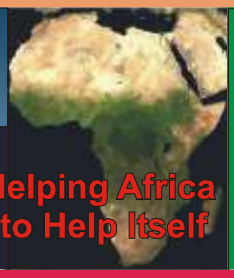
AMERICAN METEOROLOGICAL SOCIETY

10 - 14 JANUARY 2016 · 96TH ANNUAL MEETING

NEW ORLEANS, LOUISIANA, USA

Peter J. Lamb Symposium



Helping Africa to Help Itself

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

City Square, NAIROBI, KENYA

Sunspot numbers: Implications on Eastern African rainfall

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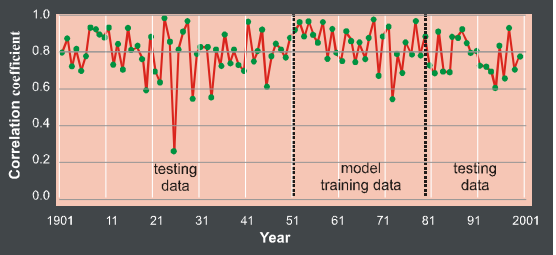
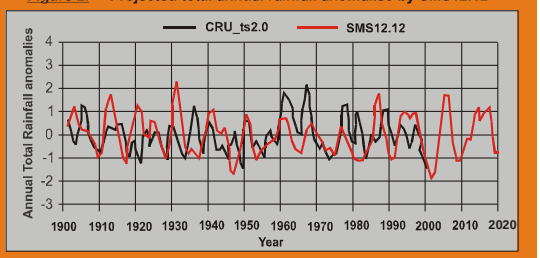
Following NASA's prediction of sunspot numbers for the current sunspot cycle[5], Cycle 24, we included sunspot numbers as an explanatory variable in a statistical model[1]. Model SMS12.12 is based on fitting monthly rainfall values with factors and co-variates obtained from solar-lunar geometry values and sunspot numbers. Figure 1 shows how the model demonstrates high predictive skill in projecting monthly total rainfall achieving a correlation coefficient above of 0.9 between model estimates and CRU_ ts2.0 (Kenya monthly total 1901-2000[7]).

Figure 1. Correlation between SMS12.12 and CRU_ts2.0



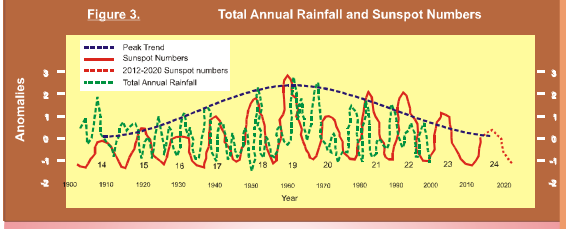
Estimates for monthly total rainfall for the period from 1901 to 2020 for Kenya indicate in Figure 2 that the model may be used not only to estimate historical values of rainfall, but also to project monthly total rainfall.

Figure 2. Projected total annual rainfall anomalies by SMS12.12



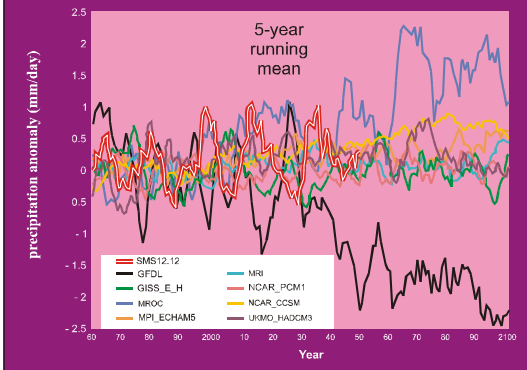
We have found that the 11-year solar sunspot cycle has an influence on the frequency and timing of extreme hydrology events in Kenya, with these events occurring every 5±2 years after the turning points of sunspot cycles. While solar declination is the major driver of annual variability, sunspots and the lunar declinations play a role in the inter-annual variability[3,4,6,8] and may have influenced the occurrence of the Sahelian drought of the mid-1980s that affected the Sahel region including the Greater Horn of Africa. Judging from the reflection symmetry, the trend of the current maximum and the turning point of the sunspot minimum at the end of the Modern Maximum in Figure 3, drought conditions similar to those of the early 1920s may reoccur in the year 2020±2.

Figure 3. Total Annual Rainfall and Sunspot Numbers



Standardized SMS12.12 estimates from 1960 to 2050 were overlaid on those generated by General Climate models of the IPCC AR4 AOGCMs projected Sahel rainfall[2]. In Figure 4, regional severe hydrology events can be seen in the model series.

Figure 4. Projected Annual Sahel precipitation anomalies from the IPCC AR4 AOGCMs and SMS12.12



Acknowledgement

We thank the following for providing data: the Kenya Meteorological Department (Nairobi, Kenya), the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA), the Climate Research Unit (CRU) of the University of East Anglia (UK), and the Solar Influences Data Analysis Center (SIDC) of the Royal Observatory of Belgium.

We also thank the following for providing software: R-Foundation for Statistical Computing at the National Centre for Atmospheric Research (NCAR) and Unidata for the Integrated Data Viewer at the Program Center, University Corporation for Atmospheric Research (UCAR).

Peter J. Lamb.
August 4th,2011.
During NCAR ISP Summer Colloquium on African Weather and Climate.

"Africa can help itself by understanding its climatic circumstances"

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