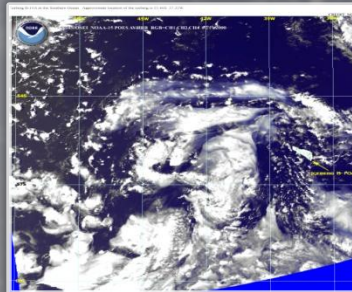
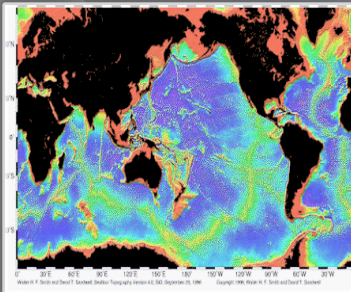
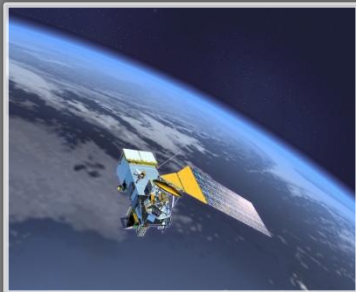
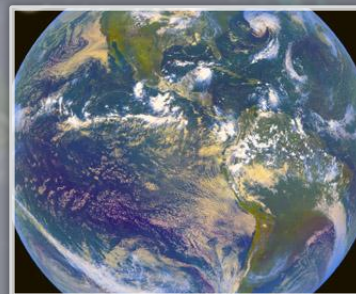


# NOAA and CEOS Space Applications for Disaster Management



Jacob Sutherlun

National Oceanic and Atmospheric Administration

Committee on Earth Observation Satellites Working Group on Capacity Building and Data Democracy – Vice Chair

18 May 2012



# Agenda

## NOAA Space Related DRM Activities

 FFG

## CEOS DRM Activities

 CEOS WGCapD

 Regional End-to-End Pilots

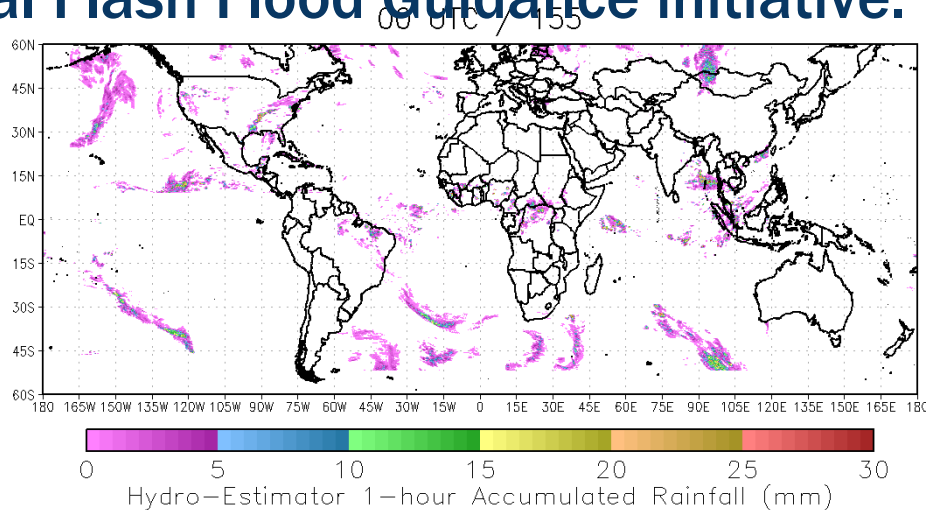


# NOAA-HRC Flash Flooding Partnership

Floods and flash floods are one of the deadliest and most costly natural disasters worldwide.

Many deaths could be prevented by adequate warning.

Estimates of rainfall from satellites are being used to support flash flood forecasting in many parts of the world through the Global Flash Flood Guidance initiative.



