THE NATIONAL WEATHER CENTER

AND MANY MORE...
HYDROMETEOROLOGY AND REMOTE SENSING LABORATORY

- Data Assimilation
- Quantitative Precipitation Estimation
- Flash Flooding and Landslides
- Remote Sensing

- 29 researchers
- Over 100 publications
- Product development
  - Global
  - National
- Partners around the world
Faculty and Scientists

Postdocs and Visitors

Graduate Students

WORKING TOGETHER IN WATER, WEATHER, AND CLIMATE

Plus several undergraduate students and over 40 alumni.....
PROJECT BACKGROUND

- NASA SERVIR - project with USAID to use satellites to help developing nations improve “environmental decision making”
  - Weather forecasts, flood forecasts, drought monitoring…
- CREST is a joint development between NASA and OU
- Namibia has highly variable climate; mostly arid or semi-arid; lots of floods and droughts
CHALLENGES

- Resolution
  - Temporal: every 3 hours
  - Spatial: 0.25 deg latitude and longitude (~110 km at equator)
- Background data missing or incomplete
- Lack of observations (only six gauges)
  - No rain gauges
- Ephemeral rivers
- Endorheic rivers
EXAMPLE DATA FOR MODELS

1. **HWSD Soil Texture**
   - 0 - 5 - 10
   - 1 - 6 - 11
   - 2 - 7 - 12
   - 3 - 8 - 13
   - 4 - 9

2. **HydroSHEDS**
   - Global river network derived from SRTM elevation data

---

The image shows maps of the world with various data representations, including soil texture and hydrographic data.
matsu.opencloudconsortium.org/namibiaflood

Daily Flood Bulletin from the Namibia Hydrological Services →
Calibration
2003.01.01-2005.12.31
NSCE=0.688
Bias(%)=0.774
CC=0.830

Validation
2006.01.01-2007.12.31
NSCE=0.247
Bias(%)=44.998
CC=0.792

Streamflow (cmsg)

Next steps include:

- CREST near-real-time forecasts for major river basins (6-12 hours)
- Remote training (MOOC)
- Higher-resolution distributed CREST over all of northern Namibia
- Develop CREST examples in the cloud
NAMIBIA FLOOD DASHBOARD

- Reduce all these steps (and those on previous slide!) to 2 or 3 that can be executed free of charge on the Web.
CREST TRAINING

- Multiple courses
  - Each roughly 40 hours or one week of full days
  - Lectures, practical examples, field work (?), worksheets, videos

- Course I completed February 2014 Namibia
- Course II tentatively planned January 2015 Namibia
- Course I may be re-taught (partially) at University of Oklahoma – Spring 2015

- May use OU MOOC system
- Post materials on Dashboard
- Will also use manuals and journal articles
CREST TRAINING

- Some areas aren’t amenable to in-person training
  - Pakistan

- Alternative is a training video or YouTube
  - Easier to use with slow Internet connections in some countries
Day 1 & 2 Flood and Drought Risk Management Workshop

Day 3
- Overview of CREST and hydrologic modeling

Day 4
- Data used in CREST
- CREST applications (US, globally, other regions)
- Running CREST (Wangchu basin, China)
- Using CREST with relative referencing and batch files
- Manual and automatic calibration

Day 5
- Visualization in Microsoft Excel (hydrographs)
- Visualization in ArcGIS
- Downloading/using DEMs, FACs, and FDRs
- Running Okavango calibrated example

Day 6
- Field Campaign to update EO-1 images for gauges in Kuiseb River Basin
NAMIBIA
WHY NAMIBIA?

- Independence from South Africa in 1990
- Ministry of Agriculture, Water, and Forestry
  - Department of Hydrology (~50 employees?)
  - Part of the Directorate of Resource Management
- Past head, Guido Van Langenhove, recently passed away
- Loss of institutional knowledge
- Good time to learn CREST?
NAMIBIA’S HYDROCLIMATE

[Map showing average rainfall (mm/yr) and average evaporation (mm/yr) in Namibia]
Gauge station along typically dry river bed (has water usually less than 10 days per year)

Middle of Namib Desert but near coast

Source of groundwater for Walvis Bay

Namwater operates a station, tanks, and several boreholes

Inhabited by Topnaars – live in desert, speak click language, sell nara seeds
In case you get lost in the desert, signage is always available.
120 km SE of Walvis Bay

A river gauge station operated by Hydrology Dept (and another for Namwater)

Gauge installed in the 1970s; telemetry since 2012

Communicates via EUMETSAT

Water has not ever reached the gauge house but record gauge datum is over 3 meters

Tourism Dept/Desert Research Foundation has a research station nearby
Installed in the 1960s (160 km upstream of Gobabeb)

- Not accessible by road; if stream has water they climb down the cliffs and hills (otherwise use 4x4 low and drive down the riverbed; 2 km or so from nearest bridge)
- French had a station downstream in mid 2000s
- When water in river, inject dye at the weir and then few hundred meters downstream monitor dye flow rates
- We were lucky – water in river (but shallow enough to ford!)
  - Rained in Windhoek on Tuesday – took until Friday or Saturday for water to reach Schlesienweir
TECHNOLOGICAL CHALLENGES

- Outdated equipment (I had never seen actual hydrograph paper)
- Old calibrations
- Hard-to-reach stations
- Sandy stream channels