# Development of a drought and yield assessment system in Kenya

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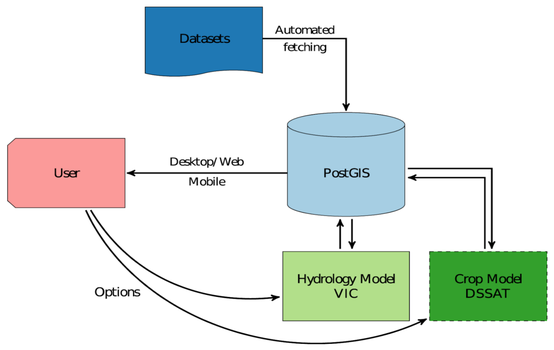
## Motivation and Objectives

- Dependence on rainfed agriculture in a highly variable climate, renders crop and livestock production vulnerable to impacts of drought in Kenya.
- Stakeholders in the region have highlighted the need for timely and actionable detailed early warning information on drought and its implication on crop productivity
- Here we apply the Regional Hydrological Extremes Assessment System (RHEAS) to estimate current and future drought conditions onset, severity, recovery, and duration) and expected productivity outlooks.

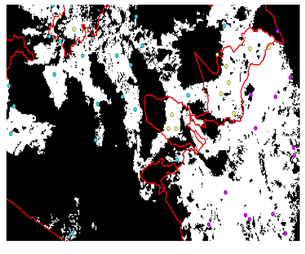
## The RHEAS Model

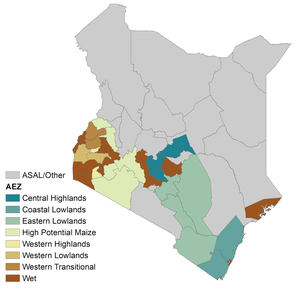
- RHEAS is an easily scalable open source system that is made up of a hydrological model (Variable Infiltration Capacity Model, VIC) and cropping system model (Decision Support System for Agro-technology Transfer, DSSAT).

Schematic diagram of the RHEAS framework




- Selection of points to run the crop model. White portions are agricultural areas as provided from a customized crop type map (maize) and points are randomly selected from within these crop masked locations.



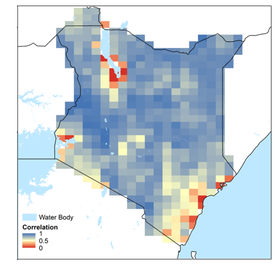


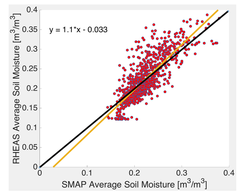

- The Ministry of Agriculture, Livestock, Fisheries and Irrigation (MOALFI) has supported the customization of the model by providing data for validation and informing estimation of inputs applied in different production zones.

In a data limited environment, a satellite driven, coupled land surface-crop model can reliably estimate **drought conditions** and **crop yield**

## Results

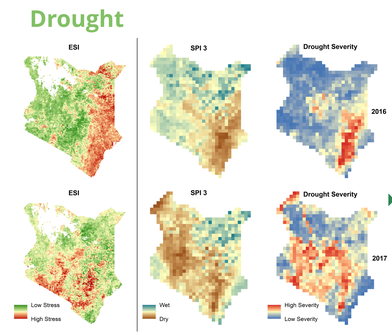
### Model Validation using SMAP



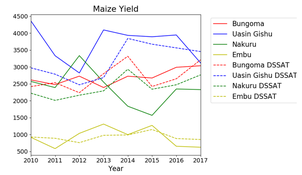

- Correlation between VIC (0-10 cm) and SMAP SM for years 2015-2017. Mostly the correlation is good (>0.75), however near water bodies the correlation drops closer to 0.

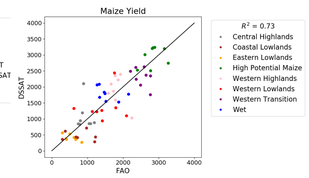
### Drought



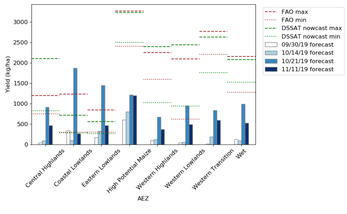

- RHEAS is used to generate drought indices and products. These are being compared against the Kenya NDMA's current drought bulletins

### Crop Yield




- RHEAS estimates maize crop yield using local management data specific agro-ecological zones. Overall, correlation are good (>0.7) with low (~2-400kg/ha) RMSE's.




- We are currently evaluating the NMME forecast skill throughout the season with MOALFI as part of the Digital Food Balance Sheet

## Conclusions

- Model analysis show results matched expected variations in yields during drought and good years and correlate well
- More work is needed to customize at the county level
- Next Steps
  - NMME/ESP forecast evaluation
  - Combined Precip forcing [CHIRPS/CHIRP/CHIRPS-GEFS]

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