# Analyzing Space-based Datasets for Improved Characterization of Field-Scale Interventions for Food Security

Ashutosh Limaye, Lee Ellenburg, Kevin Coffee, William Ashmall, Kris Stanton, Jason Burks, and Daniel Irwin

SERVIR

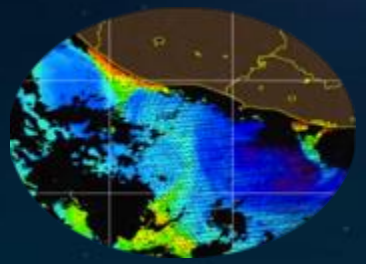
adpc

ICIMOD

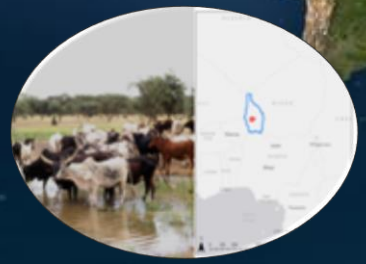
USAID FROM THE AMERICAN PEOPLE

NASA

SERVIR is a joint development initiative of NASA and USAID, working in partnership with leading regional organizations around the globe, to help developing countries use information provided by Earth observing satellites and geospatial technologies to address Food Security, Water and Disasters, Weather and Climate, and Land Use/Land Cover Change.

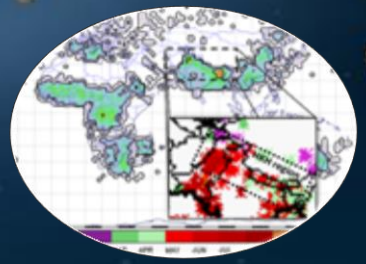



Preventing seafood-borne illnesses in Central America by mapping harmful microalgae

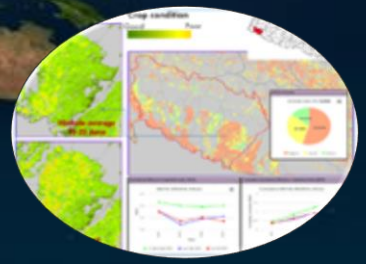


Helping herders and farmers in West Africa by detecting ephemeral water bodies

Conserving forests in eastern and southern Africa by mapping land cover and land use change



Protecting lives in South/Southeast Asia by monitoring and forecasting intense thunderstorms



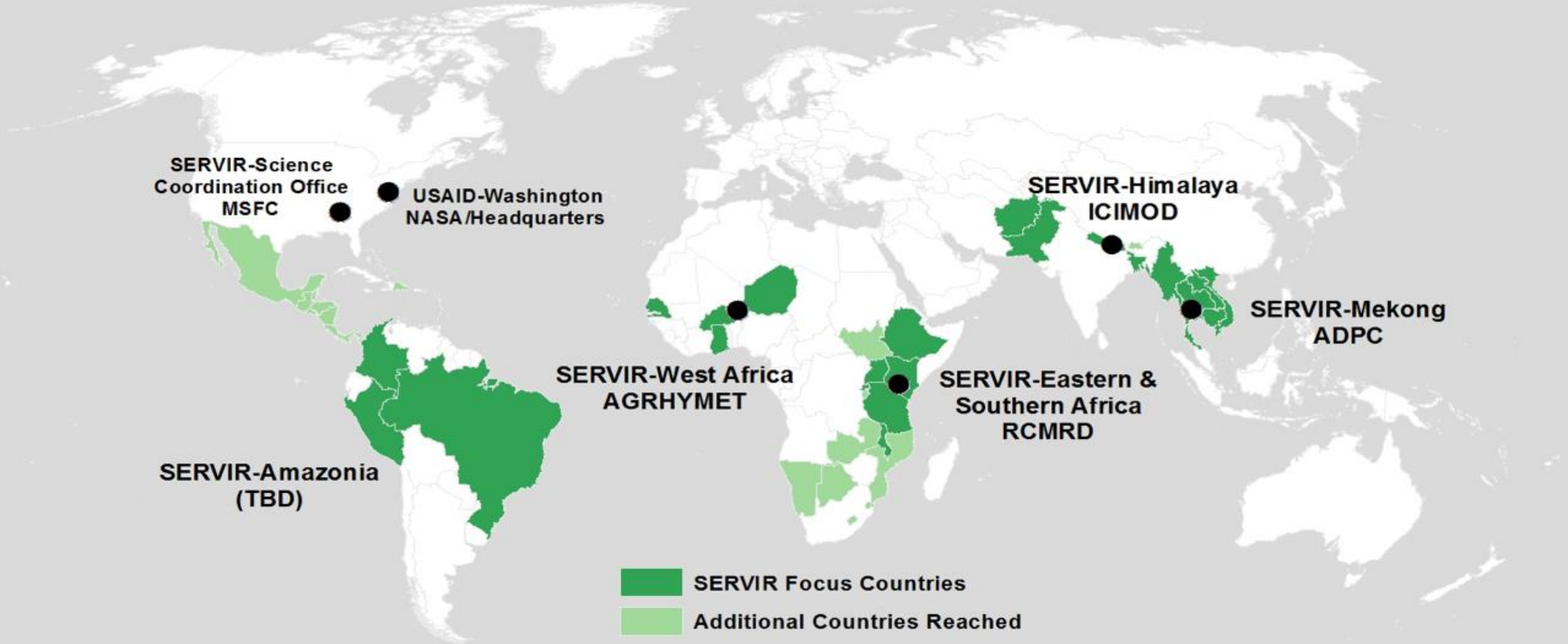
Supporting food security in Nepal by monitoring agricultural drought

adpc

ICIMOD

USAID

# The Current SERVIR Hub Network



# SERVIR Thematic Service Areas

1. Agriculture and Food Security
2. Water and Water-Related Disasters
3. Land Cover and Land Use Change, and Ecosystems
4. Weather and Climate

The aim is to develop individual services that build the capacity of the regional hub organizations and their users in national governments to use Earth observations for improved environmental decision making.

