Flash Flood Guidance System On-going Enhancements

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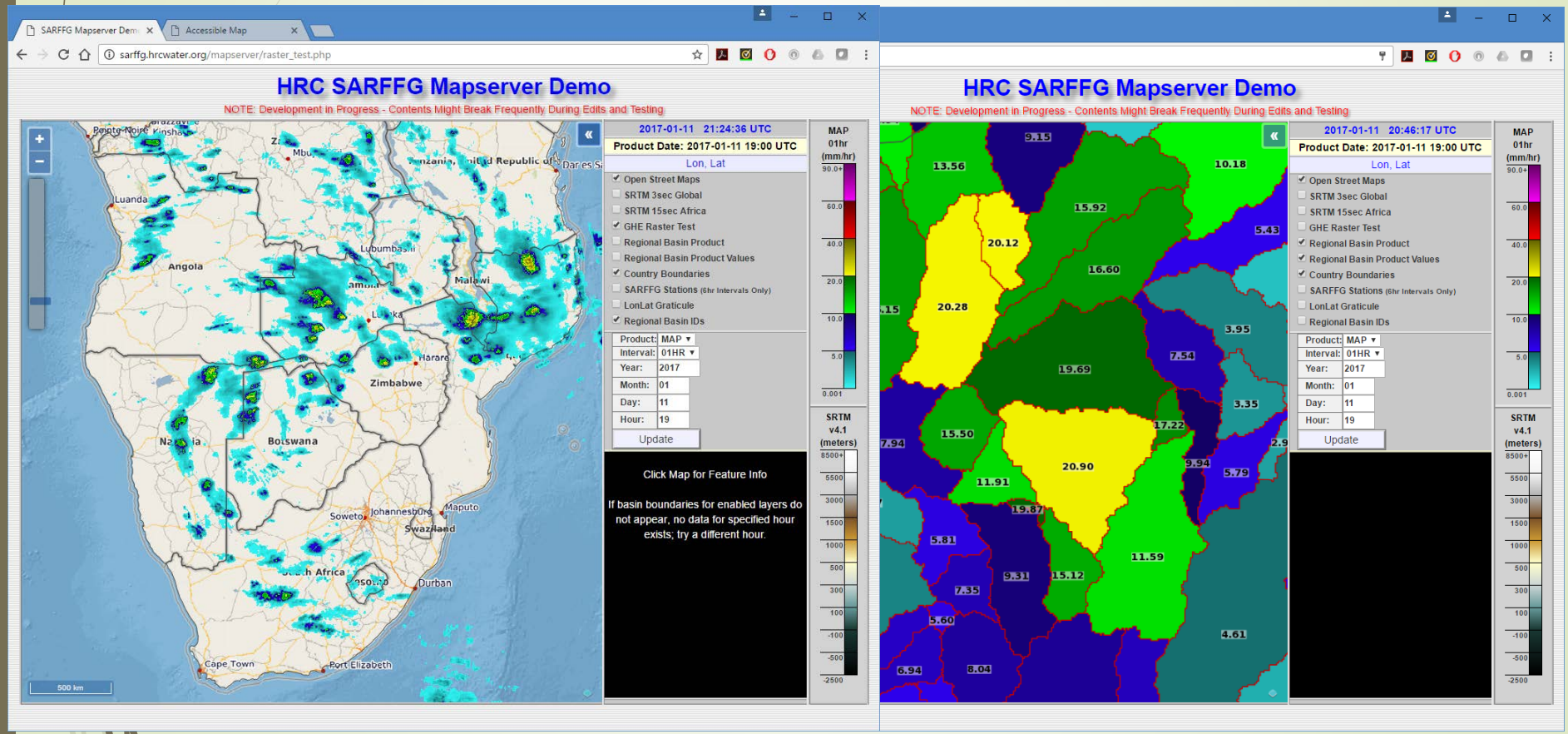
CARFFG SCM4 31 OCT – 2 NOV 2017 Astana, KAZAKHSTAN

FFG System Enhancements

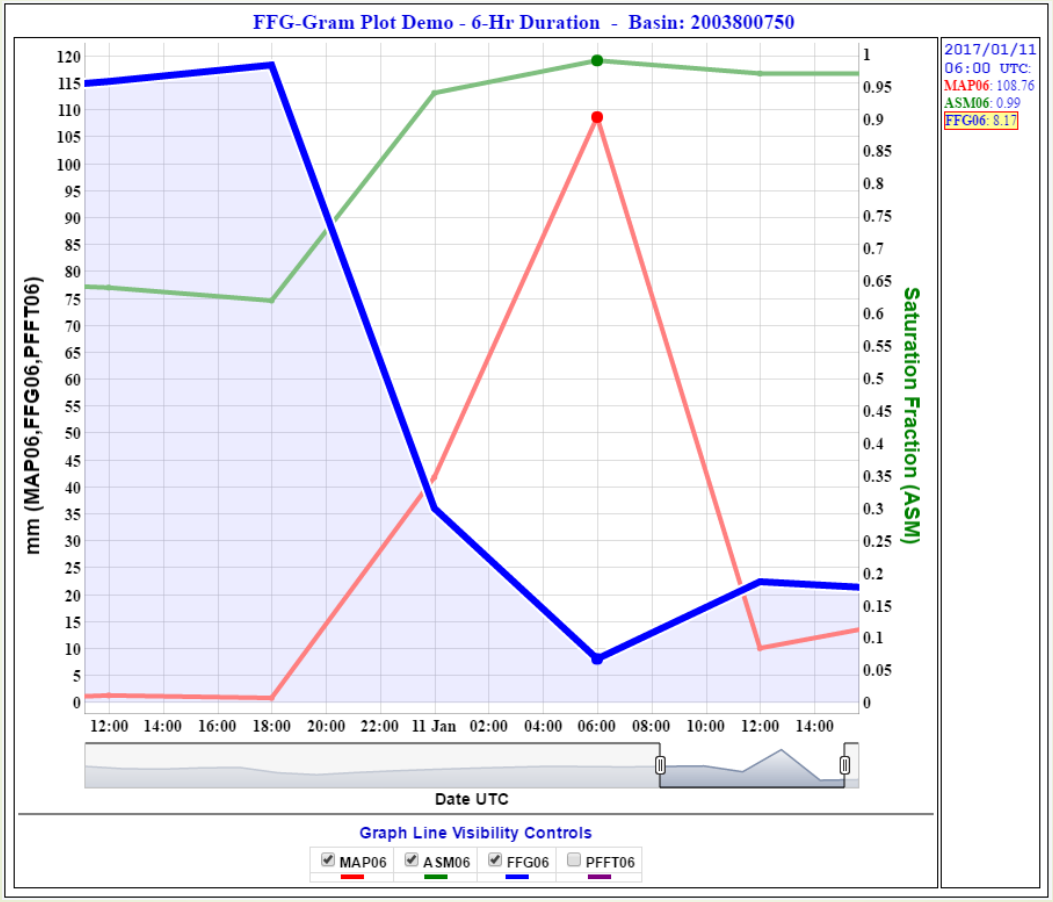
The following enhancements are in various stages of development and implementation based on specific country needs, expressed interest, funding priorities and cooperation.

