R-square)

Here we have the value of the significant test value R-square is = 0.121. So, R-square is less than 0.5. It means that the linear trend doesn't significantly represent the temperature anomalies points cloud. We can recommend to go further analysis by using the standardised anomalies.

B- Precipitation anomaly

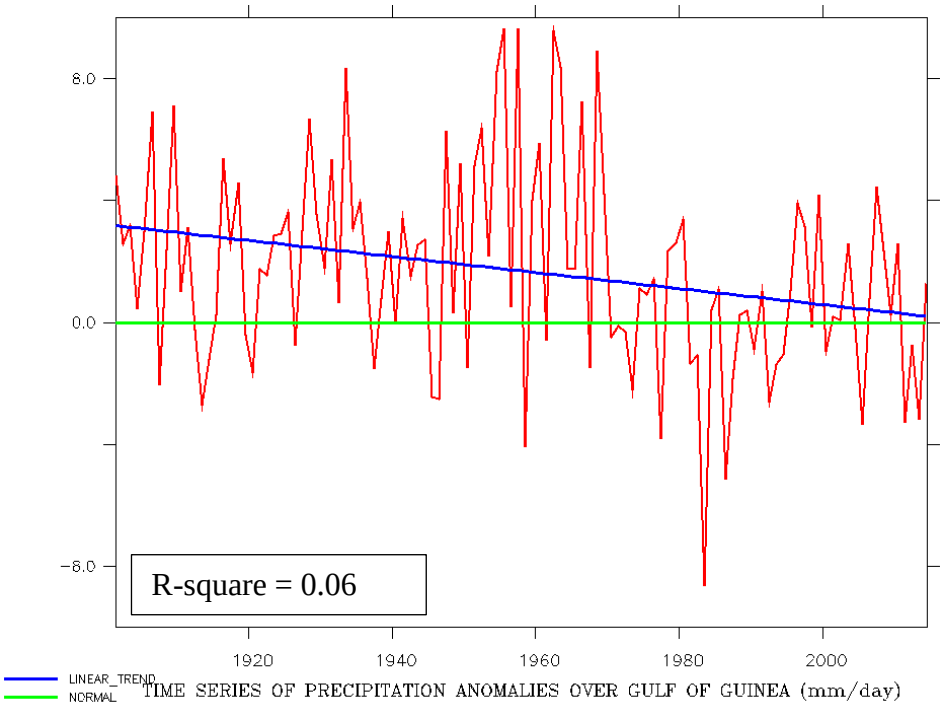

Figure 4

Comment:

The figure above is the plot of the (non-standardised) annual anomalies of temperature on the Gulf of Guinea, analysed on time series from 1901 to 2014. It is the deviation (difference) between the annual observed values and the climatology. The considered period to compute the climatology is 1981 – 2010. We have anomalies growing from -8.5 mm per day to +9.60 mm per day.

The first observation is that the general trend is going downward as demonstrated by the drawn linear regression (negative slope). This involves the years are going drier in the Gulf of Guinea.

Taking in account the distribution on both sides of the normal value, we can make a second observation by dividing the whole timeseries in 2 subperiods:

- **From 1901 to 1970:**

In this period, the anomalies values are mostly positive. It means that the observed values are greater than the normal value of precipitation and they tend to a positive peak of +9.60 (in 1958) mm per day. We have a rainfall regime.

- **From 1970 to 2014:**

This period is characterized by negative values of annual precipitation anomalies, meaning that the observed values are less than the normal value of precipitation. The minimum anomaly is around -8.5 mm (in 1983). Thus, we have dry regime.

Conclusion (About the R-square)

Here we have the value of the significant test value R-square is = 0.06. So, R-square is much less than 0.5. It means that the linear trend doesn't significantly represent the precipitation anomalies points cloud at all. We can recommend to go further analysis by using the precipitation standardised anomalies.