# SCO Engagement with the Hubs

SERVIR Science Coordination Office (SCO), with support from NASA Applied Sciences Program and USAID E3 Bureau, enables science and geospatial technology support to the SERVIR network.

1. Provides direct science support to the hubs
2. Engages SERVIR AST to the hubs
3. Brings other NASA -supported expertise to support SERVIR network
4. Facilitates Technical Assessment Groups (TAGs)
5. Enhances each hub's geospatial capabilities

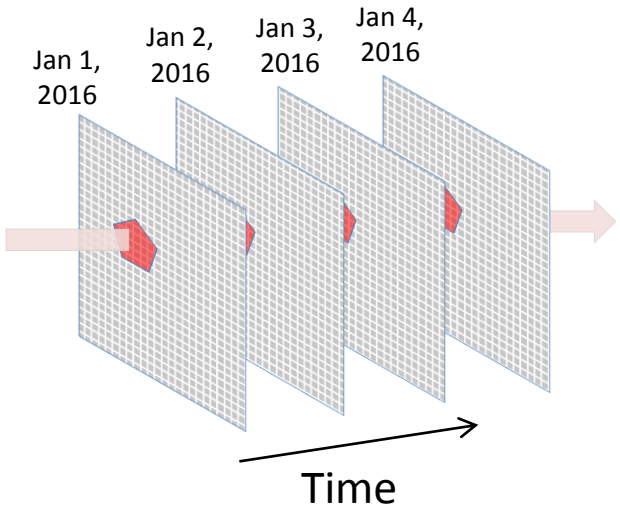
# Rationale behind ClimateSERV

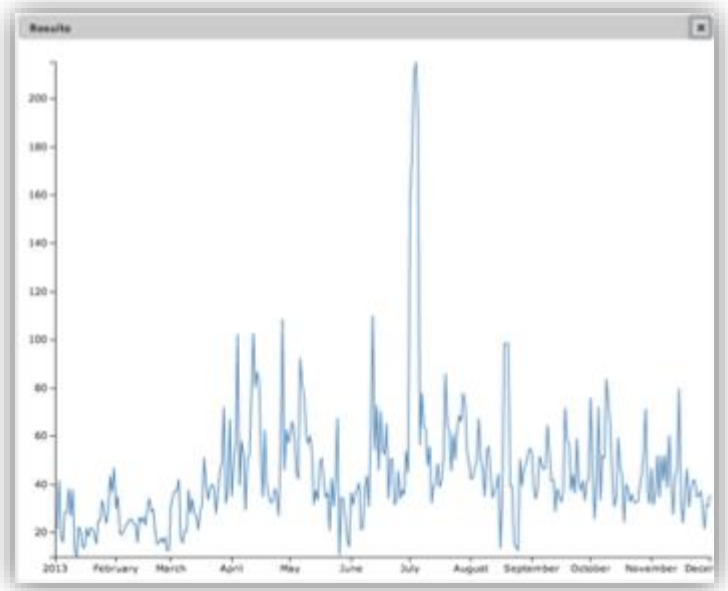
- Most users do not need global data for each day, instead need only information for their geographic area of interest and for their time period of interest.
- SERVIR developed an online portal, **ClimateSERV**, that churns global or regional data, for the time period and area of users' interest.
- The entire data archive is stored in an Amazon cloud instance or on Google Earth Engine. The highly parallelized data processing system is fast but flexible.
- Front portal allows users to process the data of interest on the fly.
- Machine-machine connectivity makes this portal versatile.