- *Multi-model quantitative precipitation forecast (QPF) use within FFG systems*
- *Use of satellite inundation mapping and associated surface soil moisture observations to adjust FFGS soil water estimation.*
- *Landslide susceptibility and landslide occurrence prediction*
- *Urban Flash Flood Warning*
- *Riverine routing and discharge ensemble prediction*

Map Server Interface



FFG –Gram time series plots:



Geostationary Operational Environmental Satellite - R Series (GOES-R)

Launched in Nov 19, 2016

QPE:

- 2km
- 4- time per hour
- Latency ~5min
- Using 5 IR bands
- Calibrated with MW

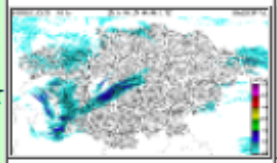
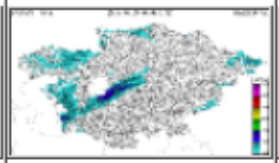
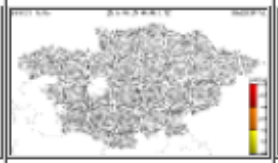
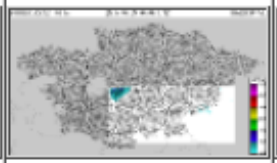
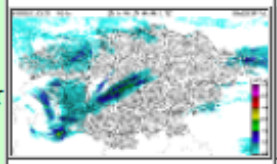
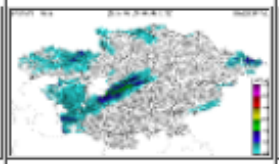
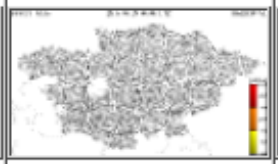
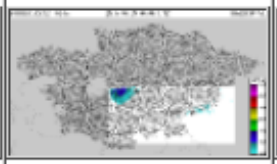
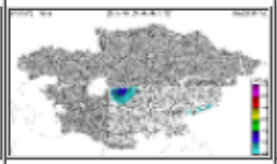
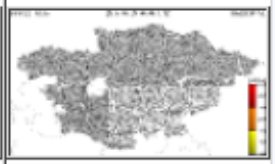
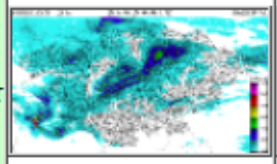
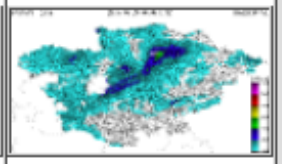
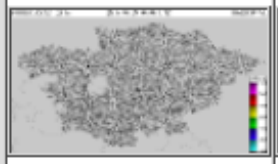
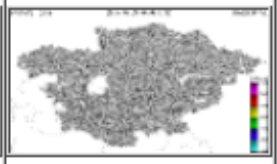
Current Meteosat Satellites

SATELLITE	LIFETIME	POSITION	SERVICES
Meteosat-11 (MSG)	15/07/2015 – tbc	In orbit storage	n/a
Meteosat-10 (MSG)	05/07/2012 – Nominal fuel lifetime is until 2022	0° 36,000 km	0º SEVIRI Image Data. Real-time Imagery. Data Collection Service
Meteosat-9 (MSG)	22/12/2005 – Fuel lifetime is expected to be extended until 2021	9.5° E 36,000 km	Rapid Scan Service from 9 April 2013. Real-time Imagery
Meteosat-8 (MSG)	28/08/2002 – Fuel lifetime is expected to be extended until 2019	41.5° E 36,000 km	Full IODC service

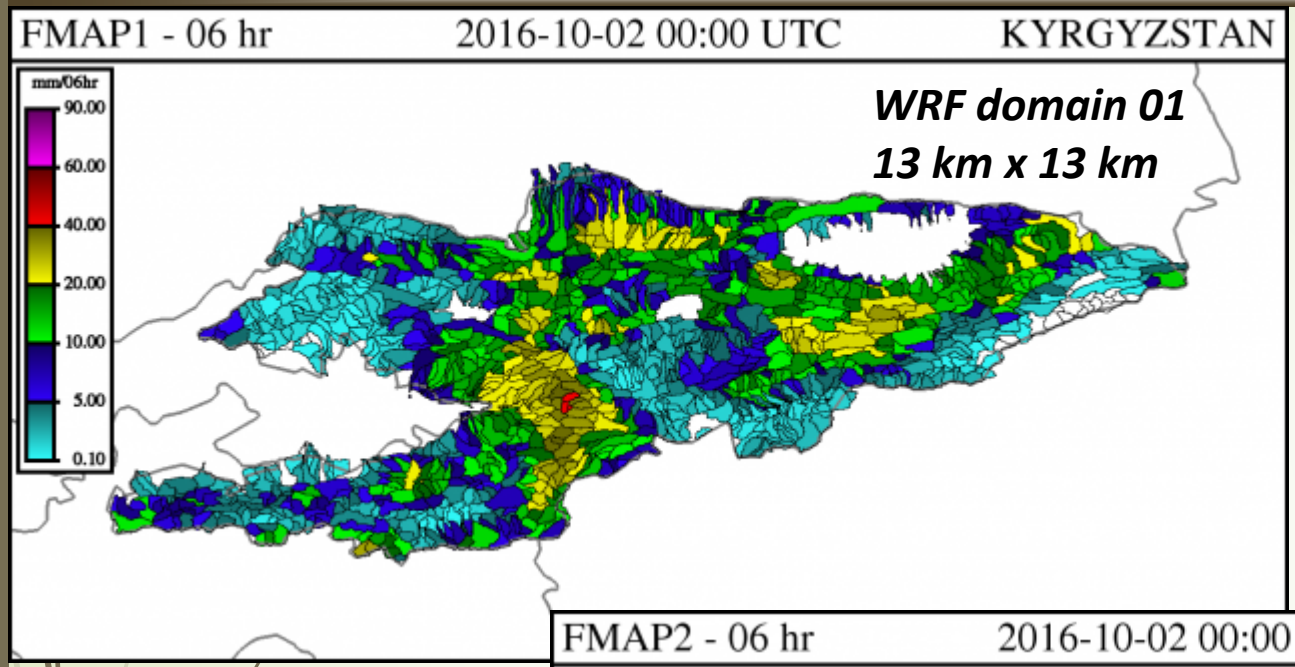
http://www.goes-r.gov/products/ATBDs/baseline/Hydro_RRQPE_v2.0_no_color.pdf

