

SERVIR

Connecting Space to Village

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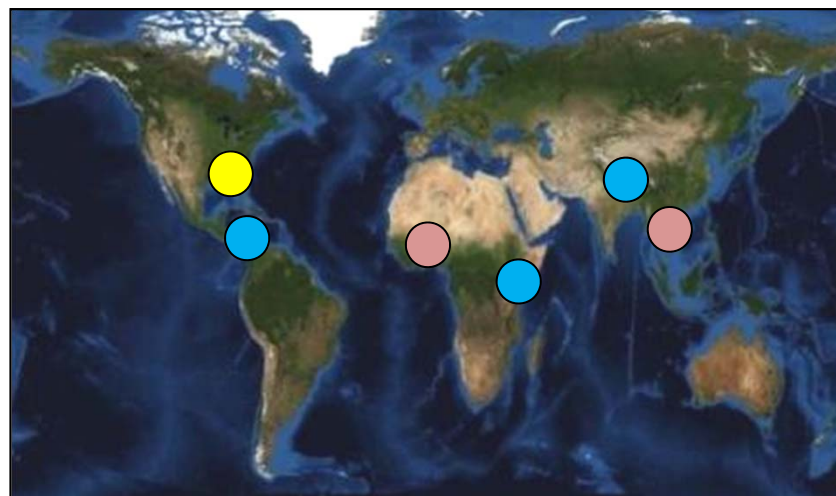
About SERVIR

SERVIR

A NASA-USAID partnership to **improve environmental management and resilience to climate change** by strengthening the capacity of governments and other key stakeholders to integrate earth observation information and geospatial technologies into development decision-making



SERVIR Network



- SERVIR Hub
- Program Office (NASA/MSFC)
- Potential Future Hubs

SERVIR Network



RCMRD – Host of SERVIR-East Africa



ICIMOD – Host of SERVIR-Himalaya

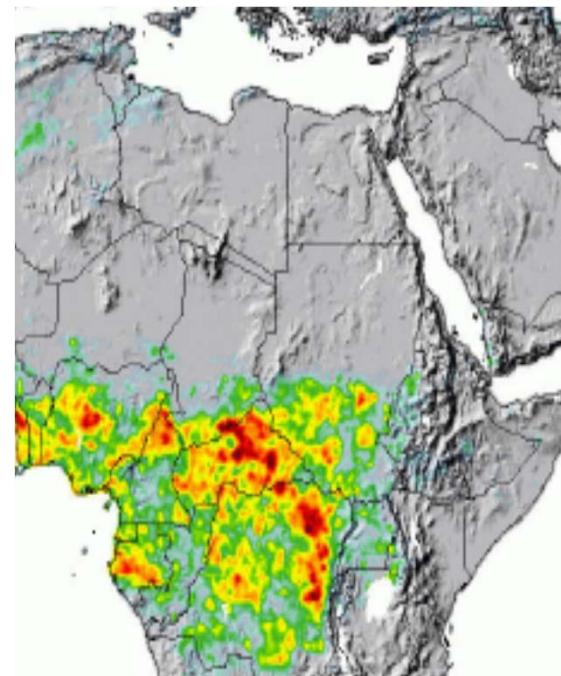


CATHALAC – Host of SERVIR-Mesoamerica

What We Do

SERVIR

- Identify needs in SERVIR regions
- Link science products from US institutions to meet those needs through improved access to data, models, online maps, and visualizations
- Build capacity of regional institutions, stakeholders, and young professionals
- Strengthen partnerships and foster collaboration across SERVIR network



Linking Science to End User Needs



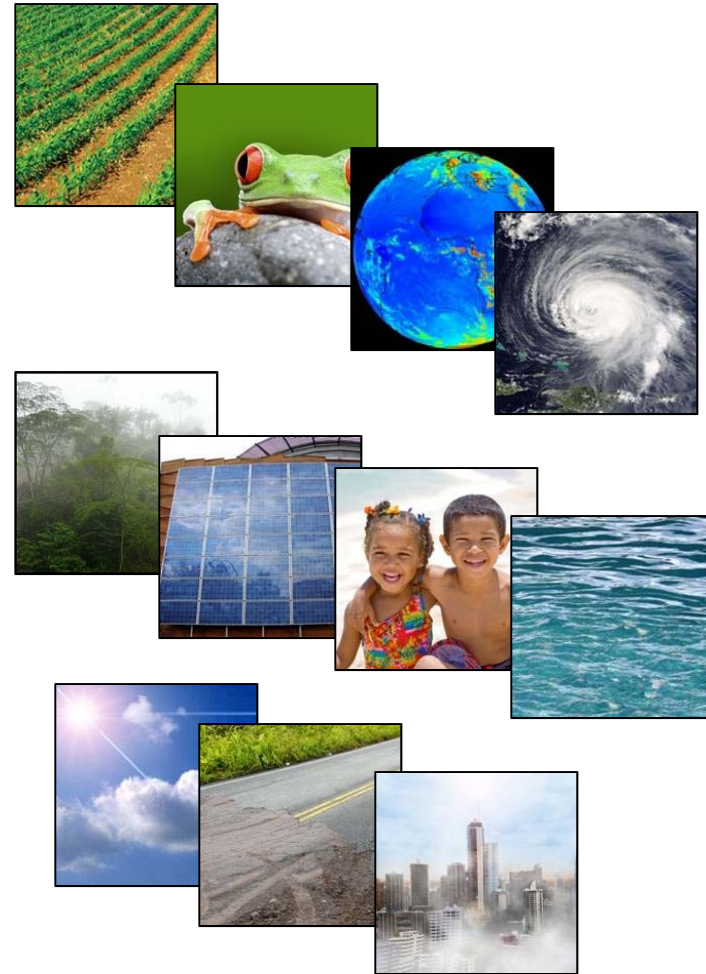
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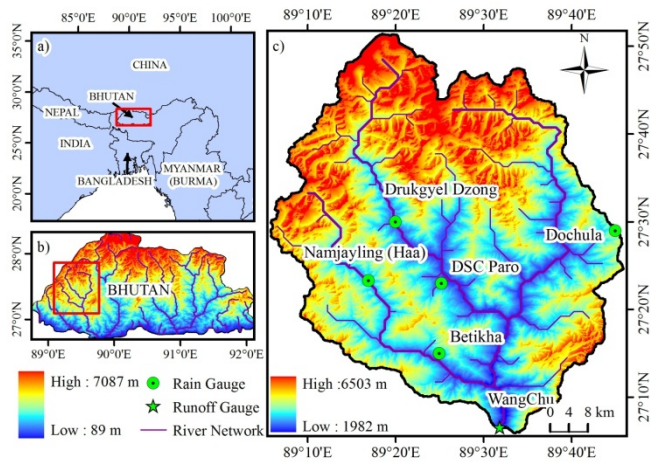
SERVIR Thematic Areas