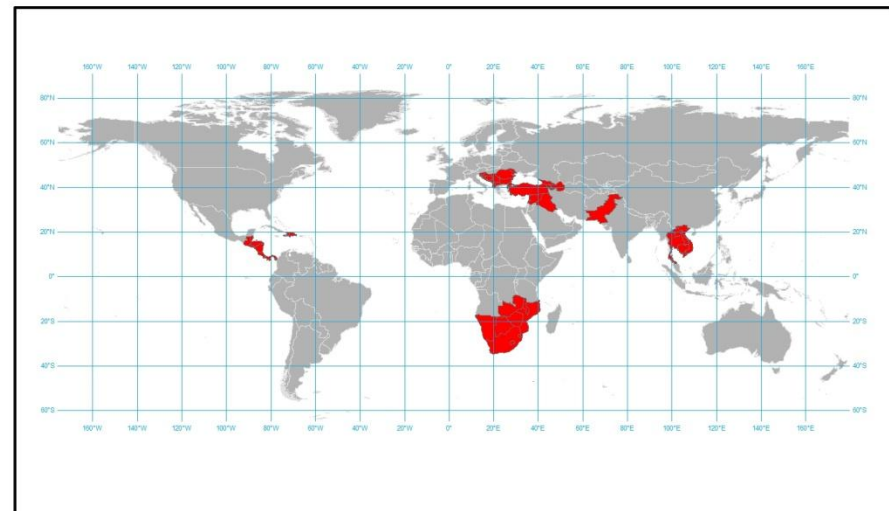


# Flash Flood Guidance Partnership

Collaboration between NOAA and the Hydrologic Research Center (HRC) to provide Flash Flood Guidance (FFG) systems for different parts of the world is supported by a MOU among NOAA, HRC, WMO, and USAID.

NOAA provides satellite rainfall estimates for a HRC-developed forecasting tool used by in-country weather services to identify regions of flash flood risk.

- Each systems is run by the host country—a local solution to a local problem.
- Currently serving nearly 10% of the world's population.