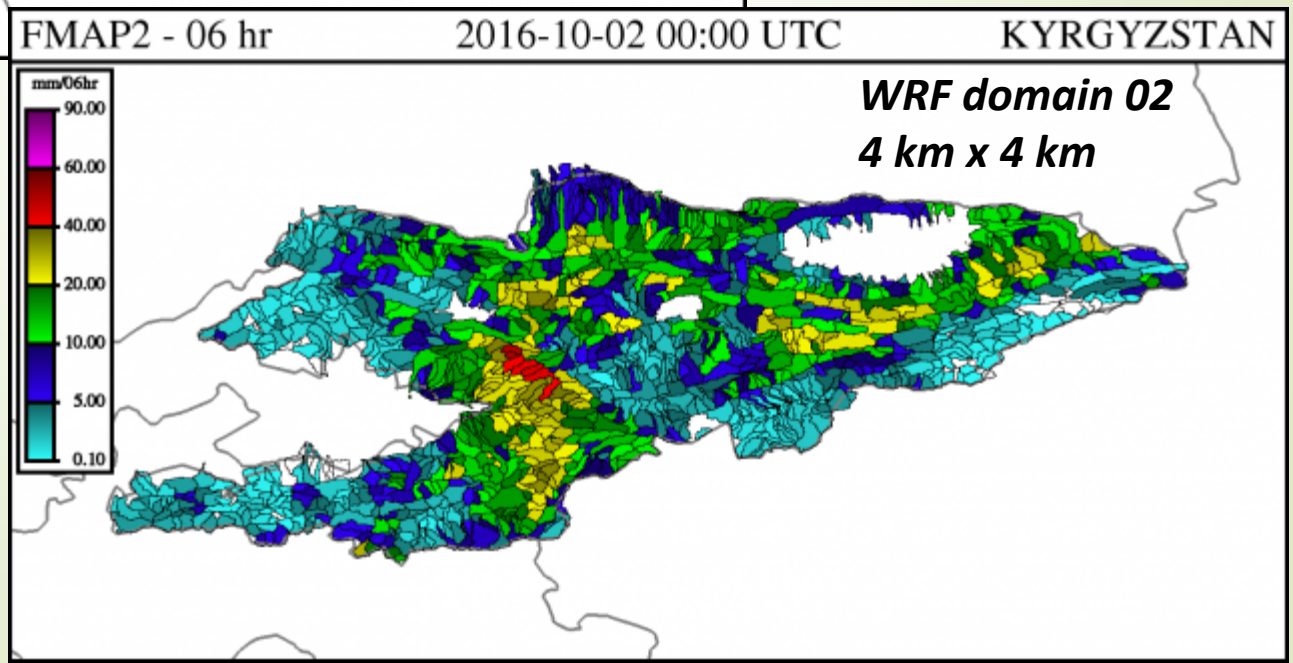
Multi-model QPF Use in CARFFG System

Forecast Products

DT	WRF D01 Forecast	WRF D01 FMAP	WRF D01 FFFT	WRF D02 Forecast	WRF D02 FMAP	WRF D02 FFFT
01-hr						
03-hr	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view
06-hr	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view
24-hr	 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view		 2016-09-29 06:00 UTC Text: view	 2016-09-29 06:00 UTC Text: view	

Multi-model QPF Use in CARFFG System





Land Slides

EOS Earth & Space Science News

NEWS | NEWS FROM AGU JOURNALS | TOPICS & DISCIPLINES | OPINIONS | BLOGS | JOBS & RESOURCES

NATURAL HAZARDS | Project Update

An Early Warning System for Landslide Danger

Advances in satellite imaging, mapping, and rainfall estimations have made it possible to implement a regional real-time assessment of landslide hazard threats across Central America.

After a 2013 landslide in Finca Loma Linda, Guatemala, 65 people were forced to evacuate to an emergency shelter in a community hall. The Hydrologic Research Center, a nonprofit research corporation, is developing a landslide hazard threat assessment for Central America. Credit: Conred Guatemala, CC BY-ND 2.0

By Ari J. Posner and Konstantine P. Georgakakos | 3 November 2016

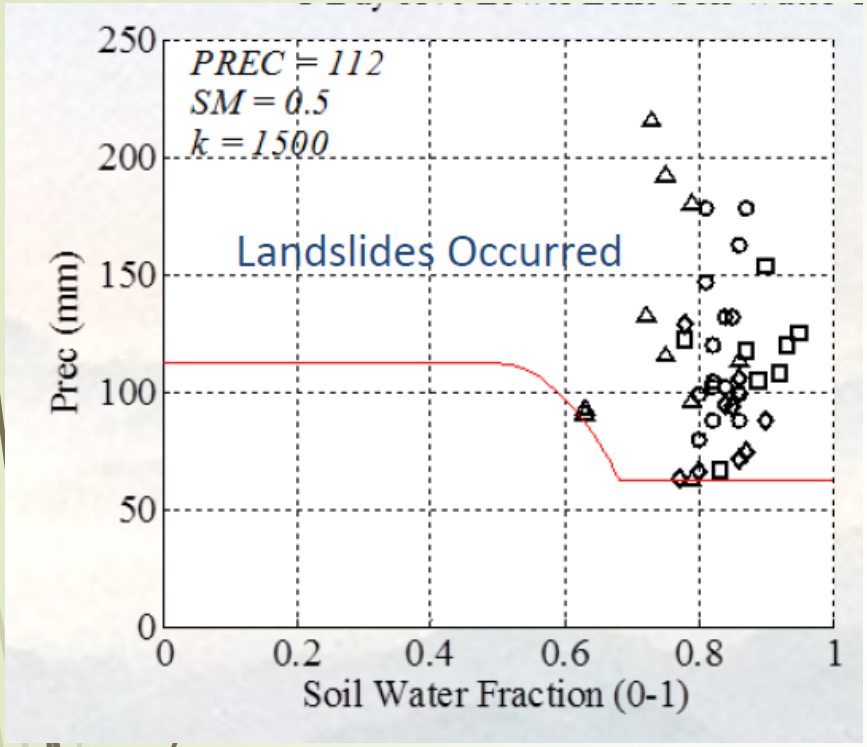
For more information on the Landslide Early Warning System for Central America ...