- Agriculture
- Biodiversity
- Climate
- Disasters
- Ecosystems
- Energy
- Health
- **Water**
- Weather



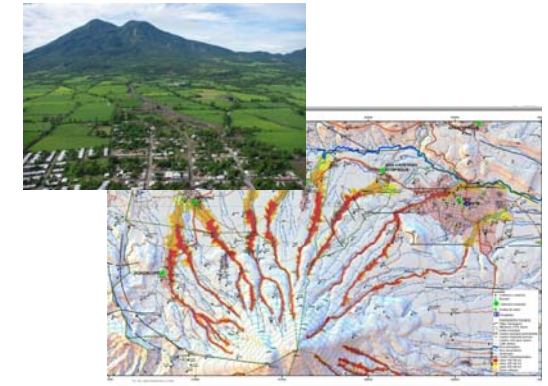
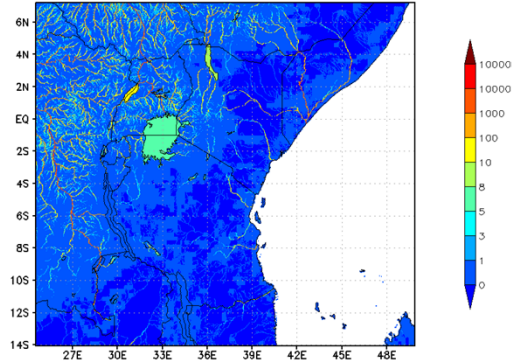
SERVIR Science Applications for Decision Making



Bhutan Water Resource Assessment

Real Time Streamflow in East Africa

Latest 24h/3h Stream Flow (m³/s) 2013-09-19 15h

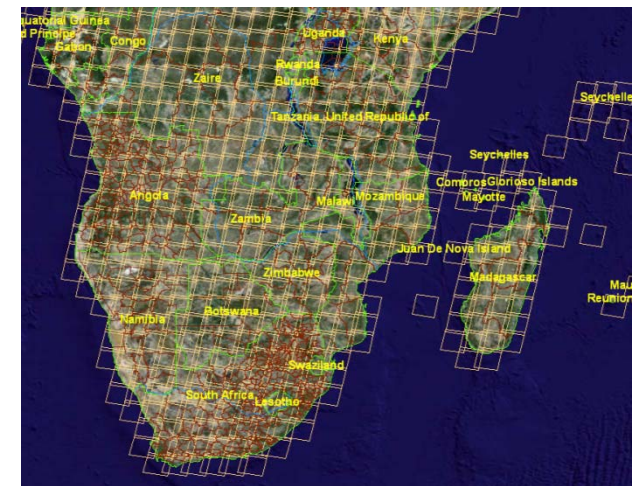
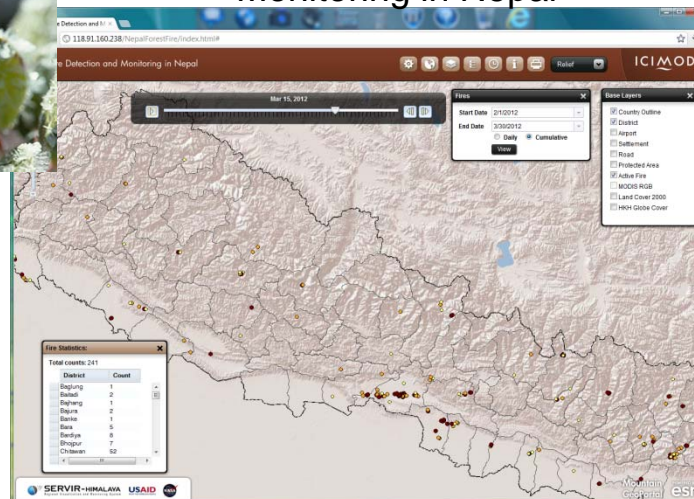


Landslide Prediction System in Mesoamerica

Near Real-time Forest Fire Monitoring in Nepal



Frost Mapping in Africa



Greenhouse Gas Emissions Inventory in Africa

Flood Forecasting in East Africa

SERVIR 

- Needs assessment in East Africa identified characterization and forecasting of droughts and floods as two most pressing needs.
- Ministry of Water in Kenya, Rwanda, Uganda, and Tanzania do not have real time assessments of hydrologic conditions
 - Very few real time stream gages, even fewer in working condition.
 - District managers need real time information to inform the local authorities of floods, ideally forecasts with several hours of lead time.



