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# Are there solar signals in the African monsoon and rainfall?

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A review of areas of Africa where a signal in meteorological, hydrological or sedimentological parameters can be suspected to be of solar origin shows a variety of deposition. Nowhere is a persistent signal clearly defined, but many areas are involved: Nile basin, Ethiopian high plateau, Sahel, North and South Africa, Central and East Africa. Each area shows a repartition of rainfall distributed by successive sequences of drought and inundation, each lasting several years. Nearly all areas show a strong quasi-biennial fluctuation; in the Sahel, for instance, the mean annual river run-off in Senegal is about 2.3 years. The 11.4-year signal is also seen in many records of extreme (positive or negative) river run-off.

To test if this can be considered as the consequence of a physical process we first examine the main rainfall mechanism in the Sahel. The mechanism of Sahelian individual rainfalls (during summer monsoon) is controlled mostly by the possibility and frequency of squall line formations. Among the necessary conditions for a reasonable frequency and intensity of rainfall, the African easterly jet wind must not be too strong, because these winds have a saw effect, stop the cumulo-nimbus development and inhibit rainfall. The simplified model shows that small changes in the general atmospheric circulation can enhance or diminish the frequency of rainfall during the summer monsoon. Rain could be related to the strengthening or slowing of the African and tropical easterly jet as part of the general atmospheric circulation.

At the timescale involved the possible solar action is not a result of a change in irradiance energy of the Sun, but it seems to be changing along with its corpuscular and electromagnetic activity.

The mechanism of this discontinuous solar activity, which has a possible effect on global climate, may be found in the interaction between the low ionosphere and the high troposphere through the gravity waves of the quasi-biennial oscillation. Because electric currents in the Earth's magnetic field have opposed latitudinal displacement with their zonal direction, they tend to compress or expand the polar vortex. And because the electrojets change their west to east direction along with solar activity, they are a possible link through the following simplified process.

When and where the ionospheric electrojet gravity waves come to add their momentum to high tropospheric jets, they speed the general circulation. This could give a 'cold global situation' with a strong polar vortex and a feeble monsoon, giving more frequent droughts in Sahel.

When the situation is reversed and the electrojet direction is opposite, it tends to slow down the high tropospheric wind: a 'warm global situation' is more frequent, the Northern Hemisphere summer monsoon can expand more and droughts are less frequent.

In this proposed mechanism, one momentum is of gravity origin in the general neutral atmospheric circulation (coriolis) and the other one takes its dynamics in the electromagnetic forces (ampère) of the ionized stratosphere and ionosphere.