# ClimateSERV Workflow


**Create Area of Interest**
**Or choose predefined geometry**


**Select parameters, data type and date ranges**

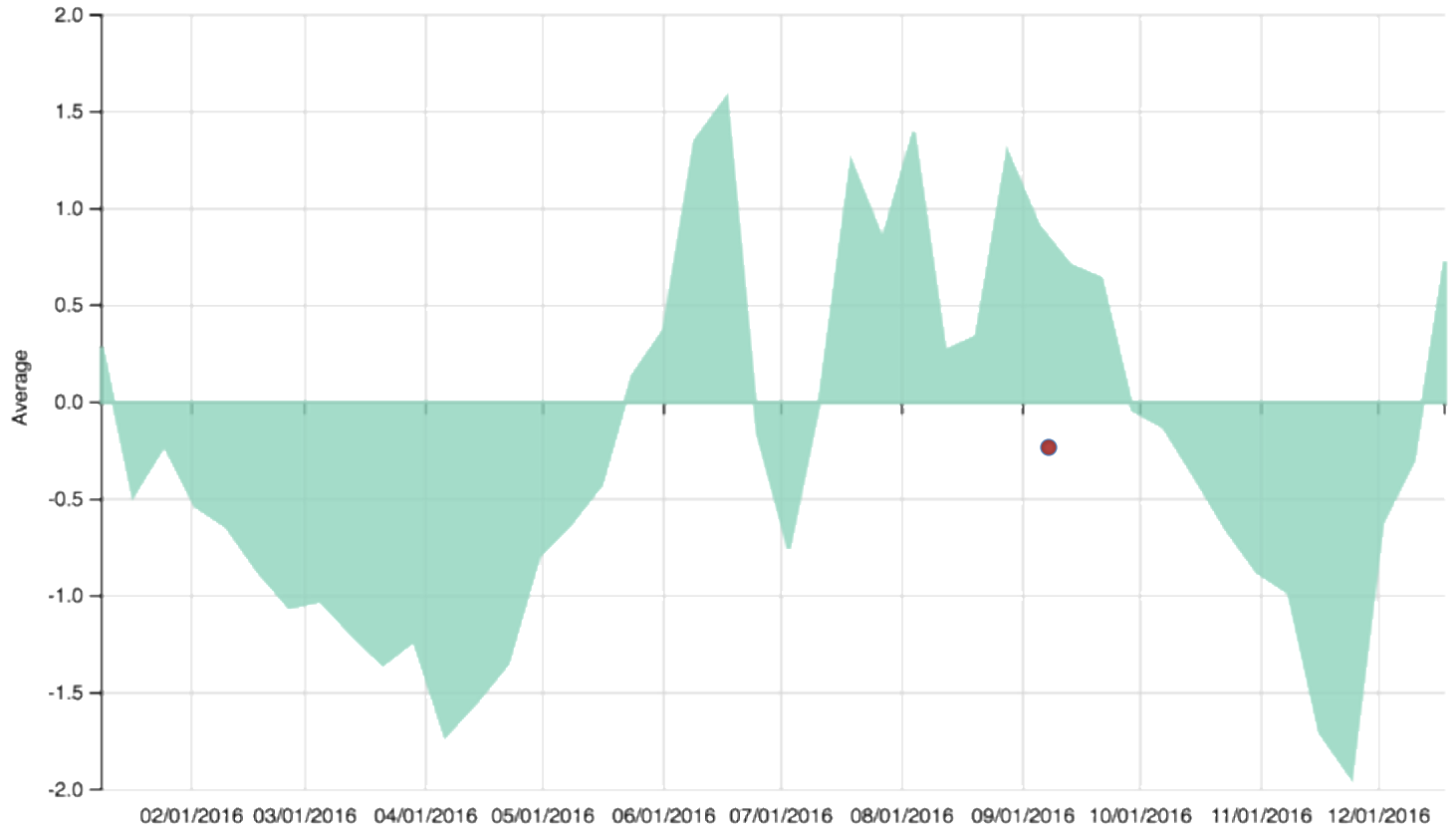



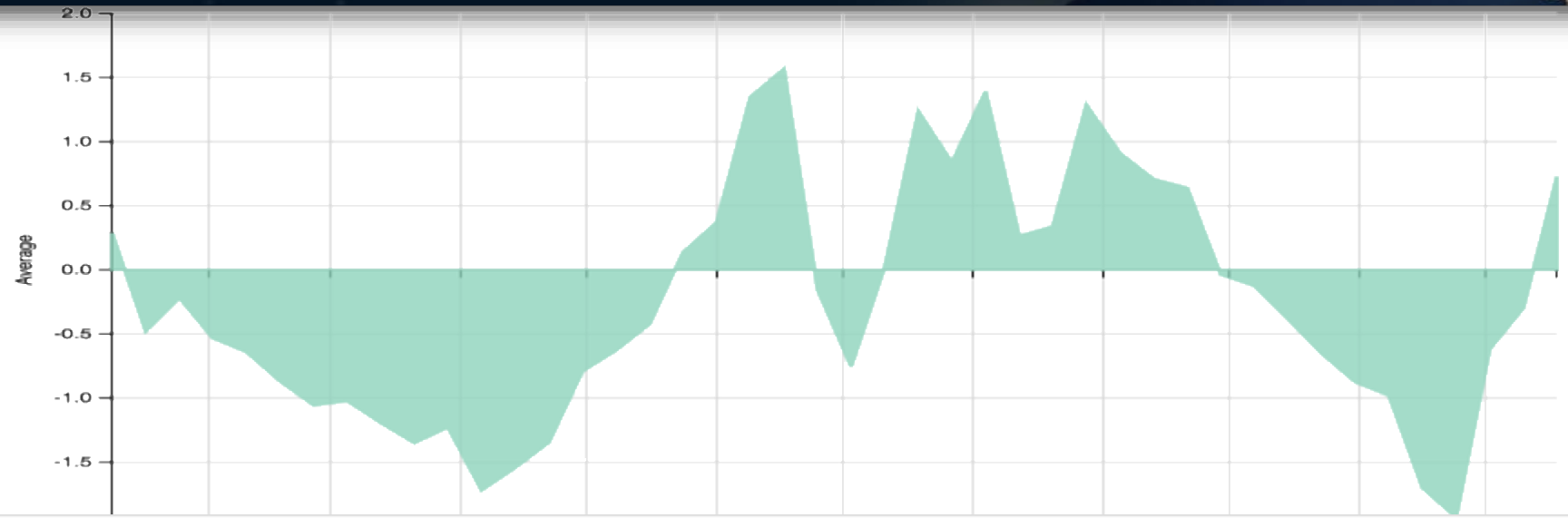
https://climateSERV.SERVIRGlobal.net

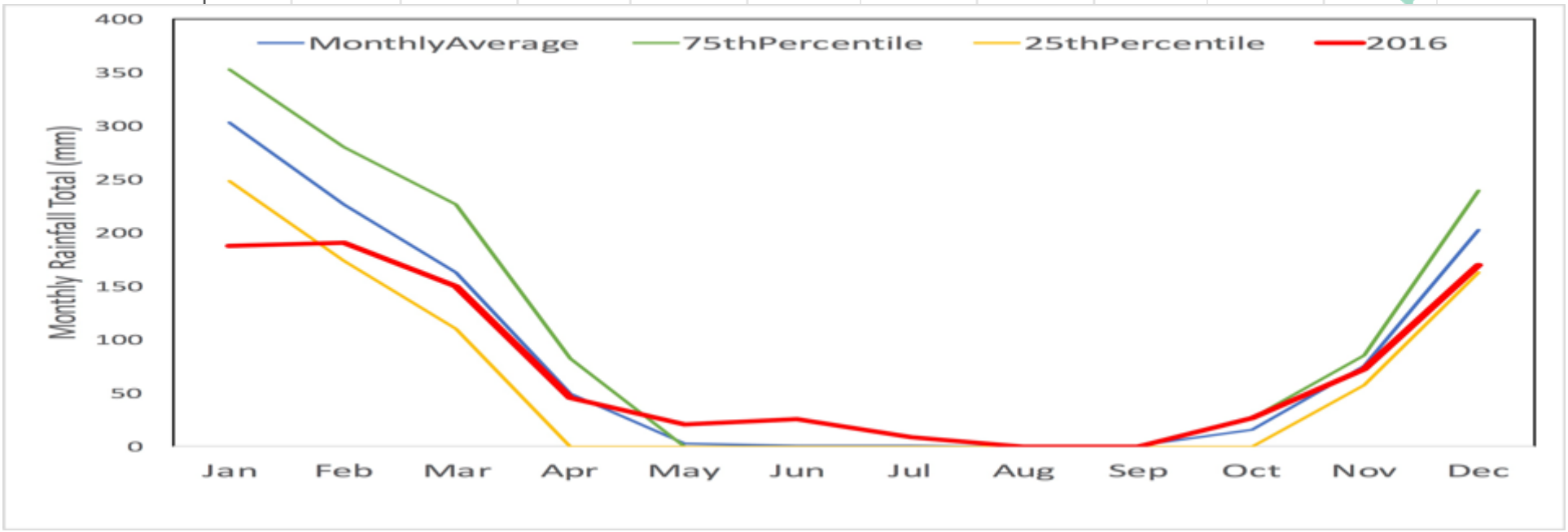
# Datasets

- CHIRPS
- eMODIS NDVI
- Evaporative Stress Index (ESI)
- North American Multimodel Ensemble
- MODIS Land Surface Temperature



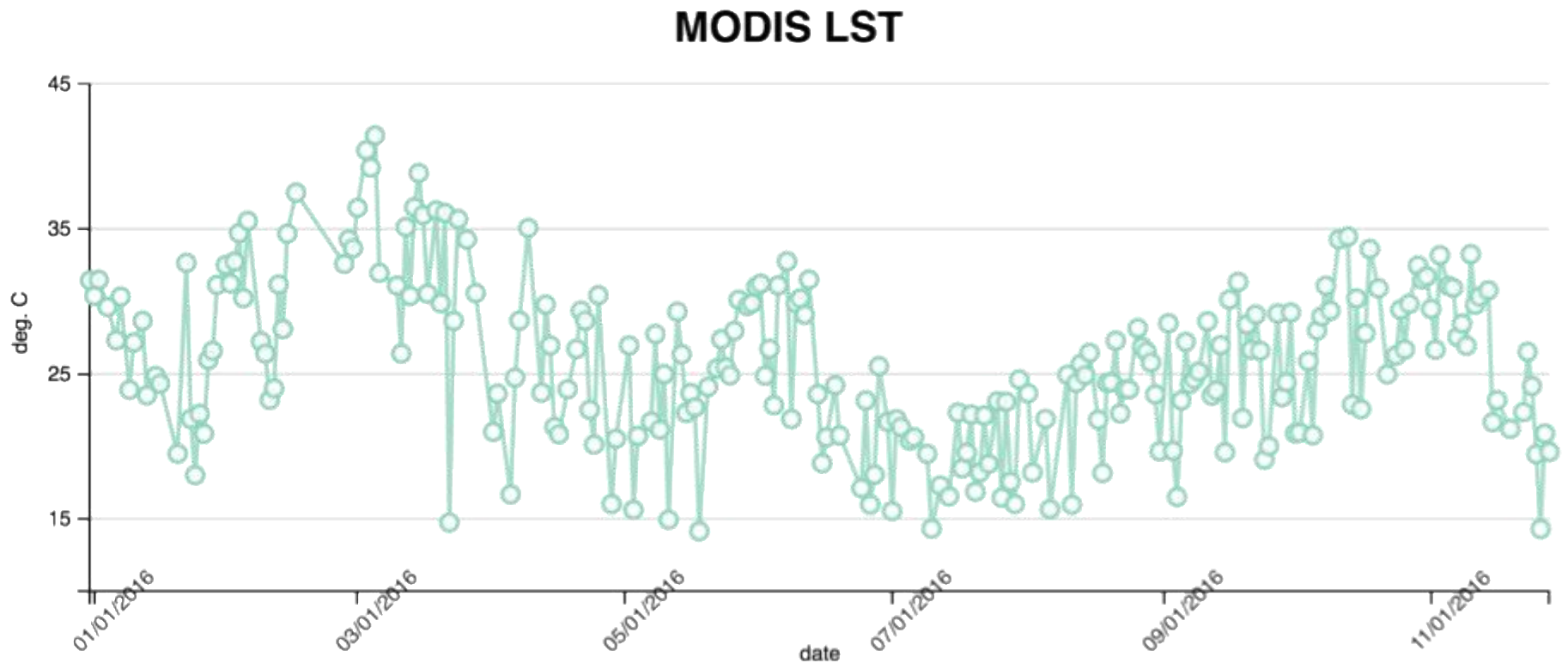
# Evaporative Stress Index
# CHIRPS rainfall comparison



# MODIS Land Surface Temperature from Google Earth Engine

NASA MODIS-derived Land Surface Temperature (LST) climatology is available from 2000. The dataset is produced in real time, is available through NASA data archives, as well as on Google Earth Engine (GEE). SERVIR now pulls data from GEE gateway to access MODIS LST, and make it available for further processing for the area of interest.