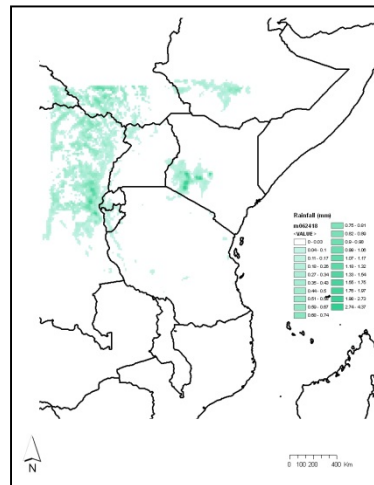
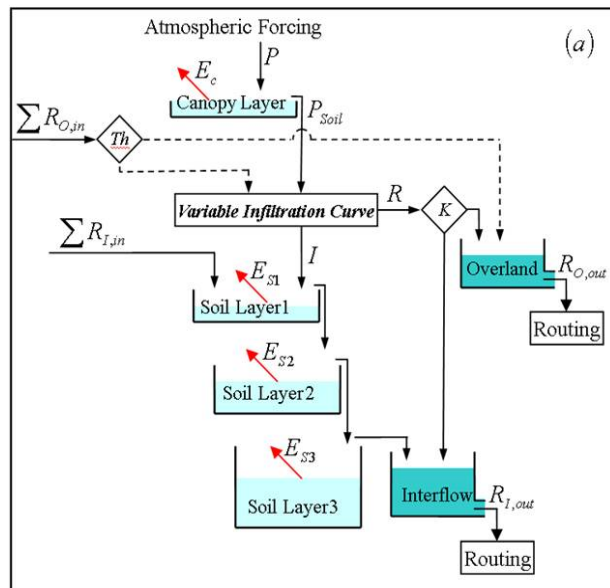
USAID
FROM THE AMERICAN PEOPLE



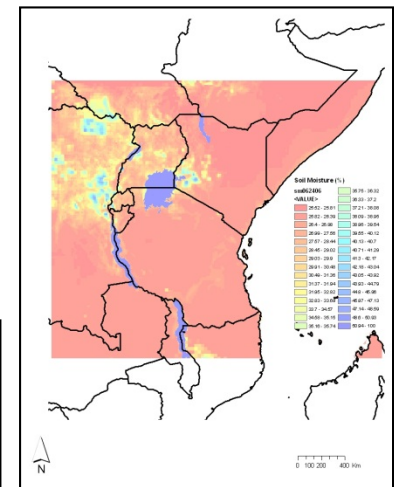
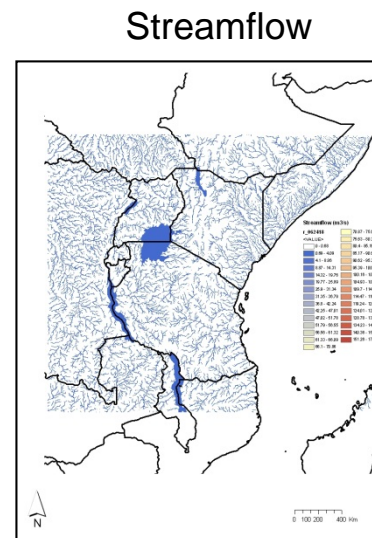
SERVIR Africa and the Hydrological Modeling



- Spatially distributed hydrologic model CREST, developed under a ASP ROSES project at GSFC.
- Spatial resolution 1km, run every 3 hours using near real time data in the Amazon cloud
- Uses near real-time satellite-derived rainfall estimates and rainfall forecasts from Kenya Meteorological Department (KMD) to produce streamflow
- Streamflow estimates enable Kenya Department of Water Resources to issue early flood warning, especially in the flood prone watersheds in western Kenya.



KMD QPF

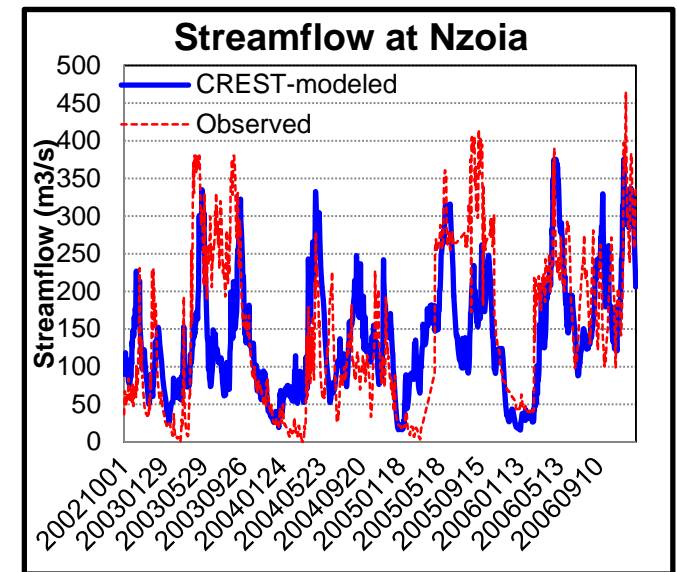
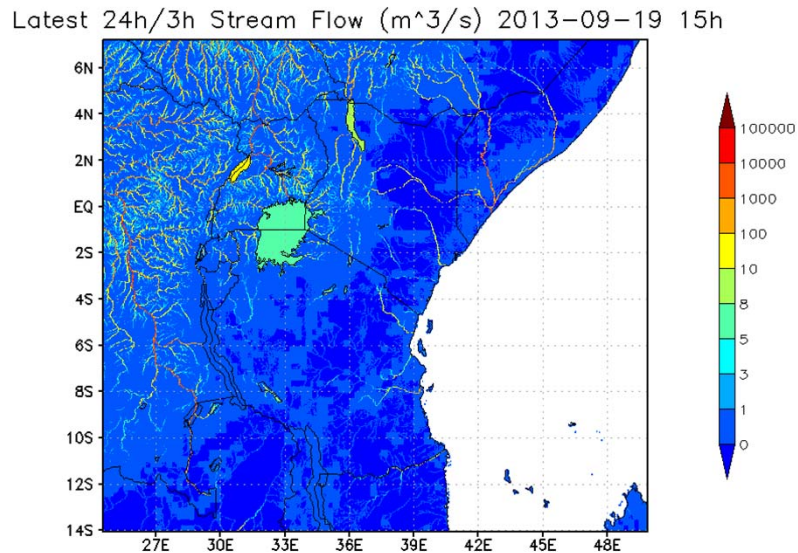