See the recent article in EOS. Available at:

https://eos.org/project-updates/an-early-warning-system-for-landslide-danger

Citation: Posner, A. J., and K. P. Georgakakos (2016), An early warning system for landslide danger, *Eos, 97*, doi:10.1029/2016EO062323.
Published on 03 November 2016.

Landslide Assessment in Real-Time



Currently being deployed for Central America FFG System

1) From database of historical landslide events, develop threshold line of antecedent soil moisture condition and precipitation for those known events.

2) Use of real-time FFG system estimates of lower soil moisture and precipitation to identify at-risk watersheds.

3) And then the landslide susceptibility map to identify critical regions within watersheds.

Historical analysis is data-intensive, requiring quality records of landslide occurrence, location and other attributes.

Land Slide Threat [LST]

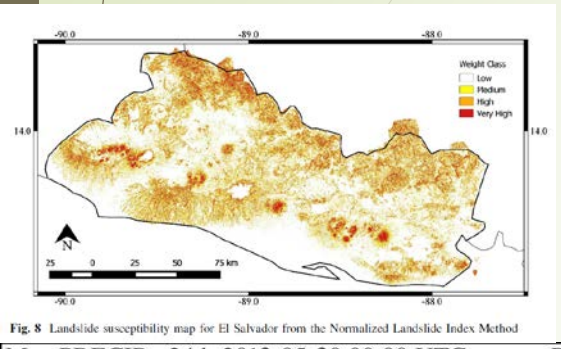
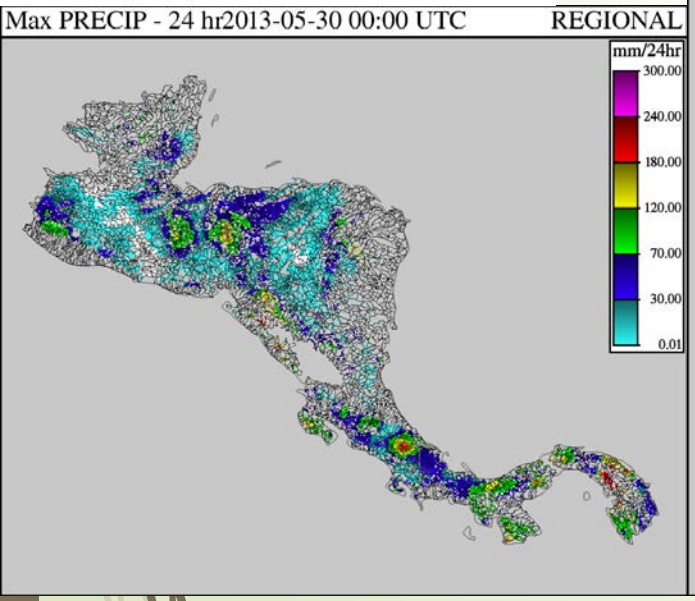
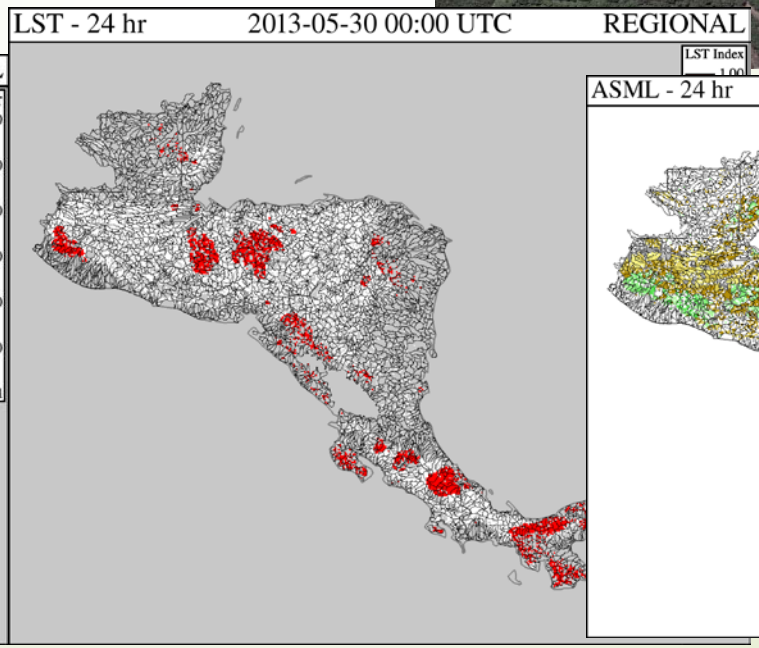
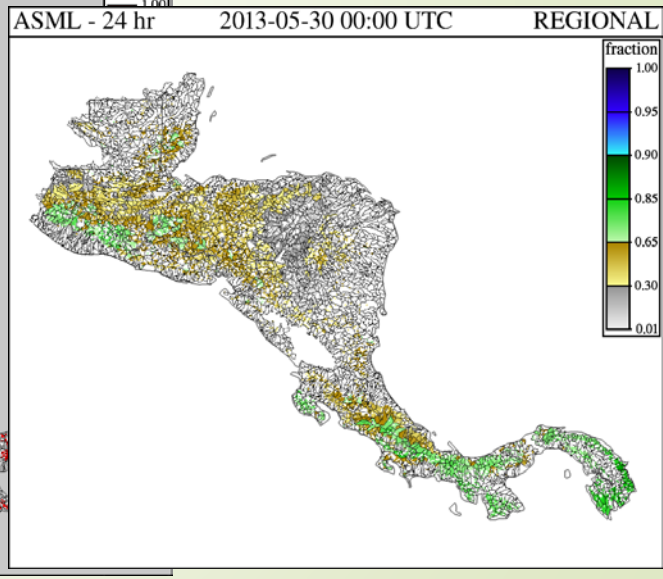


Fig. 8 Landslide susceptibility map for El Salvador from the Normalized Landslide Index Method