# Seasonal Rainfall and Temperature Forecasts

- North American Multi-model Ensembles are global model run made by NOAA, NASA, IRI among other institutions. The model runs are created once every month for six months in the future, and at 1°spatial resolution. However, many applications need daily data at higher spatial resolution.

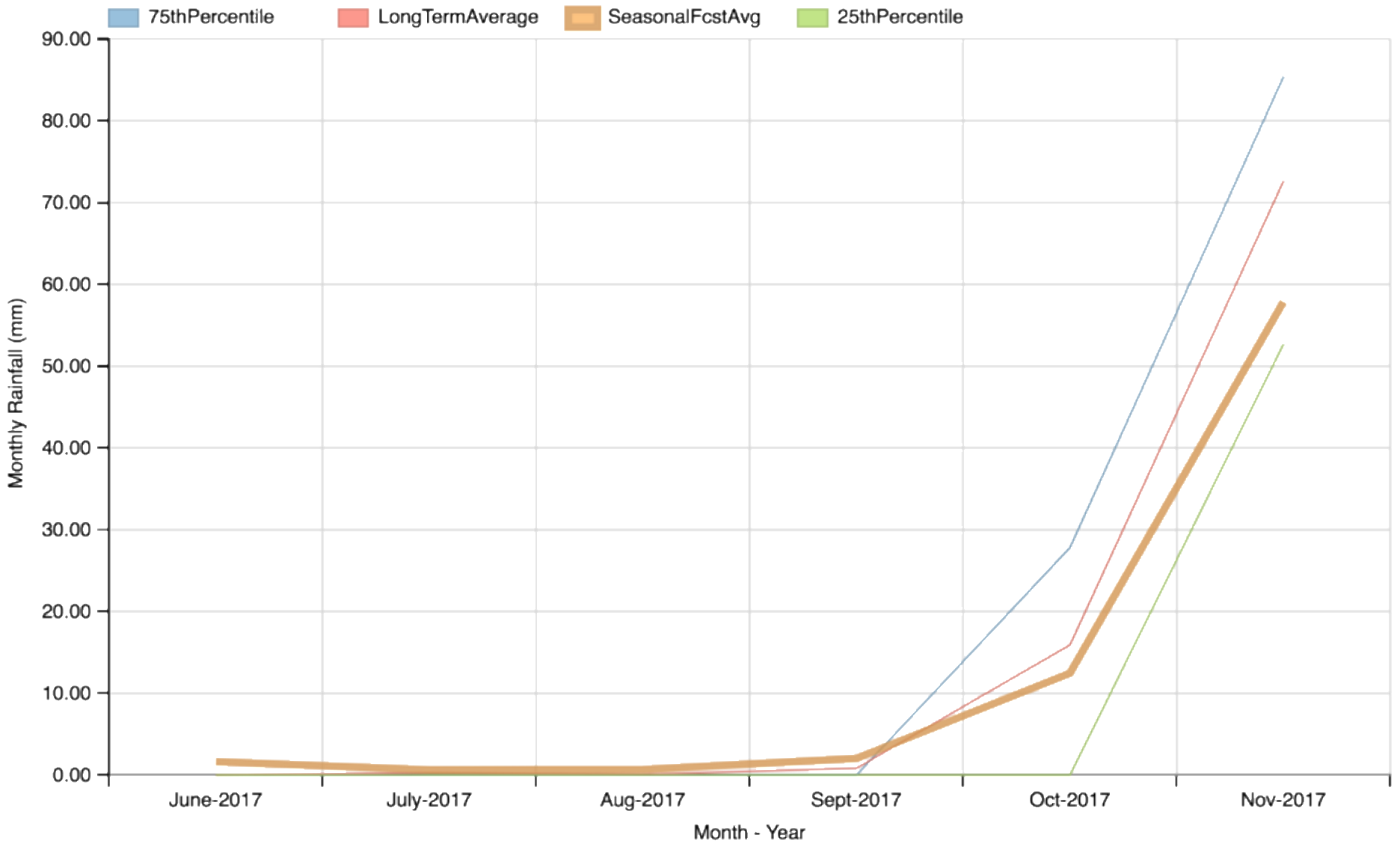
- The downscaled data are at 0.5° spatial resolution (~50 km).

- Daily rainfall and temperature records for 180 days in advance.

- Updated every month, around the 10$^{th}$ of the month.

**NOTE: These seasonal forecasts are to be used as proxies of seasonal prediction over next several months. These are NOT weather forecasts.**