Soil Moisture

Historical Data Perspective

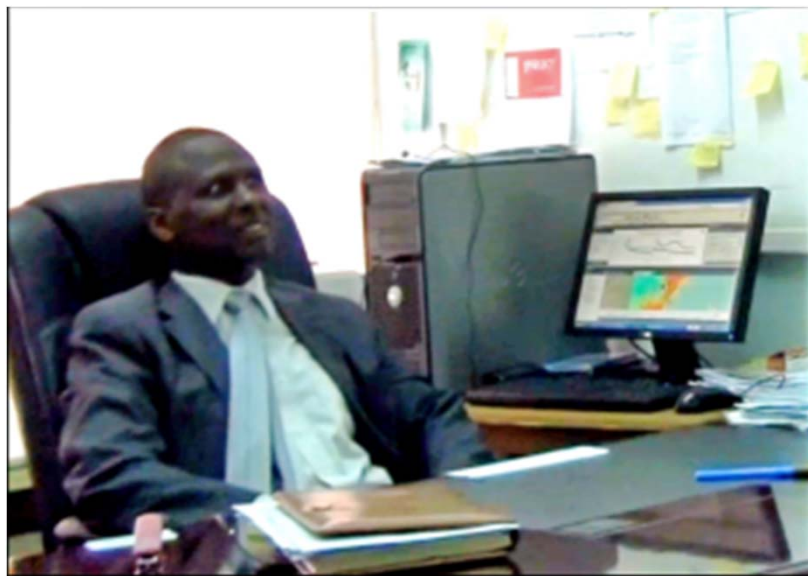


- SERVIR has used 10-year historical satellite rainfall data to drive the CREST model, which has resulted in historical daily streamflow at 1 km resolution.
- Those historical and near real time data are shared with Kenya Department of Water Resources (KDWR) for ~850 stream gage locations of their choice. SERVIR Africa makes the data available on our web portal and through automated emails to KDWR-identified field hydrologists.
- We have used the historical data to assess 5th, 20th, 80th and 95th percentiles for each 1 km pixel to put the real time streamflow in context.



Comments from CREST End User

SERVIR



“The biggest problem we have is lack of data. When someone, like SERVIR Africa comes along to help us out it is very good because we have been missing floods.”

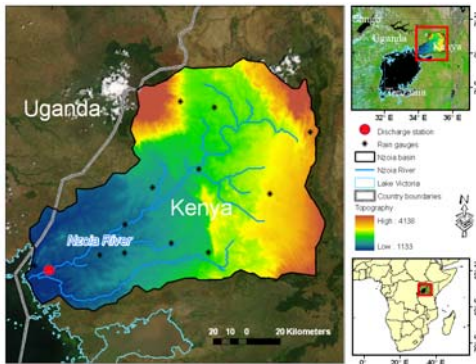
-Simintei Kooke

*Deputy Director of Water Resources,
Kenya Ministry of Water and Irrigation*

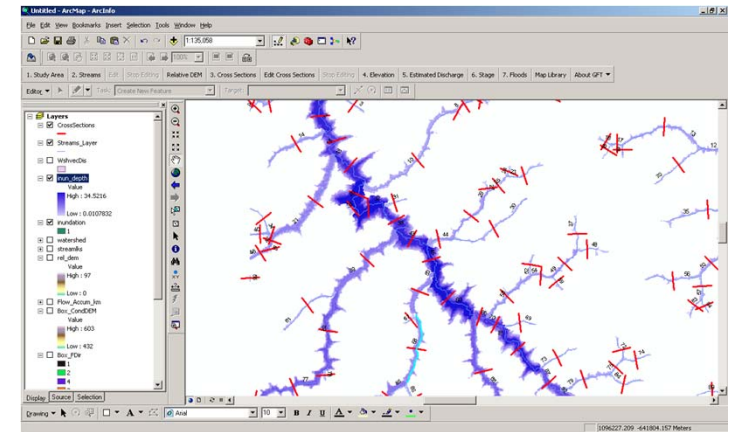
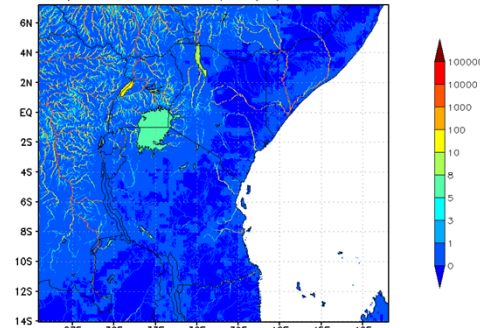
SERVIR Africa and the CREST model- Forecasting for Flood-Prone Watersheds



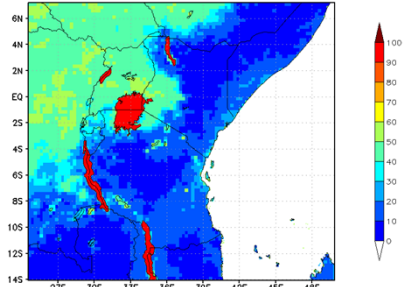
Hydrologic Model CREST Developed for Single Watershed in Kenya