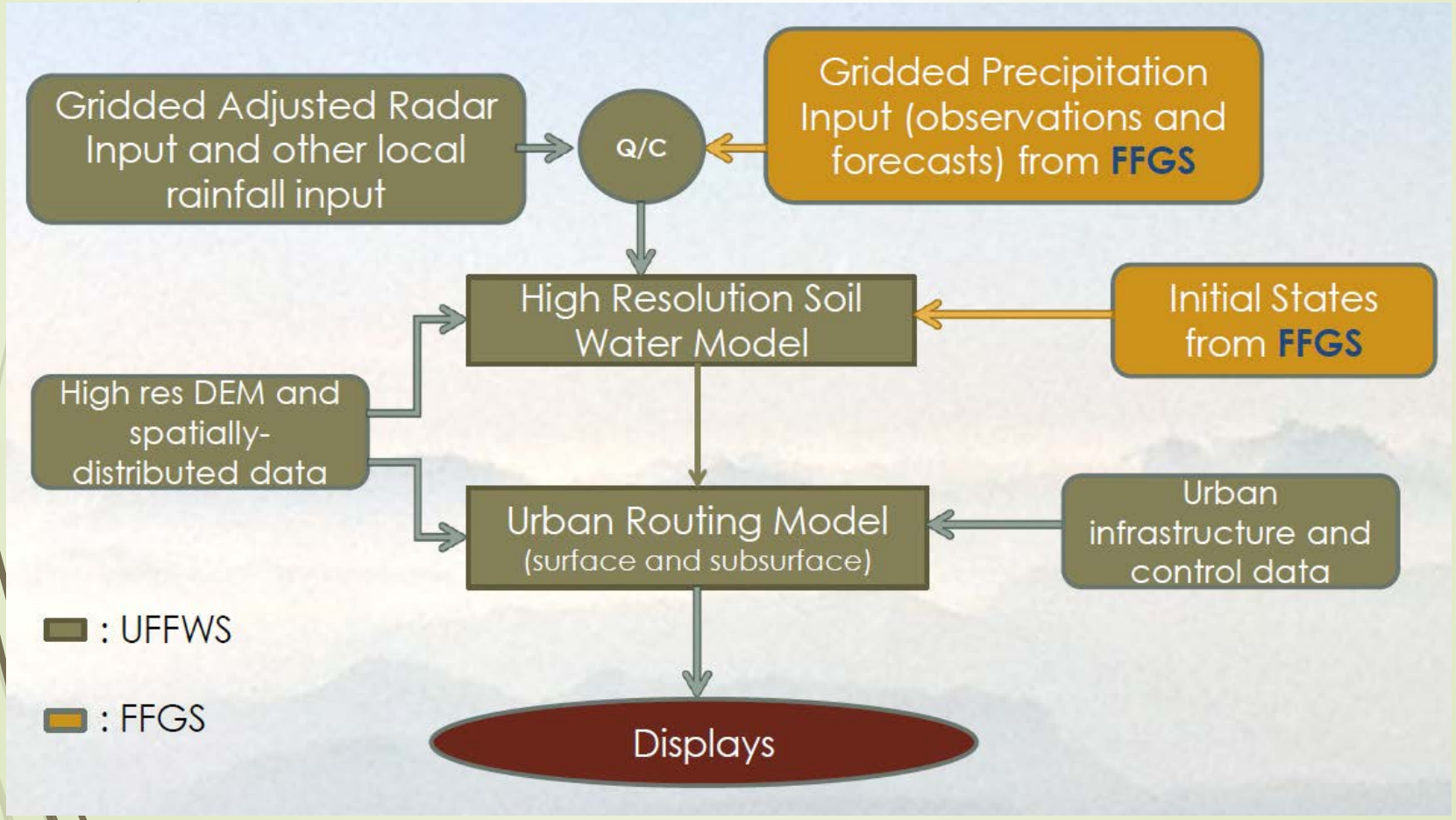






Urban Flash Flood Warning

Builds upon data available from FFGS (precipitation, model conditions) and includes high resolution modeling in urban area to include both surface and subsurface flow routing.



Urban Flash Flood Warning

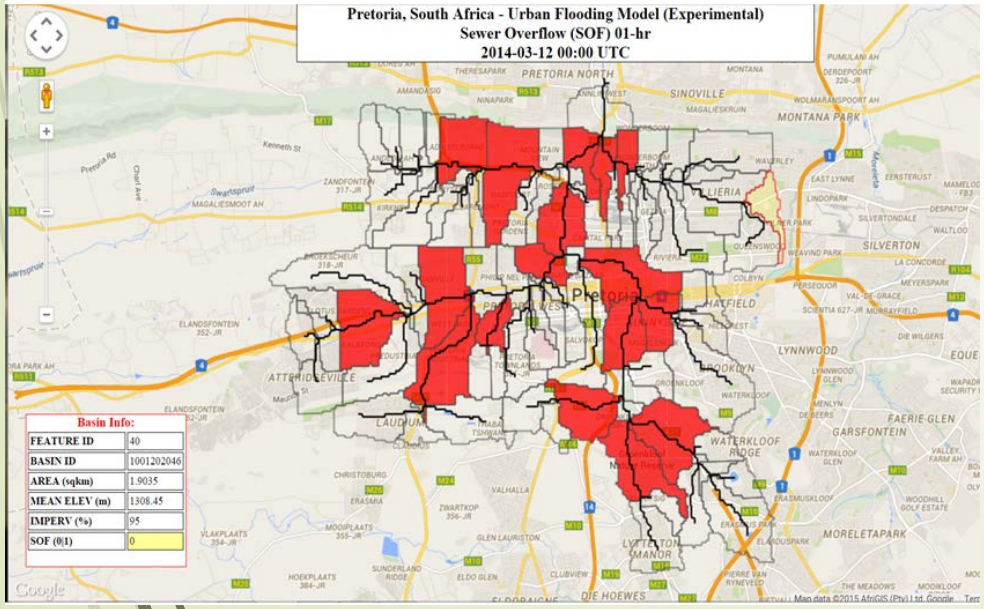
Demonstration for the municipality of Pretoria, Rep. of South Africa.

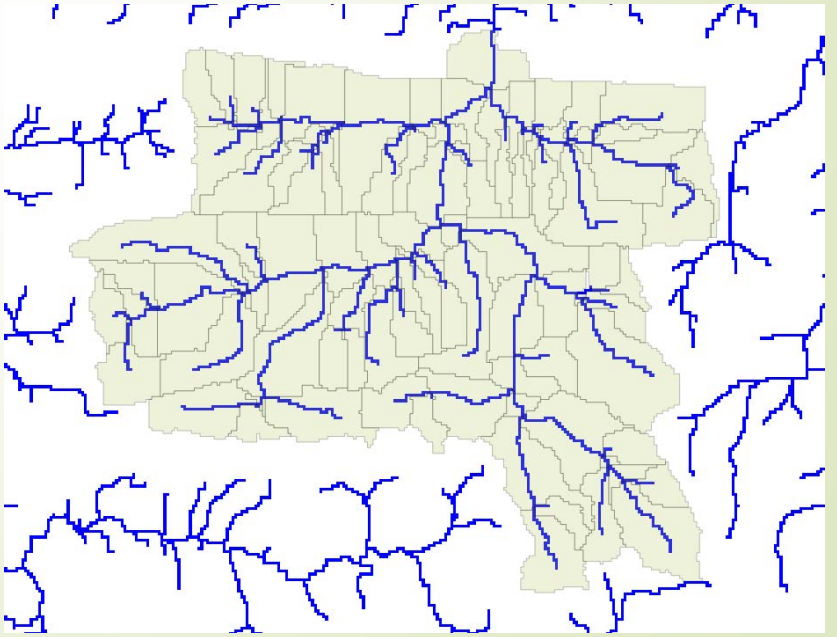
Requires urban storm sewer information.