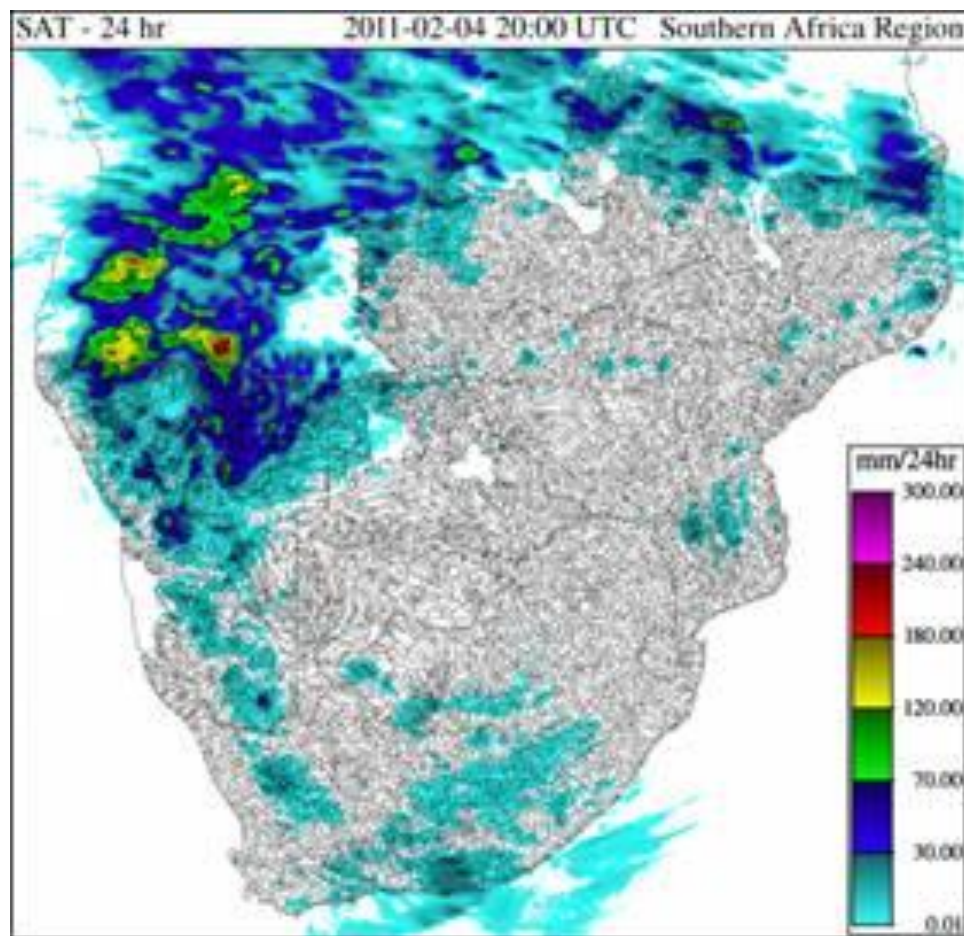




# A Success Story: Namibia

**February/March 2011—**  
heaviest rainfall in  
many areas in >120  
years of records.

**Satellite rainfall  
estimates used  
extensively in  
Namibia Hydrological  
Service (NHS)  
bulletins—very  
positive feedback  
from NHS after the  
event.**





## **For More Information...**

**Satellite Rainfall Estimation: Bob Kuligowski, NOAA  
([Bob.Kuligowski@noaa.gov](mailto:Bob.Kuligowski@noaa.gov))**

**Flash Flood Guidance System information and  
implementation: Konstantine Georgakakos, HRC  
([KGeorgakakos@hrc-lab.org](mailto:KGeorgakakos@hrc-lab.org)) and Bob Jubach, HRC  
([RJubach@hrc-lab.org](mailto:RJubach@hrc-lab.org))**



# CEOS WGCapD

Shuttle Radar Topography Mission 2 Data Being Released for Humanitarian Causes

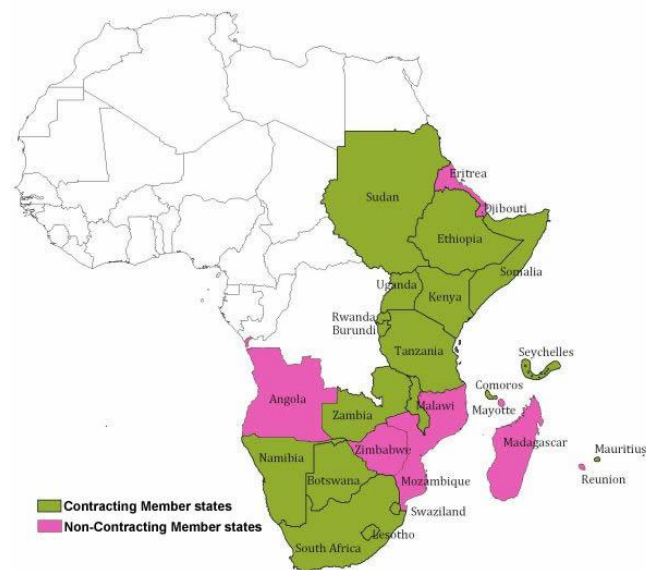
Working on Future Releases for Flood Prone Areas

Scheduling Workshops with Regional Partners to Increase Local Capacity to Use SRTM Data

Partnering with the Regional Center for Mapping of Resources for Development

CEOS WGCapD/RCMRD joint

- Refugee planning
- IWRM
- Flood Forecasting
- Agriculture Products





# CEOS Regional End to End Projects

- **Two Projects**
  - Namibia Flood Pilot
  - Caribbean Satellite Disaster Pilot
- To demonstrate the effectiveness of satellite imagery to strengthen regional, national and community level capacity for mitigation, management and coordinated response to natural hazards
- To identify specific satellite-based products that can be used for disaster mitigation and response on a regional level
- To identify capacity building activities that will increase the ability of the region to integrate satellite-based information into disaster management initiatives
- Define & facilitate implementation of a sensor web-based architecture for risk management from a multi-hazard perspective

