Long Time-Series Indicator of Agricultural Drought for the Greater Horn of Africa

Children in Uganda stare down at their reflections in a puddle of water at Cet Kana, a decongestion camp for internally displaced persons in Gulu District, northern Uganda, August 2006. In this region, drought limits already restricted access to water. © Manoocher Deghati/IRIN

Why is the AST pursuing this project? Extreme weather events such as heat waves, floods, droughts, forest fires, and landslides affect several hundred million people in the developing world, often restricting their access to food. Drought, in particular, is a climatic disaster increasing in frequency in the Greater Horn of Africa (GHA). In 2011, for example, drought contributed to full scale famine in southern Somalia and emergency and crisis conditions in neighboring countries. About 12 million people required assistance from the international community.

Emergency managers need a way to accurately assess the relative severity of current drought events and answer critical questions such as 'how severe will this drought be?' 'how does it compare to past droughts?' and 'what effect will this drought have on crop yields?' Estimations of rainfall variations are key to drought early warning and environmental monitoring. It is important to place an evolving dryer-than-normal season into historical context in order to analyze the severity of rainfall deficits. Until now, such analyses used rainfall data from specific points on the Earth's surface because that was all that was available. That data, however, fails to show the region-wide variability needed to reveal comprehensive rainfall patterns.

What does this project do? This project produces an unprecedented continuous 30-year record of satellite rainfall estimates for the GHA and the African continent, making it possible to accurately assess and monitor large-scale rainfall patterns and how these patterns may be evolving in the region as a result of climate change. The project applies these products in a crop water balance model for a water resources satisfaction index (WRSI) to estimate crop yields. It then develops an interactive application for viewing and graphing the products in the Early Warning Explorer (EWX), a web-based user interface for time series remote sensing monitoring products. EWX will be available via SERVIRGlobal.net for end-users to perform similar analyses that will meet real-time monitoring needs.

How will the AST perform this project? The team is using recently-released, globally consistent thermal infrared data from NOAA geostationary satellites and high-resolution global precipitation climatology to create an approximately 30-year time series of 5-day rainfall grids at 0.05 degree resolution for the African continent. They are applying these products in a WRSI to estimate crop yields and producing a set of long time-series drought indicators for the GHA, and then for the Sahel and Southern Africa. To develop the original WRSI, USAID's Famine Early Warning Systems Network (FEWS NET) compared rainfall amounts to crop yield data over the past 10 years and then developed a model based on the correlations. With the new dataset created in this SERVIR project, this model can be refined based on 30 years' worth of observational data and therefore provides much more accurate estimates of agricultural drought severity.

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Where is this project used? East Africa
When will it be available? When and where (link)
Who are the co-developers? FEWS NET
Who are the contributors/partners? Ministries of Agriculture in Kenya, Ethiopia, Uganda, Sudan
Who uses it? IGAD Climate Prediction Center (ICPAC), Ministries of Agriculture in Ethiopia, Kenya, Somalia Water and Land Information Management (SWALIM), Kenya Meteorological Department, USAID FEWS NET
What Earth observations and NASA products contributed to this application? Tropical Rainfall Measuring Mission (TRMM) precipitation data, Climate Prediction Center morphing technique (CMORPH) rainfall data, TAMSAT African Rainfall Climatology and Time-Series (TARCAT) rainfall data, Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN) precipitation estimations, a custom instance of NASA Land Information System (LIS) inside the FEWS NET Land Data Assimilation System (FLDAS), SERVIR historical time series of Potential Evapotranspiration (PET), NOAA operational Rainfall Estimation version two (RFE2.0), European Centre for Medium-Range Weather Forecasts (ECMWF) rainfall estimates, FTIP (a combination of TRMM V6 and Unbiased InfraRed Precipitation (UIRP) estimates)

Last updated: May 2013