New Flooding Patterns on the borders of Namibia

Namibia Hydrological Services

Tiger Project 27 Initiative
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Project Area – Description

Cuvelai Catchment

Namibia
Legend
Monitoring Stations
Id, Name
1, Engela
2, Shahaingu
3, Shanalumono
4, Shakambebe
5, Endola
6, Okatana
7, Sky Bridge
8, Kandjengendi
9, Ompundja
10, Shakanwa
11, Okalongo west
13, Onembamba
14, Shapoko
15, Onelago
16, Otamanzi
16, Shanaimbwele
17, Ombwana
Global Flood Detection System - Version 2

An experimental system to detect and map in near-real time major river floods based on daily passive microwave satellite observations. The purpose is to identify and measure floods with potential humanitarian consequences after they occur.
Namibia Flood Background

- Emergency disaster conditions for 1/3 of Namibia population, losses of lives, disruption of agriculture, economic activities and damage to infrastructure.
  - 2008, and then 2009 and then 2011: Cuvelai: Highest in living memory
- Possible impact of increased climatic variability uncertain – Climate change models anticipate higher hydro-meteorological extremes for both droughts and floods
Project Objectives

- To develop a flood management system for the Cuvelai catchments focusing on flood modelling and flood mapping using earth observation data and techniques.
 Targets

- Drainage and flood risk maps for project area
- Scientific evaluation reports of the magnitude and effect of more extreme hydro-meteorological conditions
- The institutional capacity building to map floods from space especially using radar images.
- The upgrade of 2 staff (Bsc and PM) to the MSc level is important to the organisation
- Real-time operational flood model and mapping
Methodology

- Radar Flood Mapping
- Build a simple flood forecasting model that relates rainfall in Angola to the floods in the Cuvelai area
  - Satellite based rainfall–runoff model for flood simulation
  - Modelling of hydrological processes– LIS flood Model
The modelling is needed for the catchments flood modelling

The satellite data handling is needed to serve for parameterisation of Cuvelai system. Important inputs are Meteorological data (rainfall and evapotranspiration) land cover data, soil data and maps of flood inundation
Capacity Building needs

- EO data handling
- Image acquisition (sensor type)
- Image classification, calibration, verification, and validation
- Flood risk and Hazard Mapping
- DTM processing (ALOS PRISM)
- Integrating hydrology with RS
- Results visualization and simulation
Training

- 25–29 April in Cairo, Egypt
  The basics of Remote Sensing and the use of advanced optical imagery
- 14–21 October in Nairobi, Kenya
  Advanced use of (RS) optical imagery
- 17–21 June 2011 Delft, Netherlands
  Advance passive and Microwave RS
Progress

- The Lisflood distributed model developed by JRC-Joint Research Centre- European Commission

- Model chosen because of its proven ability to forecast floods over larger spatial domains and since the model allows for assessing effects of land cover changes, effects by climate change etc

The LISFLOOD process (Source van der Knijff and de Roo, 2008)

- \( P \) = precipitation
- \( \text{Int} \) = interception
- \( \text{EW} \text{int} \) = evaporation of intercepted water
- \( \text{D} \text{int} \) = leaf drainage
- \( \text{ES} \text{a} \) = evaporation from soil surface
- \( \text{T} \text{a} \) = transpiration (water uptake by plant roots)
- \( \text{INF} \text{act} \) = infiltration
- \( \text{Rs} \) = surface runoff
- \( \text{D1, 2} \) = drainage from top to subsoil
- \( \text{D2, gw} \) = drainage from subsoil to upper groundwater zone
- \( \text{Dpref, gw} \) = preferential flow to upper groundwater zone
- \( \text{Duz, I} \) = drainage from upper to lower groundwater zone
- \( \text{Quz} \) = outflow from lower groundwater zone
- \( \text{Quz} \) = outflow from upper groundwater zone
- \( \text{Dloss} \) = loss from lower groundwater zone

Surface runoff routing

River channel
Preliminary results
Planned activities:

Modelling:

- Acquisition and processing of satellite data to parameterise the distributed runoff/flood model and to, after the model has become operational, evaluate and validate the capacity of the model to predict and forecast runoff/flood events.
- Obtain and process the ALOS PRISM 2.5 M resolution imagery from ESA and create a high resolution DEM.
- Downscaling lisflood model to finer resolution DEM generated from 2.5 m ALOS PRISM data and short duration rainfall satellite imagery data.
- Acquisition of ground observation data for model validation and calibration.
CHALLENGES

- High-resolution DEM with good elevation accuracy
- Specific training in SAR image processing for flood vectors
- Involvement of Angola and access to data from Angola
- Validation of rainfall-runoff model
Dankie  Merci  أشكرك

谢谢  Dank U  Asante

Dank U  Gracias  Obrigado

Grazie  Teşekkür ederim  Köszönöm

Thank You  Enkosi  Köszönöm