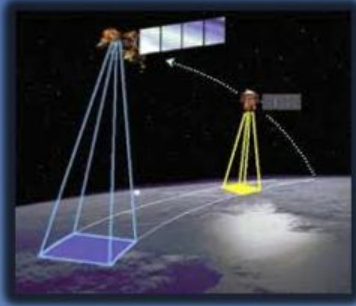




# CEOS Regional End to End Projects

- **Expected Impact:**
  - Reduce the time to acquire and improve the use of relevant satellite data for flood assessment and forecasting
  - Increase the usefulness of derived satellite flood data products for local populations
- **Approach:**
  - Document and prototype a disaster management architecture to demonstrate improved decision support capability and access to remote sensing assets
  - Conduct socioeconomic surveys in flood prone areas
    - Identify local concerns/cultural barriers which prevent use of local flood forecasts
    - Explore methods to incorporate local observations into decision support systems and social networking technology (e.g crowd sourcing)

# Objectives Illustrated



Satellite Observation



In-Situ Gauge

$$E = 1 - \frac{\sum_{t=1}^T (Q_o^t - Q_m^t)^2}{\sum_{t=1}^T (Q_o^t - \bar{Q}_o)^2}$$

Predictive Flood Model



Household Surveys



SensorWeb Processing



Decision Support System



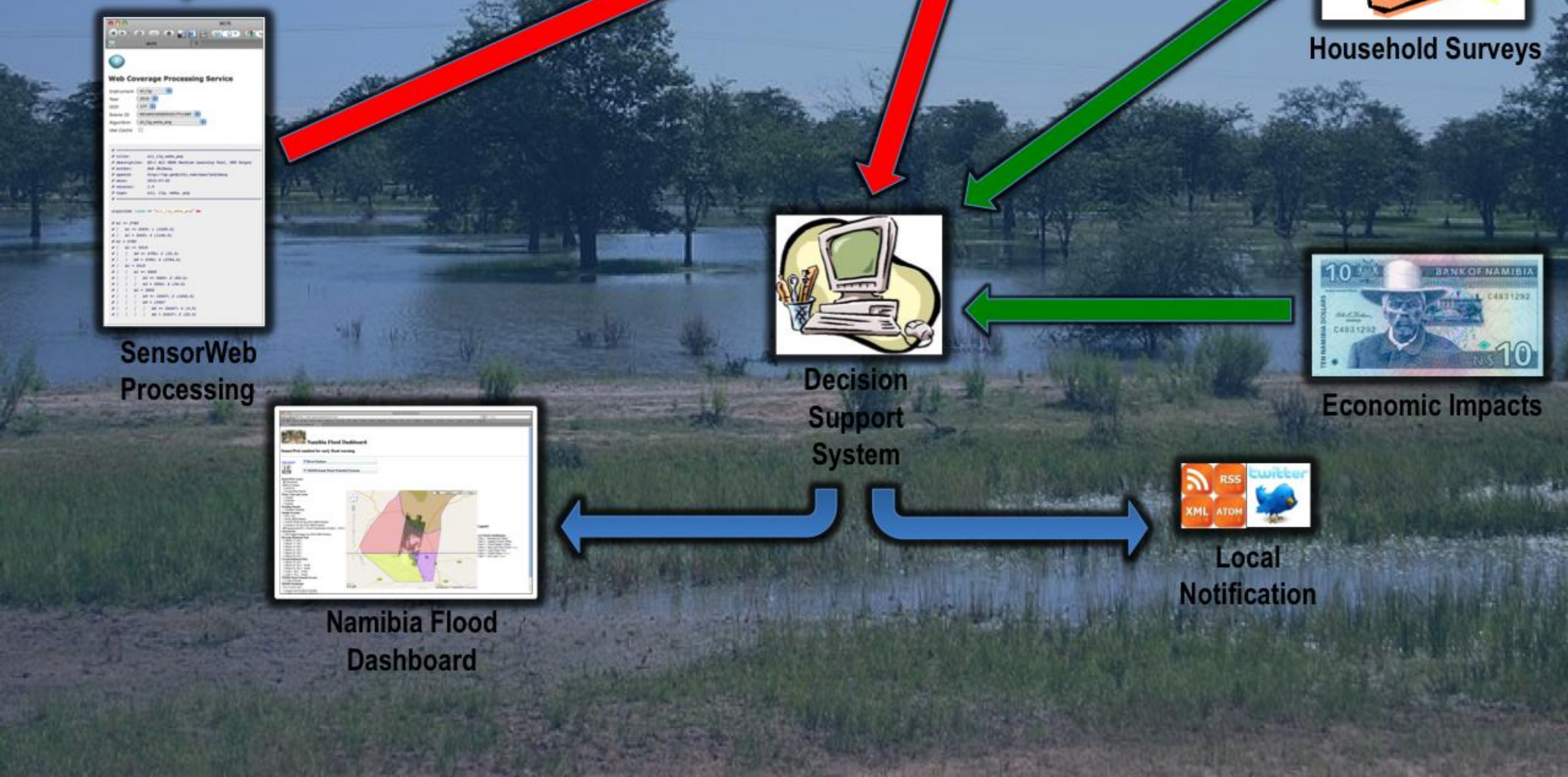
Economic Impacts



Namibia Flood Dashboard



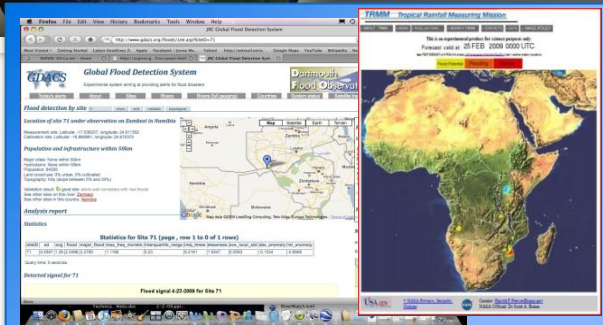
Local Notification



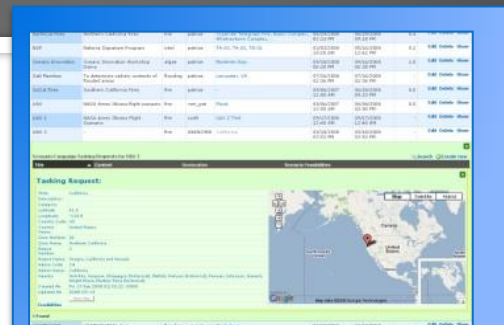




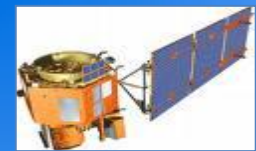
# NASA Flood SensorWeb Concept



Detect Heavy Rains and Floods Upstream at a coarse level



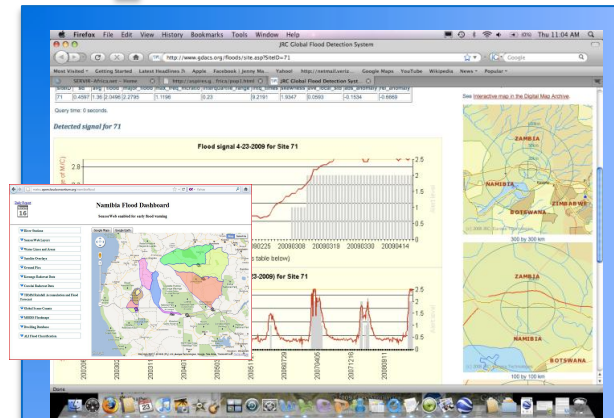
Task Multiple Sensors in Area of Interest



