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Session: Hydrometeorological Extremes: drought analysis and prediction

Title: Improved rainfall estimates and predictions for 21st century drought early warning

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As temperatures increase, the onset and severity of droughts is likely to become more intense. Improved tools for understanding, monitoring and predicting droughts will be a key component of 21st century climate adaption. The best drought monitoring systems will bring together accurate precipitation estimates with skillful climate and weather forecasts. Such systems combine the predictive power inherent in the current land surface state with the predictive power inherent in low frequency ocean-atmosphere dynamics. To this end, researchers at the Climate Hazards Group (CHG), in collaboration with partners at the USGS and NASA, have developed i) a long (1981-present) quasi-global (50°S-50°N, 180°W-180°E) high resolution (0.05°) homogenous precipitation data set designed specifically for drought monitoring, ii) tools for understanding and predicting East African boreal spring droughts, and iii) an integrated land surface modeling (LSM) system that combines rainfall observations and predictions to provide effective drought early warning. This talk briefly describes these three components.

Component 1: CHIRPS
The Climate Hazards group InfraRed Precipitation with Stations (CHIRPS), blends station data with geostationary satellite observations to provide global near real time daily, pentadal and monthly precipitation estimates. We describe the CHIRPS algorithm and compare CHIRPS and other estimates to validation data. The CHIRPS is shown to have high correlation, low systematic errors (bias) and low mean absolute errors.

Component 2: Hybrid statistical-dynamic forecast strategies
East African droughts have increased in frequency, but become more predictable as Indo-Pacific SST gradients and Walker circulation disruptions intensify. We describe hybrid statistical-dynamic forecast strategies that are far superior to the raw output of coupled forecast models. These forecasts can be translated into probabilities that can be used to generate bootstrapped ensembles describing future climate conditions.

Component 3: Assimilation using LSMs
CHIRPS rainfall observations (component 1) and bootstrapped forecast ensembles (component 2) can be combined using LSMs to predict soil moisture deficits. We evaluate the skill such a system in East Africa, and demonstrate results for 2013.