Latest 24h/3h Stream Flow (m³/s) 2013-09-19 15h

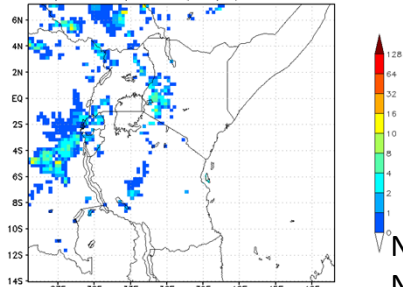


Latest 24h/3h Soil Moisture (%) 2013-09-19 15h



Soil Moisture

Latest 24h/3h Precipitation (mm/h) 2013-09-19 15h

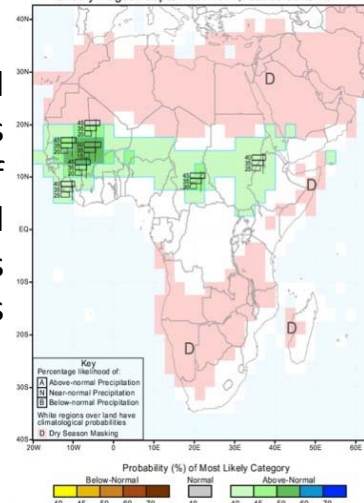


Near Real Time
NASA TRMM
Satellite
Rainfall Data

Real Time, Historic and
Seasonal Streamflow

Working on seasonal
hydrologic forecasts
at the request of
Kenyan and
Rwandan Ministries
of Water Resources

IRI Multi-Model Probability Forecast for Precipitation
for July-August-September 2011, issued June 2011



Working in collaboration with FEWS NET,
and at the request of KDWR, RCMRD
developed stand alone Flood mapping tool.
It translates the streamflow into a better
visualization and decision making tool.

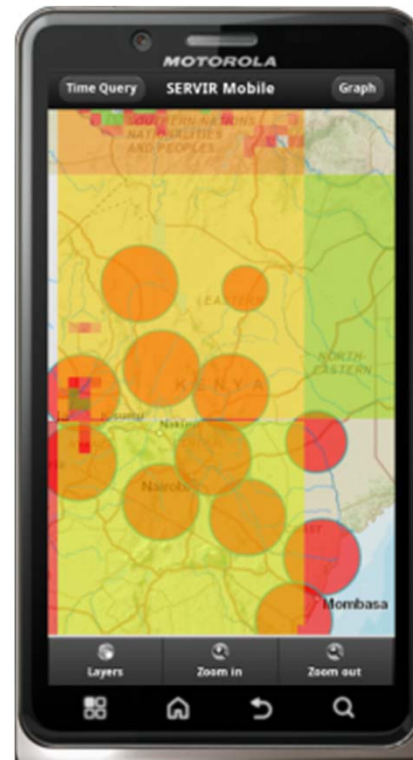
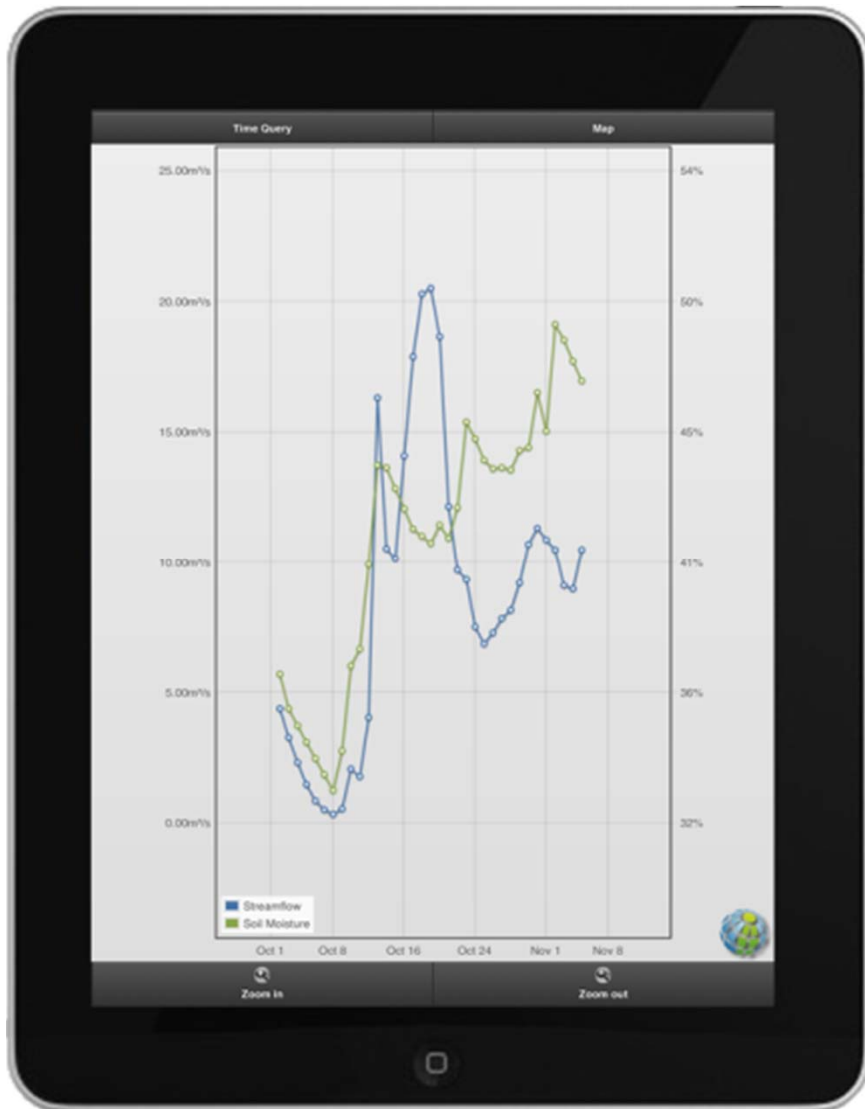
Training and Capacity Building



