Application of seasonal rainfall forecasts and satellite rainfall observations to crop yield forecasting for Africa

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Rain-fed agriculture is of utmost importance in sub-Saharan Africa; the FAO estimates that over 90% of food consumed in the region is grown in rain-fed farming systems. As the climate in sub-Saharan Africa has a high interannual variability, this dependence on rainfall can leave communities extremely vulnerable to food shortages, especially when coupled with a lack of crop management options. The ability to make a regional forecast of crop yield on a timescale of months would be of enormous benefit; it would enable both governmental and non-governmental organisations to be alerted in advance to crop failure and could facilitate national and regional economic planning. Such a system would also enable individual communities to make more informed crop management decisions, increasing their resilience to climate variability and change. It should be noted that the majority of crops in the region are rainfall limited, therefore the ability to create a seasonal crop forecast depends on the ability to forecast rainfall at a monthly or seasonal timescale and to temporally downscale this to a daily time-series of rainfall.

The aim of this project is to develop a regional-scale seasonal forecast for sub-Saharan crops, utilising the General Large Area Model for annual crops (GLAM). GLAM would initially be driven using both dynamical and statistical seasonal rainfall forecasts to provide an initial estimate of crop yield. The system would then be continuously updated throughout the season by replacing the seasonal rainfall forecast with daily weather observations. TAMSAT satellite rainfall estimates are used rather than rain-gauge data due to the scarcity of ground based observations. An important feature of the system is the use of the geo-statistical method of sequential simulation to create an ensemble of daily weather inputs from both the statistical seasonal rainfall forecasts and the satellite rainfall estimates. This allows a range of possible yield outputs to be generated, thus describing the likely accuracy of the forecast. The system is currently under development for Ethiopian maize with the potential to expand to other African countries.