Managing Extreme Floods in Pakistan

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Monsoon 2010 (July)
Interaction of Westerly and Easterly Weather Systems occurred over **NW Pakistan** instead of NE Pakistan.

The DURATION of this interaction was **24 - 36 hrs.**

Source: PMD
PAKISTAN: FLOOD/RAIN 2010

- Flood Extent 13 August 2010
- Flood Extent 16 August 2010
- Flood Extent 21 August 2010

Map showing flood extents and dam locations in Pakistan, including Warsak Dam, Tanda Dam, Khanpur Dam, Tarbela Dam, Mangla Dam, Chashma Barrage, Rasool Barrage, Marala Headworks, Qadirabad, Balloki Headworks, Sidhnai Headworks, Taunsa Barrage, Islam Headworks, Punjnad Headworks, Guddu Barrage, Sukkur Barrage, Kotri Barrage, and others.
These statistics are outcome of preliminary analysis based on rapid mapping.

Total Flooded Area: 67,903 Sq Km
Affected Roads: 10,522 Km
Affected Railway Line: 1,630 Km
Affected Settlement: 13,777
Affected Agriculture Area: 19,409 Sq Km
Affected Houses: 450,610

Except Gilgit Baltistan
Flood Forecasting and Early Warning System

Satellite-based rainfall

Geological data for river channel creation (Elevation)

Geophysical data for parameter estimation (Land use, Soil type)

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Reducing loss of life and property

Flood forecasting warning

Smooth evacuation

Application issues
Need for hydrological and geophysical data
Local capacity in using flood forecasting system

IFAS (Integrated Flood Analysis System)
1. Utilization of not only ground-based but also satellite-based rainfall data
2. Implementation of multi runoff analysis engines
3. GIS functions to create hydrologic model from global/local data
4. Visualization of flood forecasting results
5. Free distribution

Main structure of IFAS

Rainfall data

Satellite-based rainfall data

Ground-based rainfall data

Modeling

Creation of a river channel

Estimation of parameters

Runoff analysis

PWRI Distributed model

BTOP model

Display of results
Map showing flood inundated areas of parts of Balochistan, Punjab and Sindh provinces observed on August 14, 2010 using Aqua MODIS Satellite data. Pre-flood water extent is mapped using Aqua MODIS Satellite data of September 17, 2009.

Jafferabad city seems to be under high flood compare to the previous day (Aug 13, 2010)

Legend
MODIS Flood Class
- High Flood Inundated Areas
- Moderate Flood Inundated Areas
- Pre-Flood Water Extent
- Major city
- Province Boundary
- International Boundary

MODIS analysis identifies approx. 105 sq. km are flood inundated covering the Jamali, Schabour of Jafferabad District. Floodwaters invaded large swathes of Sindh and Balochistan provinces on Saturday morning, forcing hundreds of thousands of people to abandon their homes.
UPDATE 1: FLOOD WATERS NEAR SUKKUR BARRAGE, SINDH PROVINCE, PAKISTAN

Flood Analysis Based on Satellite Data Recorded on 8-12 August 2010
Manjodoro Heritage Site
UNESCO Missions to Pakistan

To define areas of cooperation with Pakistani authorities to reinforce the country’s capacity in:

– integrated flood and watershed management
– groundwater resources for emergency situations
– landslides and ground instability especially for relocation of affected population.
Time Frame

• Short term (within 1 year)

• Medium term (2 to 3 years)

• Long term (3 to 5 years)
Integrated flood and watershed management

Short term actions

– Identify areas of improvements of hydrological models for flood forecasting – augment local capacity
Integrated flood and watershed management

Medium to long term actions

– Real time flood inundation modeling linked with Flood Early Warning System (FEWS)
– Develop risk and hazard maps
– Enhance flash flood forecasting for pilot areas
– Mapping and modeling snow and ice cover
Integrated flood and watershed management

Medium to long term actions

– Diagnostic analysis of causes of floods
– Evolutionary analysis of river morphology
– Urban planning for flood resilient communities
– Facilitate transboundary data sharing using WMO and UNESCO networks such as Flow Regimes from International Experimental and Network Data (FRIEND) and International Flood Initiative (IFI)
– Enhance radar coverage of the country to be able to forecast flash floods
– Use of remote sensed precipitation data for flood forecasting
Groundwater resources for emergency situations

Short term actions

– Groundwater vulnerability assessment and mapping with special regard to groundwater emergency resources in pilot areas in Mardan and Peshawar Valleys as well as in hydrogeology suitable sites in Baluchistan, Punjab (e.g. Kasur) and Sindh
Groundwater resources for emergency situations

Long term actions

– Assessment of groundwater recharge of aquifers safe to flood disasters
– Assessment of impact of floods on groundwater quality and groundwater related ecosystems
– Groundwater monitoring networks linked with Pakistan meteorological and hydrological networks
– Evaluation of high content of fluoride and arsenic in water in Peshawar area (fluoride) and Kasur District (arsenic)
Landslides and ground instability

Short term actions

– Capacity building in integrated hydrogeology modelling
– Update Policy Guidelines for dealing with geohazards triggered by land slides
Landslides and ground instability

Long term actions

– Improve institutional linkages and knowledge
– Analyse snow avalanche mechanisms
– Launch an integrated ecogeohydrology network using UNESCO networks
– Understanding the hydro-meteorological processes of landslides
Education and Capacity Building

Short term actions

Specialized training for politicians, policy makers and higher level managers in hydrological and related geohazard risk management to deal with uncertainty
Education and Capacity Building

Medium to long term actions

– Specialized education and training of flood forecasting specialists at the tertiary level
– Training of middle level technician and managers of water departments – update curricula of existing institutes in Pakistan
– Review and strengthen community and school education in managing geohazards
Education and Capacity Building

Medium to long term actions

- Map capacity of existing institutes in water education
- Revitalize the UNESCO Centre of Excellence in water management considering hydrological extremes and related geohazards in Pakistan
Management Options

• More storage dams are a must to manage floods from Kabul River

• Proactive scenario modelling on 6 hour basis is a must to decide on controlled flooding and downstream flooding in the Sindh province

• Introduce hydrograph delays using the link canals between Chenab, Ravi and Sutlej. This extra water can be use for artificial aquifer recharge through controlled flooding