CREST Mobile App

SERVIR

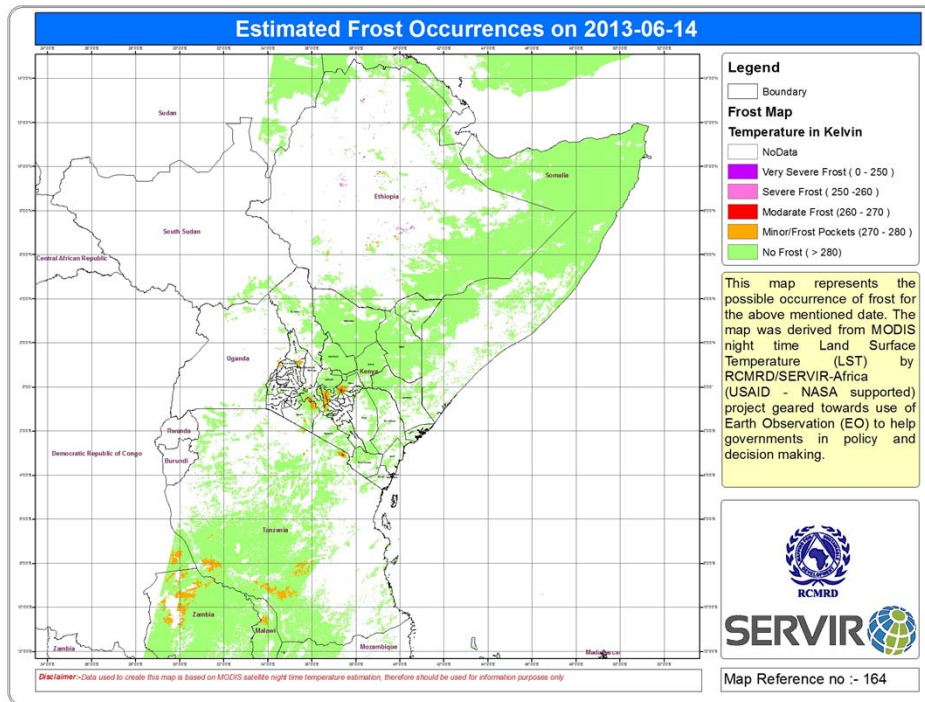
SERVIR has adapted CREST model products to fit the mobile needs.



CREST app runs on iOS and Android devices.

Frost Monitoring and Early Detection

SERVIR



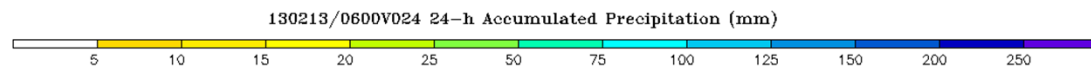
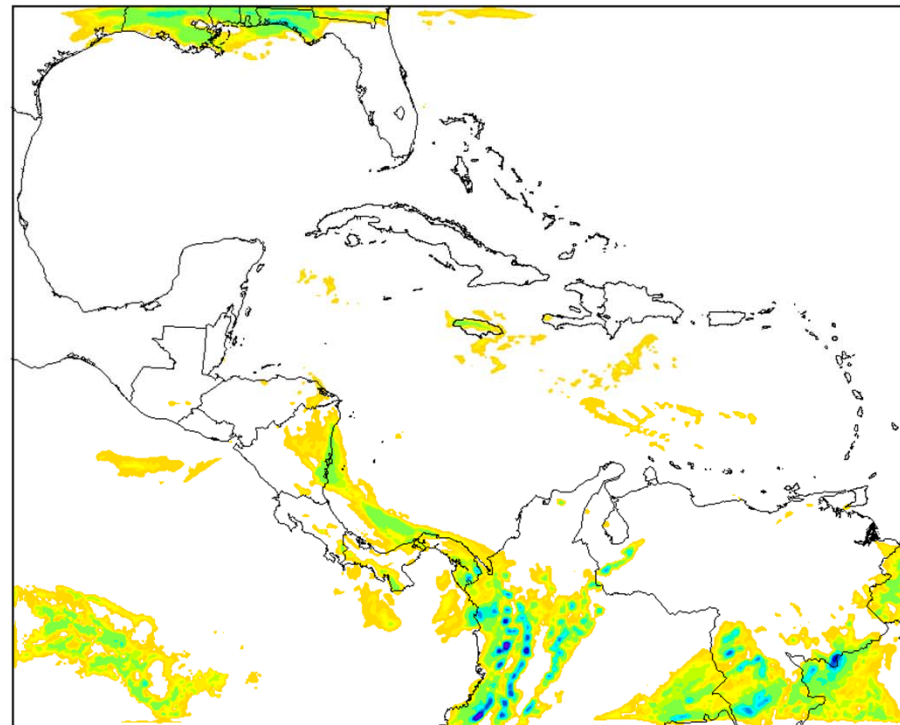
- **SERVIR is keen on getting satellite data and products to end users in the agricultural community to improve decision making.**
- **In Kenya, as with many other countries in Africa, frost damages are a significant threat to agriculture.**
- **Kenya Meteorological Department requested SERVIR to help with identifying the frost damaged areas, for public dissemination and damage assessment purposes.**
- **Using satellite and KMD datasets, SERVIR Africa has put together a system for early detection of frost and for damaged area assessment. Next phases will include near real time temperature observations and forecasts of frost areas.**



Mesoscale Atmospheric Modeling WRF for Mesoamerica and Improvements in East Africa