Urban watersheds define at a resolution of 2km².

Surface and subsurface flow modeled.

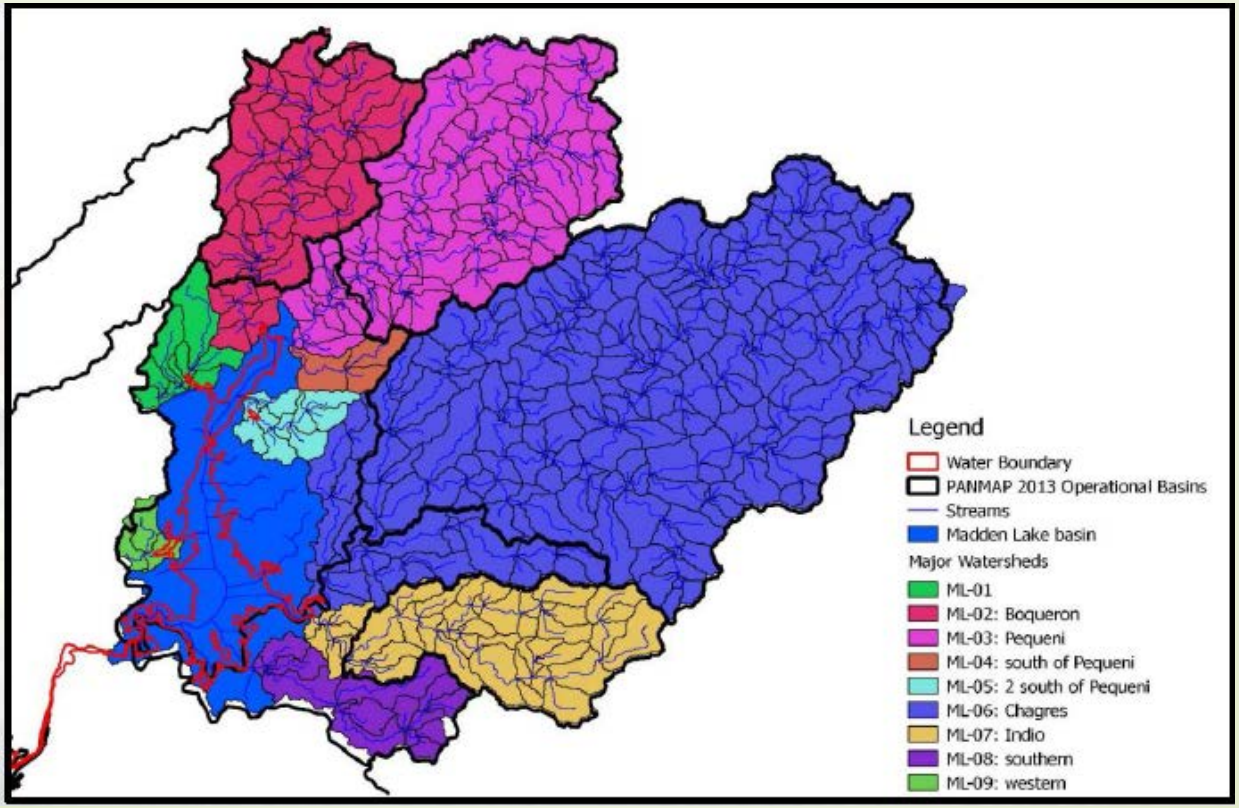
Red watersheds below indicate where system indicates storm sewer overflow.





Riverine Routing and Ensemble Discharge Prediction

Extracts sub-catchment runoff from FFG System and routes river flow through channel network at high resolution to estimate discharges. Algorithms developed to consider operation of large reservoirs (requires information on operating curves).



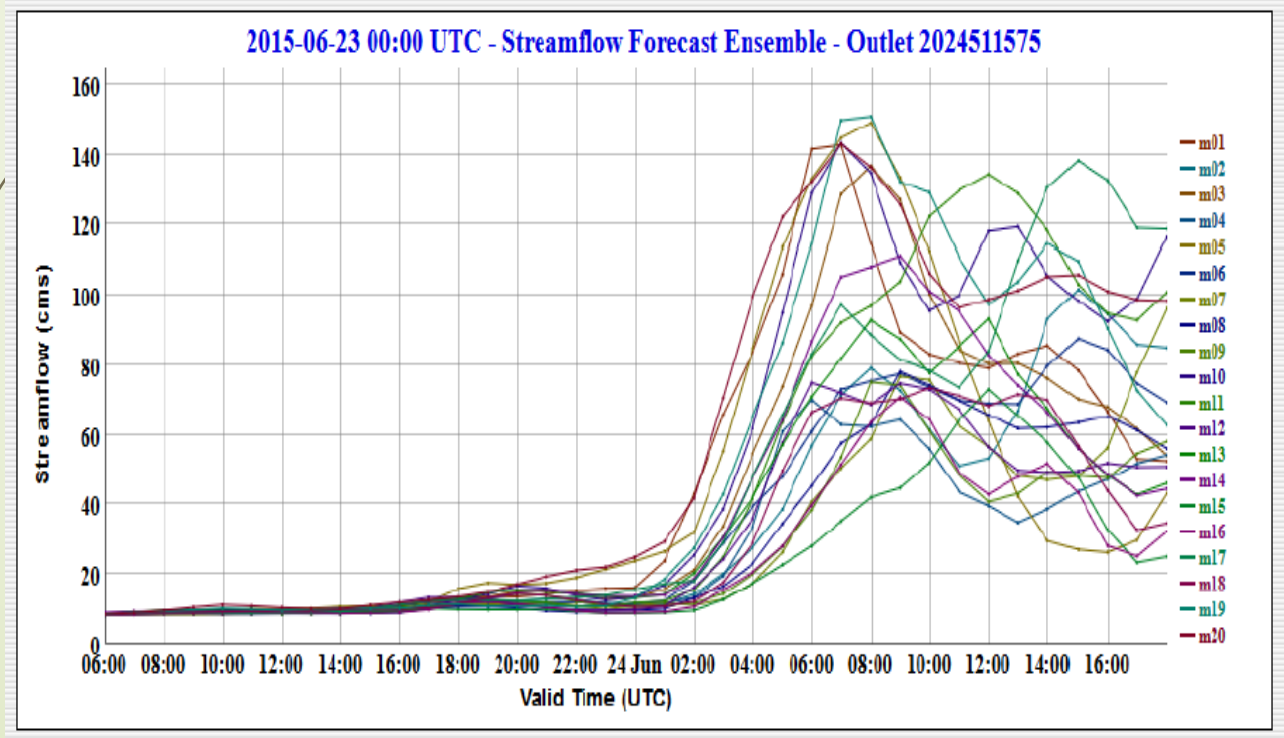
Example of distributed flow modeling network from the Panama Canal.