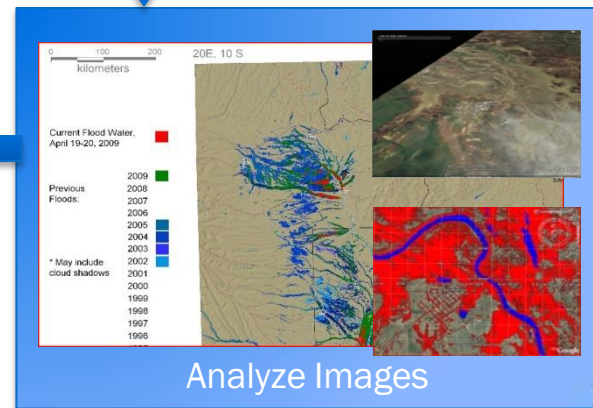
Acquire Satellite Data (Images)



(River Gauge)



(1) Automatically update model and validate (2) Display data on Web





# Approach

- **Namibia Department of Hydrology, Namibia Ministry of Health**
  - In-country equipment, personnel and other resources
  - Logistics support
  - Direct technology development of other stakeholders
  - Local conditions expertise
- **NASA, Univ. of Maryland, Univ. of Chicago, Univ. of Oklahoma, Open Cloud Consortium**
  - Satellite imagery
  - Training on how to process the imagery to extract salient flood information
  - Preliminary flood models
  - Training on further refinement of flood models
  - Computation cloud and web interface to host data, models and displays
- **Univ. of Namibia and Univ. of Maryland**
  - In country survey development and design
  - Conduct case study surveys in flood prone areas
  - Culturally informed data analysis





# Training for Data Capture



Georeferenced photos to enable Rob Sohlberg from Univ. of Maryland to train classifier to detect presence of water in grassy marsh lands via from satellite data.



McCloud Katjizeu (orange) Dept of Hydrology compares GPS readings of control point with UNAM students for mapping exercise



# Project Augmentation: Socioeconomic Assessment



Left to Right: Matt Handy (NASA), Reinhold Kambuli (NDH), Village Resident, Dr. Julie Silva(UMD), John Moyo(Local Guide)

Preliminary visits to flood prone villages to gauge community interest in participating in socioeconomic surveys and assess familiarity and perceptions of radio flood forecasts.





# Flooding and Impacts on Local Livelihoods



Villager shows flood damage and impact during team site assessment







# Flood Impact on Wild Life and Subsequently on Humans Nearby



Hippo tracks near villager  
Crop fields. Hippo crop  
destruction is big impact to villagers.





# Request from Namibia Hydrological Services

**Monitor flooding in near-real time**

**Create classification products**

- ✔ partition floodwaters by turbidity
- ✔ presence of grasses, etc.

**Demonstrate rapid prototyping utilizing Web Coverage Process Services (WCPS)**

- ✔ To be used to both inform civil managers and – more importantly – to develop and validate predictive models.

**Improved hydrological model based on CREST**

- ✔ Model developed by University of Oklahoma

**Improved data products pipeline ( more automation)**



# Contributions of Namibian Partners

Local terrain expertise to improve modeling

Expertise on conducting local surveys

Develop new techniques and products useful to decision makers

Namibian model will be extended to other countries and applications.