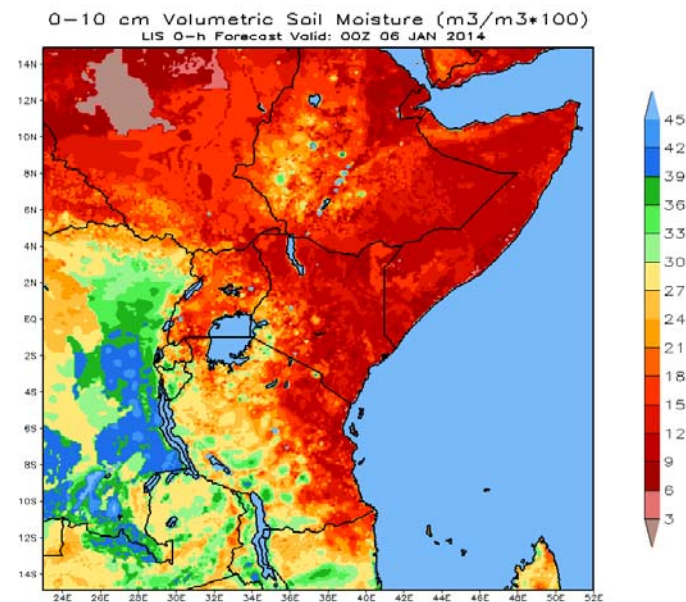
- SERVIR, with the help of NASA Short-term Prediction Research and Transition Center (SPoRT), is producing real-time numerical weather forecasts for Mesoamerican region at the request from Meteorological Services in the region.



KMS Needs in East Africa



- Kenya Meteorological Service (KMS) has responsibilities analogous to US National Weather Service.
- KMS uses numerical weather forecasting model WRF, along with the observed data, to generate alerts on potential vulnerabilities in the region, such as floods and droughts, and to support the agriculture sector with accurate weather information.
- KMS alerts are well regarded and widely used in the region. However KMS does not use satellite datasets in generating their numerical weather forecasts. KMS recognize the potential of improving the forecasts using satellite data, especially the soil moisture products from SMAP.
- KMS approached SERVIR Africa to improve their WRF modeling system. Recently, we have integrated NASA LIS into their WRF forecasts. Remotely sensed soil moisture products is expected to enhance the WRF accuracy. Our preliminary assimilations have shown substantial improvement.



SERVIR Applied Science Team (AST)



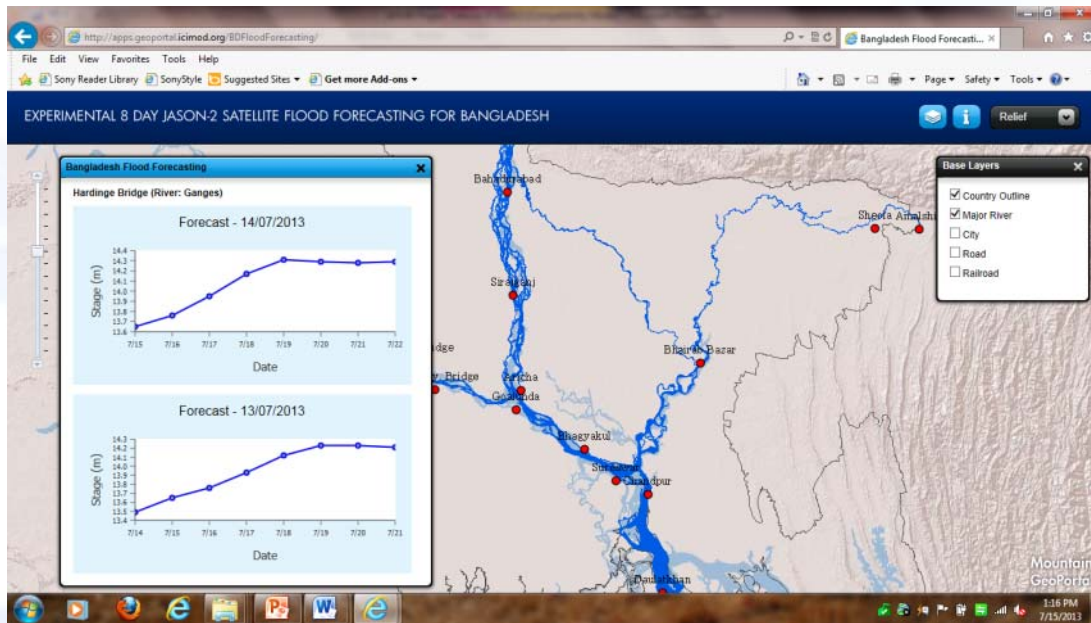
PI Last name	Title	Institution	Theme	Region
Laporte	Forest carbon assessment for REDD in the East Africa SERVIR region	The Woods Hole Research Center	Carbon	East Africa
Kargel	Interdisciplinary science applications to glacier and alpine hazards in relation to development and habitation in the Hindu Kush-Himalaya: SERVIR Science Team project	University of Arizona	Disasters	Hindu Kush-Himalaya
Hossain	A Satellite-based Early Warning, Mapping and Post-Disaster Visualization System for Water Resources of Low-lying Deltas of the Hindu Kush-Himalayan region	Tennessee Technological University	Water	Hindu Kush-Himalaya
Verdin	A Long Time-Series Indicator of Agricultural Drought for the Greater Horn of Africa	U.S. Geological Survey	Agriculture	East Africa
Blackman	Using Earth Observation Data to Improve REDD+ Policy in Mesoamerica and the Dominican Republic	Resources for The Future, Inc.	Carbon	Mesoamerica
Huff	Applications of Satellite Products for Air Quality Monitoring, Analysis, Forecasting, and Visualization in the SERVIR Mesoamerica and Himalaya Regions	Battelle Memorial Institute	Air Quality	Mesoamerica, Hindu Kush-Himalaya
Robertson	Leveraging CMIP5 and NASA / GMAO Coupled Modeling Capacity for SERVIR East Africa Climate Projections	NASA / MSFC	Climate Scenarios	East Africa, Hindu Kush-Himalaya, Mesoamerica
Granger	East Africa Drought and Agricultural Productivity Assessment and Prediction System	Jet Propulsion Laboratory	Disasters, Agriculture	East Africa
Valdes	SERVIR Water Africa-Arizona Team (SWAAT)	The University of Arizona	Water	East Africa
Kirschbaum	Landslide Hazard Assessment and Forecasting System using near real-time remote sensing information over SERVIR-Mesoamerica	NASA Goddard Space Flight Center	Disasters	Mesoamerica
Ceccato	Development and Implementation of Flood Risk Mapping, Water Bodies Monitoring and Climate Information for Disaster Management and Human Health (integration within SERVIR)	Columbia University	Public Health	East Africa