Riverine Routing and Ensemble Discharge Prediction

Ensemble discharge prediction if multiple NWP predictions or ensemble NWP results from single model are available.

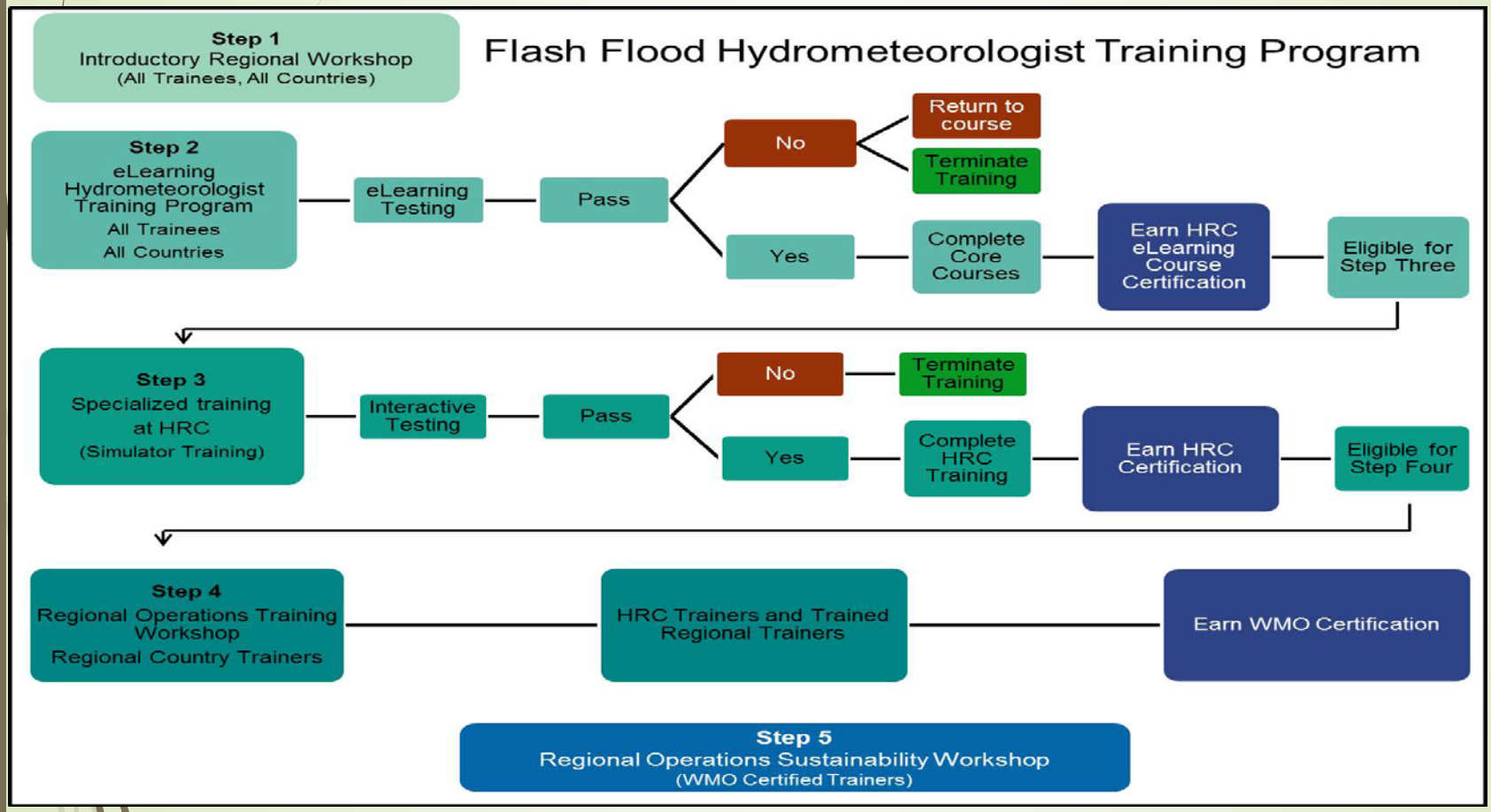
Longer lead time of NWP predictions is required (> 48hours).

Bias adjustment on forecast precipitation will also be required.



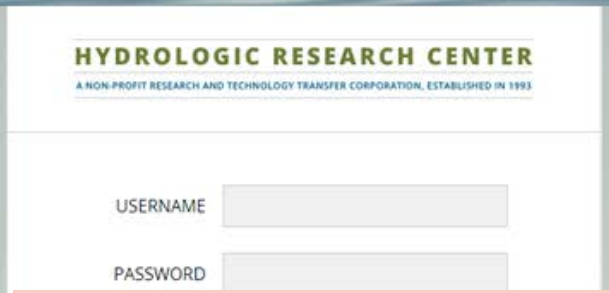
Example of ensemble discharge prediction from Panama.

Flash Flood Hydro-meteorologist Training Program



Some of the Classes are available in Spanish, French, and Russian

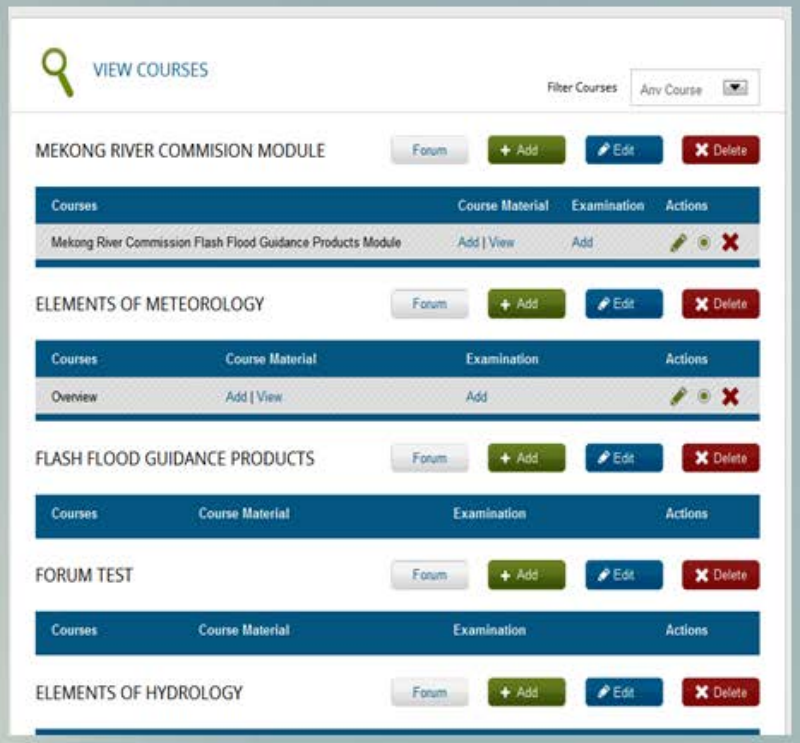
Flash Flood Hydrometeorologist Training (FFHT) Program