# NMME Rainfall Forecast in the context of CHIRPS rainfall climatology



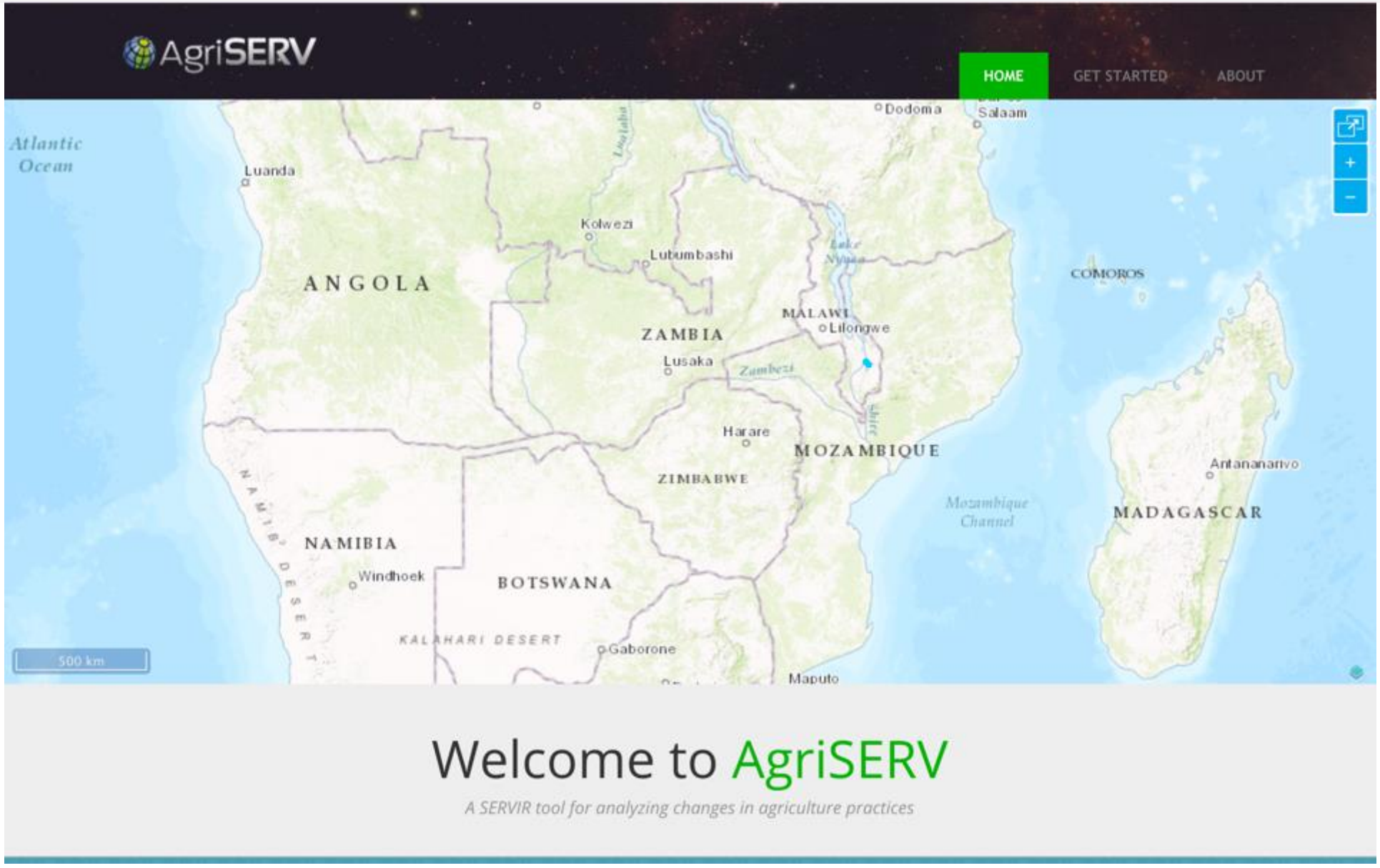
# Building on ClimateSERV

- The ClimateSERV interface allows for ease in data processing and download for specific analyses or for tailored prototypes.

- **One such prototype is AgriSERV**: https://agriserv.servirglobal.net/
  - It enables computation of “growing season”, based on the NDVI curve and CHIRPS rainfall
  - The tool compares growing season and the rainfall amounts in two adjacent user-defined regions

- One specific application of this tool has enabled assess the efficacy of agriculture interventions.
  - Interventions can be distribution of drought tolerant seeds or irrigation systems
  - Enables selection of two adjacent regions (one where project was undertaken and other control region without any intervention).
  - The tool allows objective analysis of efficacy of those intervention between the project and control area, as seen by independent remotely sensed datasets.