Improved Flood Forecasting in Bangladesh



- **Problem:** Bangladesh's severe flooding affects millions of residents every year. The Flood Forecast Warning Center (FFWC) issues flood forecasts in Bangladesh just 3 days in advance – insufficient time for families and farmers to prepare.
- **What SERVIR did:** A SERVIR AST effort led by Dr. Faisal Hossain linked satellite altimetry data (JASON 2) to flood forecasts. SERVIR-HKH has trained FFWC scientists to generate flood forecasts 8 days in advance using this near real time satellite data.



- **Results:** FFWC has begun generating experimental 8-day forecasts representing river levels for the 2014 monsoon season. The satellite-derived system is being run independently by FFWC, and is expected to be adopted as the official forecasting system for the 2015 monsoon season. The 8-day forecasts will provide 160 million impacted citizens with longer lead time for disaster preparedness.

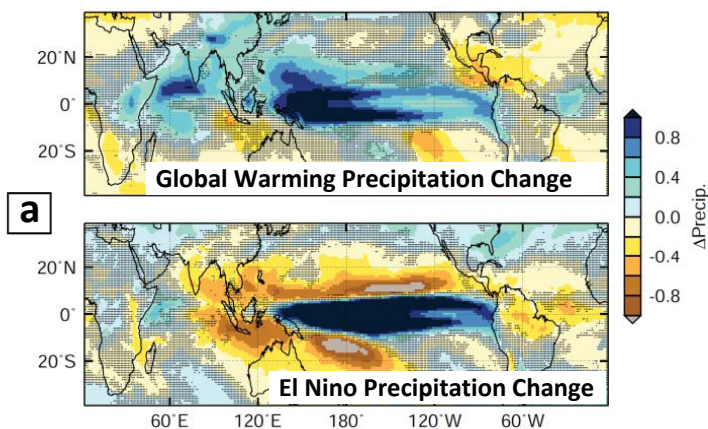
Leveraging Coupled Climate Model Projections for SERVIR Applications Science



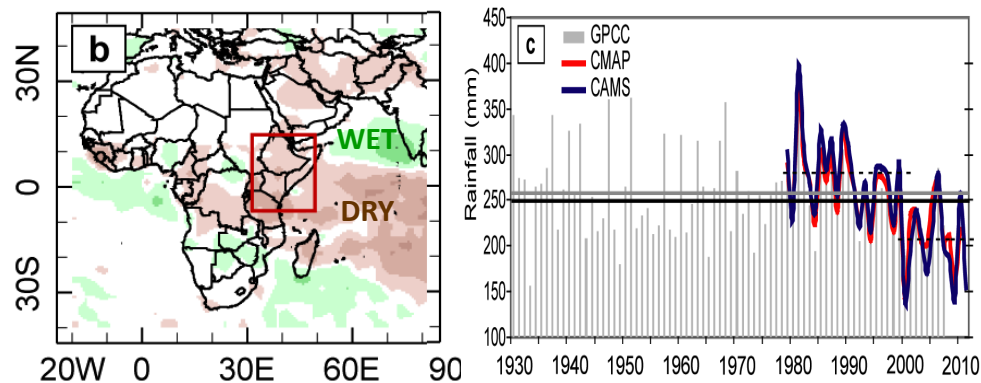
- Critically assess and employ CMIP5 and US NMME climate model projections of seasonal / interannual / decadal hydrometeorological climate variability / change affecting SERVIR Hub regions (Mesoamerica, E. Africa, Himalayas).
- Develop and refine scenarios through downscaling, and stochastic modeling to provide SERVIR Applications Science Team and Hub Scientists with information to drive decision support system models of crop production, water availability etc.

A Big Challenge :

Identifying / Separating / Quantifying Natural Variability vs Anthropogenic Effects



a) CMIP models show 21st Century regionally varying precipitation trends (*top panel*) due to anthropogenic forcing. Note increased rainfall over East Africa. These expected changes will mix with natural climate variability (*lower panel*).



b) Satellite-observed Mar-May (1999-2010 avg) rainfall departure from 1979-2010 mean.

c) Mar-May observed and satellite-estimated rainfall averaged over East Africa (10S-12N, 30-53E). Why does this decadal trend contrast with model-projected increases?

Summary



- SERVIR is a link between research institutions and end user decision making.
- SERVIR efforts are led by the needs of the region. Some examples include hydrological modeling, frost monitoring, fire alert system, and land cover change assessment.
- Presence of SERVIR Hub, a technical institution with regional governmental support, makes the linkage sustainable.



More information:

SERVIR Global: <http://www.servirglobal.net>

SERVIR Contacts:

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Nancy Searby – NASA HQ Program Manager

Ashutosh Limaye – Project Scientist (Ashutosh.Limaye@nasa.gov)

SERVIR GLOBAL



Connecting Space

To Village