- **Elements of Meteorology**
- **Elements of Hydrology**
- **GIS Basics**
- **Flash Flood Guidance system Products**
- **Remote Sensing**

<u>Under Development</u>

Advance Hydrology
Advance Meteorology
Fluvial Geomorphology
Early Warning System

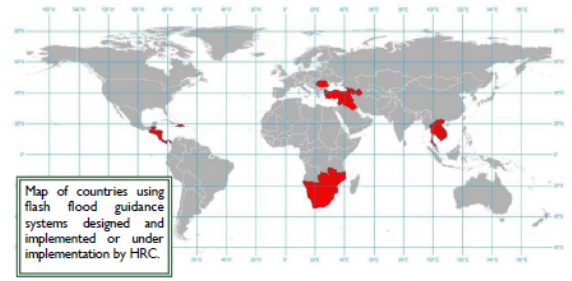


Flash Flood Guidance Model Products, Remote sensing and Early warning systems.

Quarterly Flash Flood Guidance Gazette [English & Spanish]
Over 400 people on the distribution list mostly from national meteorological and hydrological services

FLASH FLOOD GUIDANCE GAZETTE

Flash Flood Guidance systems around the World



Map of countries using flash flood guidance systems designed and implemented or under implementation by HRC.

Since 1993 the Hydrologic Research Center (HRC) has led the technical development and application of flash flood guidance systems in thirty different countries.

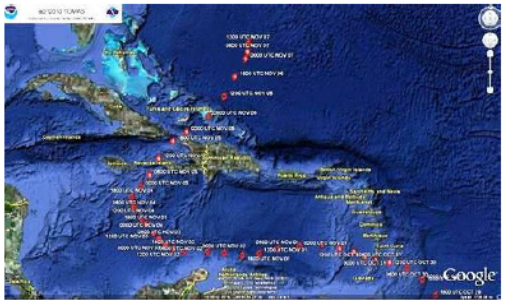
In collaboration with the national meteorological and hydrological services, HRC Flash Flood Guidance systems will serve more than half a billion people worldwide by the end of 2011.

The South Africa Regional Flash Flood Guidance System

The South Africa Regional Flash Flood Guidance (SARFFG) system will be the first fully automated real-time regional flash flood guidance system in the Southern Africa region, in operation in seven countries - South Africa, Botswana, Namibia, Malawi, Mozambique, , Zambia and Zimbabwe in 2011.

The SARFFG system is a diagnostic tool for analyzing weather-related events that can initiate flash floods and is designed to allow the forecaster to add his/her experience with local conditions, incorporate information and any last-minute local observations, to assess the threat of a local flash flood.

Haiti and Hurricane Tomas



Map illustrating the track of Tomas (October 30 to November 7, 2010). Source: U.S. National Weather Service/National Hurricane Center.

On 4th and 5th of November 2010, Haiti was impacted by Hurricane Tomas, with heavy rains and winds over various areas of the country.

Tomas developed from a tropical wave east of the Windward Islands on 29th October and quickly intensified into a hurricane passing near Santa Lucia on 31st October.

During its closest passage to Haiti, Tomas was a Category 1 Hurricane per the U.S. National Weather Service, National Hurricane Center. See the following discussion to learn how the FFG system was used in Haiti.

For more information on the HDRFFG system see - http://www.hrc-lab.org/right_nav_widgets/realtime_hdrffg/index.php

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Hydrologic Research Center
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Flash Flood Guidance Gazette

Flash Flood Guidance (FFG) Gazette, a bi-annual newsletter bringing users of FFG products all the latest news – operational information, technical advances, case studies and a new e-learning environment for the flash flood community.

Special Issue: Disaster Risk Reduction

The International Day for Disaster Reduction (13th October, 2014) is a day to celebrate how people and communities are reducing their risk to disasters and raising awareness about the importance of Disaster Risk Reduction (DRR). For flash floods and floods community experience can provide the local knowledge and gender perspectives necessary for successful flash flood risk management strategies. Through DRR education it can also provide an understanding of the types, causes, and impacts of flash floods; flash flood hazards, and vulnerability to communities.

A community's DRR education can be the key to development and critical to broad-based economic growth, mitigation of the effects of fragility and conflict, and promoting country security. This is particularly true for areas heavily impacted by natural disasters such as droughts, floods, flash floods and earthquakes. As the sudden and emerging threats from natural disasters challenge individuals, families, communities and countries, educating affected populations becomes not only vital, but a requirement in the rebuilding process.

DRR education is not only a foundation of human development, in emergency situations; it provides physical and psychosocial protection, which can be both life-saving and life-sustaining. It is through education we can develop positive attitudes and responses, which are vital to confront crises, provide a channel for conveying survival messages, and promote personal development and preparedness for responsible citizenry.

Pakistan, Thailand, Haiti and the Philippines have been particularly hard hit in the past few years and the development of DRR programs that support literacy, numeracy and life skills training provide a logical focal point to aid in rebuilding communities. The development of DRR education programs for communities is a systematic approach to identifying, assessing and mitigating the hazards associated with extreme natural hazards. If we focus on floods and flash floods, in particular, an education program aimed at understanding the important characteristics of the physical processes associated with these natural disasters (such as short lead times) and with the potential impacts (such as the ability of as little as two feet of flowing water to carry away cars) allows the learner to pose and answer certain fundamental questions pertaining to the learners own situation. This practical approach where the learners understand their role and are given an opportunity to participate is one way to create an atmosphere of awareness with individuals, families and communities. It is by the knowledge the learner gains from understanding these and other natural disasters and their impact that can reduce the risk, empower the citizenry and advance approaches to mitigation and adaptive management strategies.

The following articles provide examples of educational programs that involve individuals, families and communities.

Contributor
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