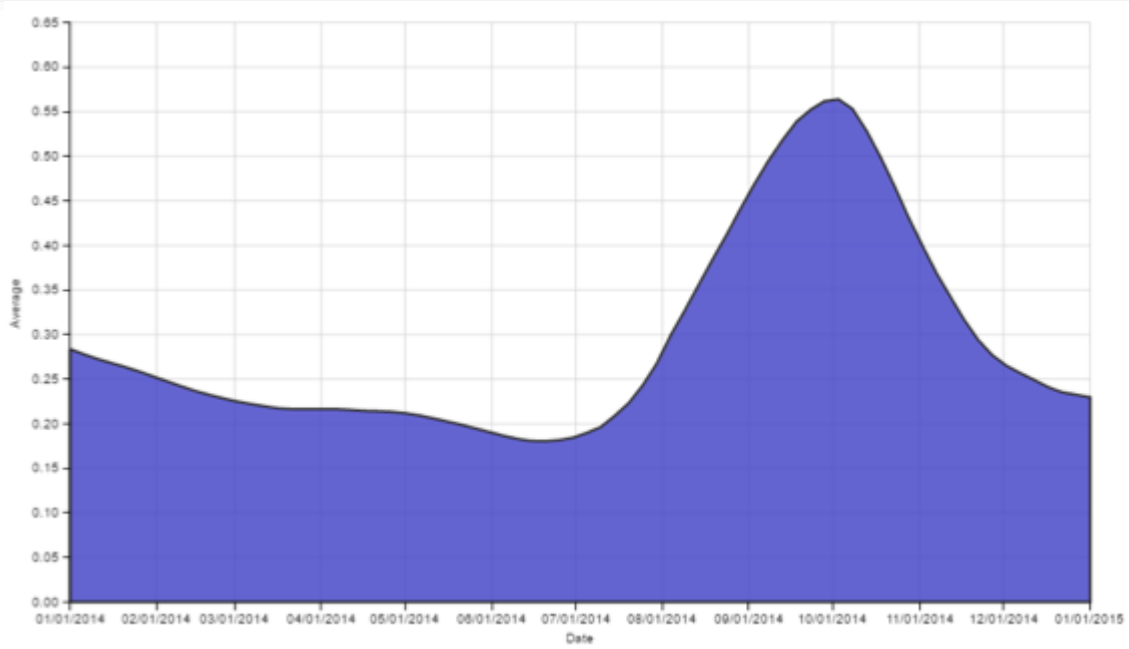
# AGRISERV Interface

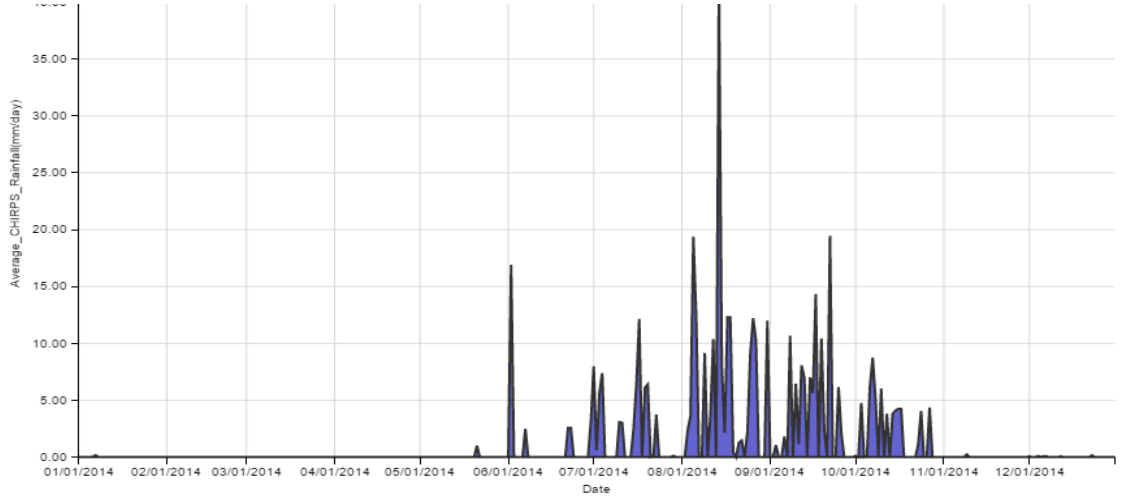


# AGRISERV - Analysis

Allows users to visualize NDVI curves along with precipitation across multiple years.

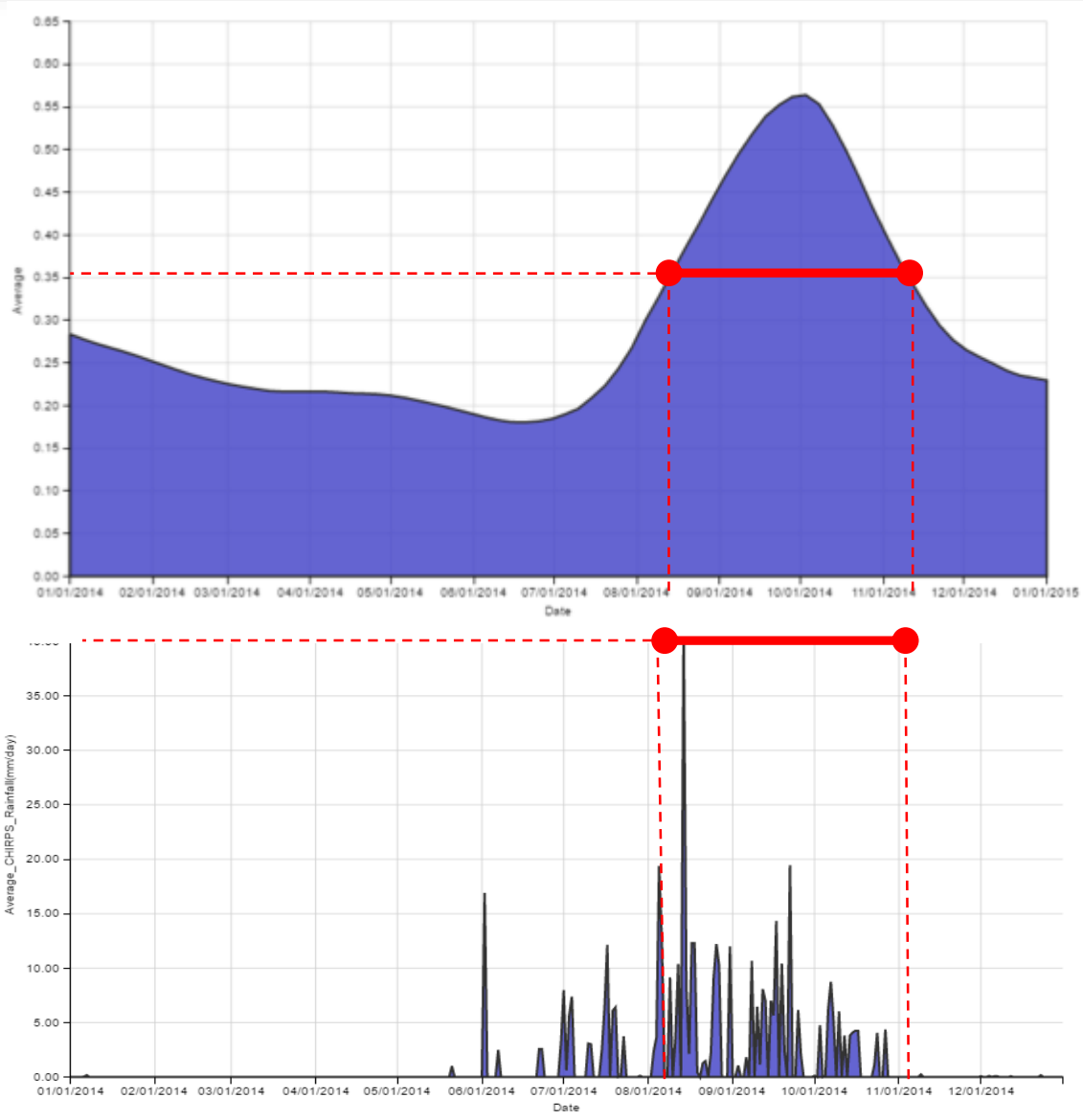
- A poor rain season for agriculture?
- If this is a control plot, how would intervention plots be different?