Hydrology team begins river validation exercise

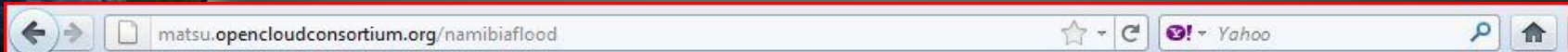


Dan Mandl/NASA, Alphons Mosimane/UNAM, Selma Lendevlo//UNAM, Dr. Julie Silva/UMD, Dan Mandl/NASA, Victoria Shifidi/Dept Hydrology , Dr. Simon Angombe/UNAM, Margaret Angula/UNAM

**Socioeconomic team discusses desired outcomes, timeline and next steps to develop a village level study which is integrated with Hydrology Dept. effort.**



# Flood Dashboard from Namibia



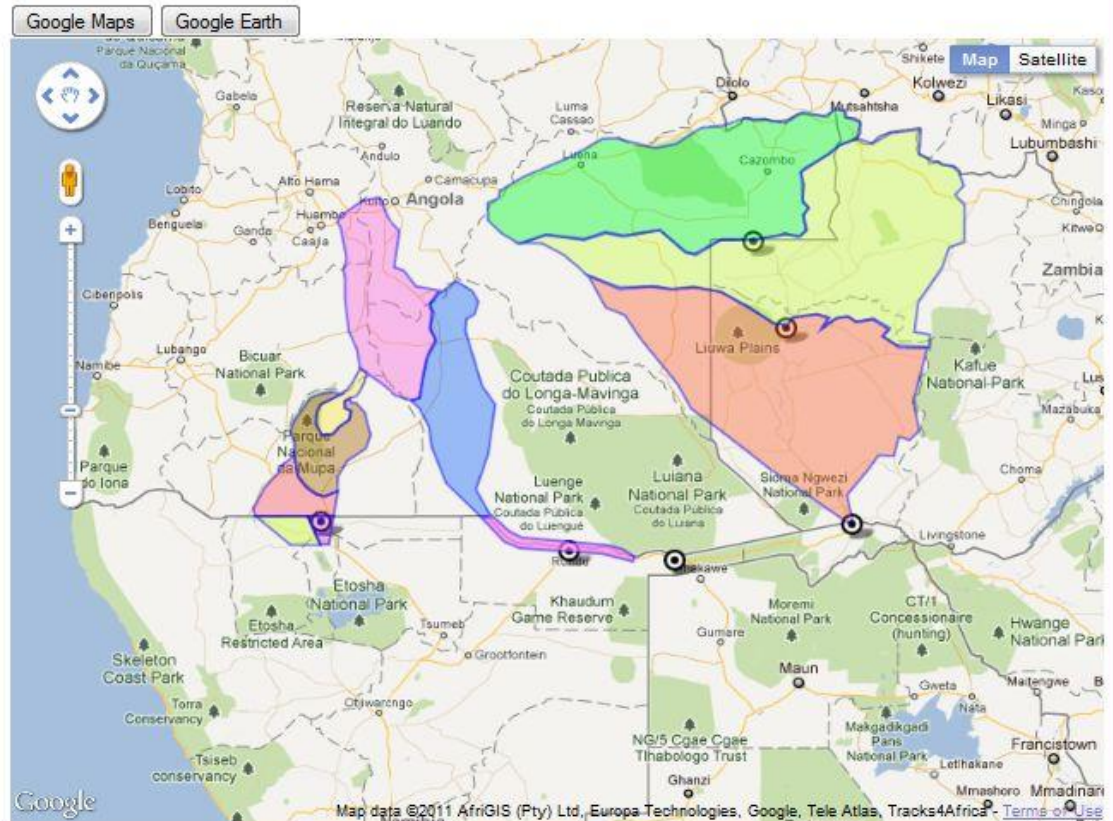
[Daily Report](#)

Nov  
**16**

## Namibia Flood Dashboard

SensorWeb enabled for early flood warning

- ▼ River Stations
- ▼ SensorWeb Layers
- ▼ Water Lines and Areas
- ▼ Satellite Overlays
- ▼ Ground Pics
- ▼ Kavango Radarsat Data
- ▼ Cuvelai Radarsat Data
- ▼ TRMM Rainfall Accumulation and Flood Forecast
- ▼ Global Scene Counts
- ▼ MODIS Floodmaps
- ▼ Dwelling Database
- ▼ ALI Flood Classification





**Questions?**