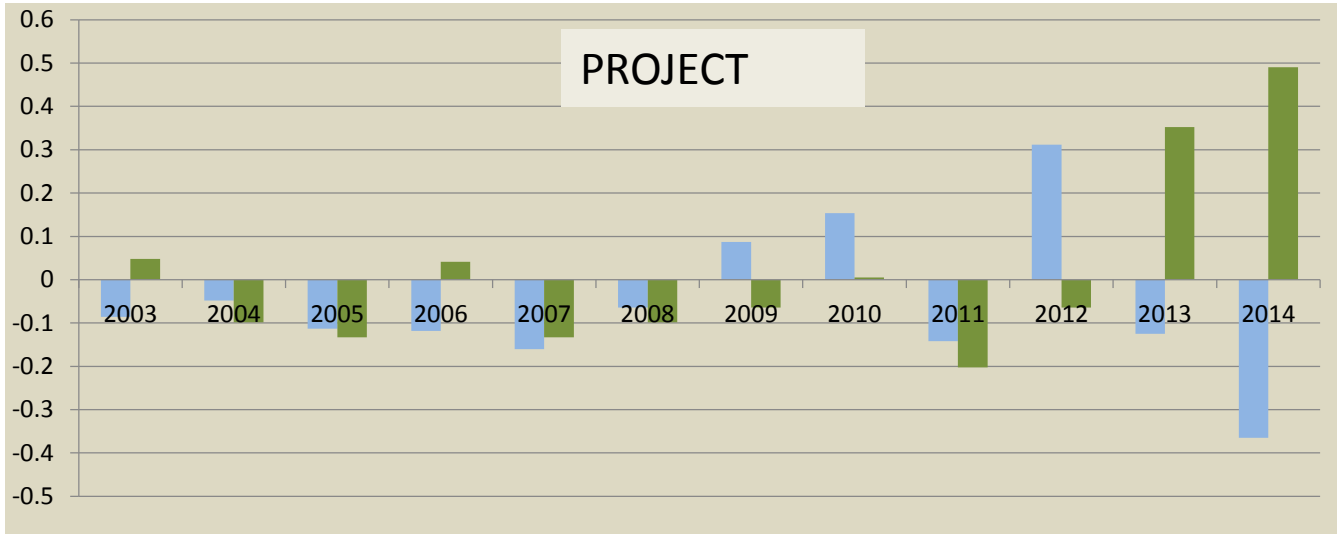



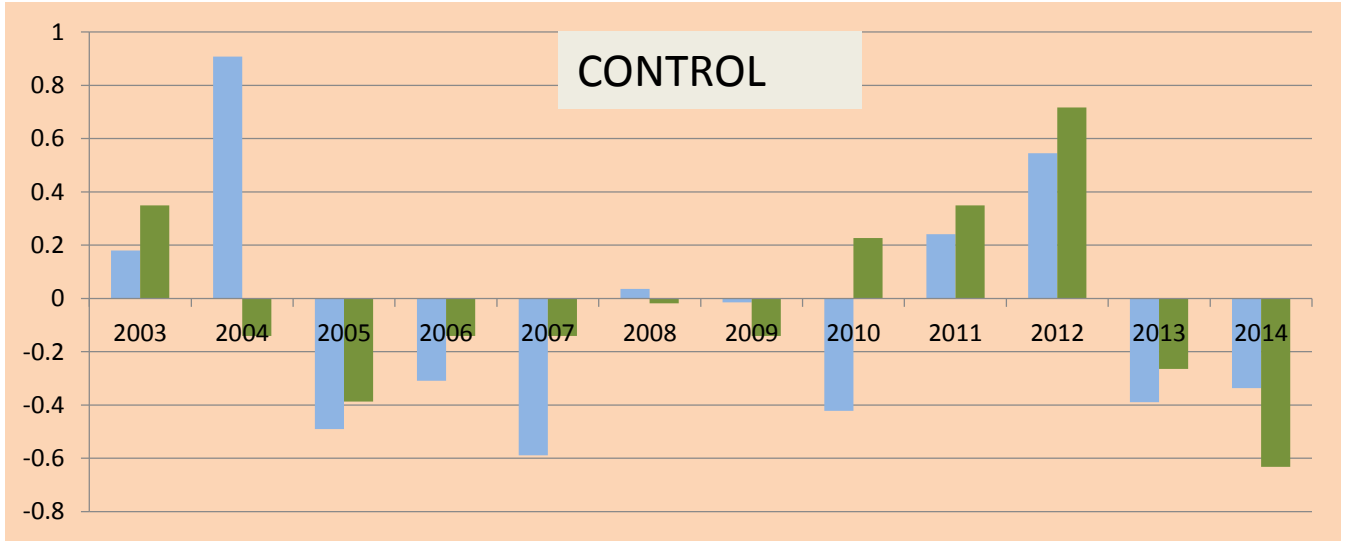
# AGRISERV - Analysis

- User can adjust a threshold on the NDVI curve (blue shape)
- “Season Length” is the time period the curve is above the threshold
- Rainfall is the amount of rain during that time period



# AGRISERV Example




Green - Season Length

Blue – Rainfall

- Big change in project area in 2013
- "Control" shows pretty close relationship with rainfall
- Caution – there is noise
- Helps tell the story

# Thank you