

Spatial and Non-Spatial Infrastructure on Flood Monitoring and Early Warning System

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Motivation

The free web based access to flood disaster information, is limited and only available at point locations.

It is hard for general users to directly determine which areas may be affected from disaster.

Most of the existing providers offer satellite images, which can be viewed online through the Internet. → Can general users indentify where the flood occurred.

Consequently, the web-based satellite images are not practical in some cases.



The flood resource information provided to public is suffice for them to plan for emergency flood situation.

The next question is what can be done to improve flood distribution information to increase local awareness on flood disaster events.

Objectives


Develop a receiving disaster information system from different source providers i.e. U.S. Geology Survey (USGS), Global Disaster Alert and Coordination System (GDACS)

Implement IFAS to analyze, discover, and improve visualization of the flood distribution that will result in increasing the awareness of flood disaster.

Develop the automated tool to integrate the TRMM rainfall receiving support function to analyze and immediate identify flood distribution in a spatial-based manner

Assessment and Goal

- Assessment and analysis of outcomes will be examined by the Integrated Flood Analysis System (IFAS) as a backend system.
- The TRMM rainfall data receiver function is developed to acquire information and perform as near-real time data transmission.



IFAS has been developed and distributed by ICHARM (International Centre for Water Hazard and Risk Management under the auspices of UNESCO (www.icharm.pwi.go.jp))

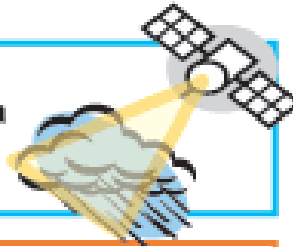
Goal

- Raising Public Awareness on Catastrophe Occurrence.
- Freely access with no defensive barrier from software.
- Enhance the functionality and information distribution.

Main Structure of IFAS

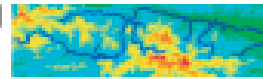
Rainfall data

Satellite-based rainfall data
Ground-based rainfall data



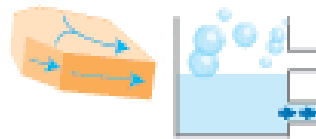
Modeling

Creation of a river channel
Estimation of parameters

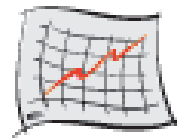


Runoff analysis

Distributed model
BTOP model



Display of results



The IFAS aims to analyze the flood situation and transfer result as imagery, graph and table. Runoff model requires area characteristics such as topographic data, LU/LC, soil.

Source: www.icharm.pwi.go.jp

Remarks: A Blocked-wise TOPMODEL (BTOP) as an extension of the TOPMODEL concept in a grid based framework for distributed hydrological simulation of large river basins (Developed by Yamanachi University). → A rainfall-runoff model that bases its distributed predictions on an analysis of catchment topography.

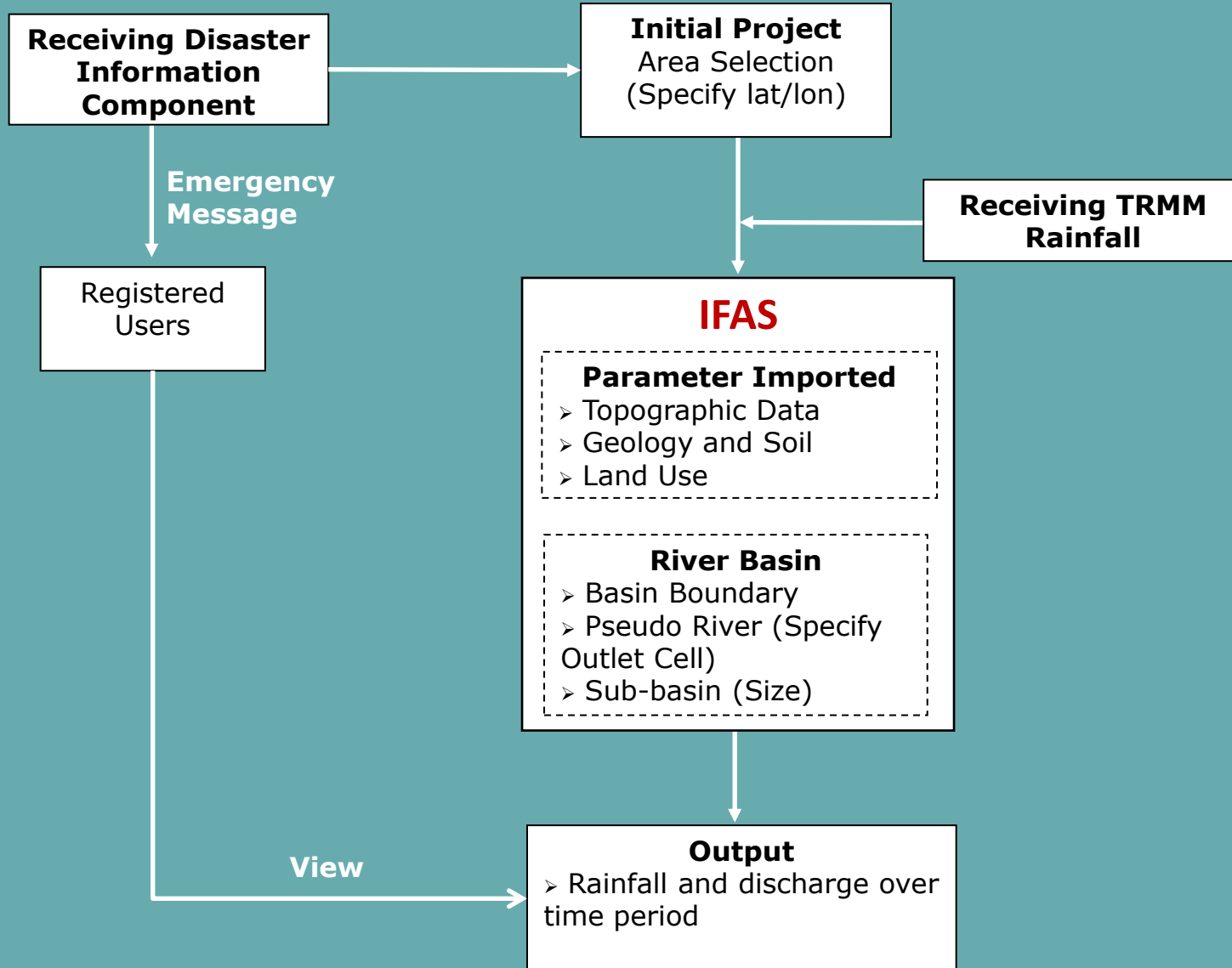
TRMM

Tropical Rainfall Measuring Mission (TRMM) satellite was the first dedicated observation satellite to observe precipitation data. It is designed to measure rain rates from the outer space using combination of

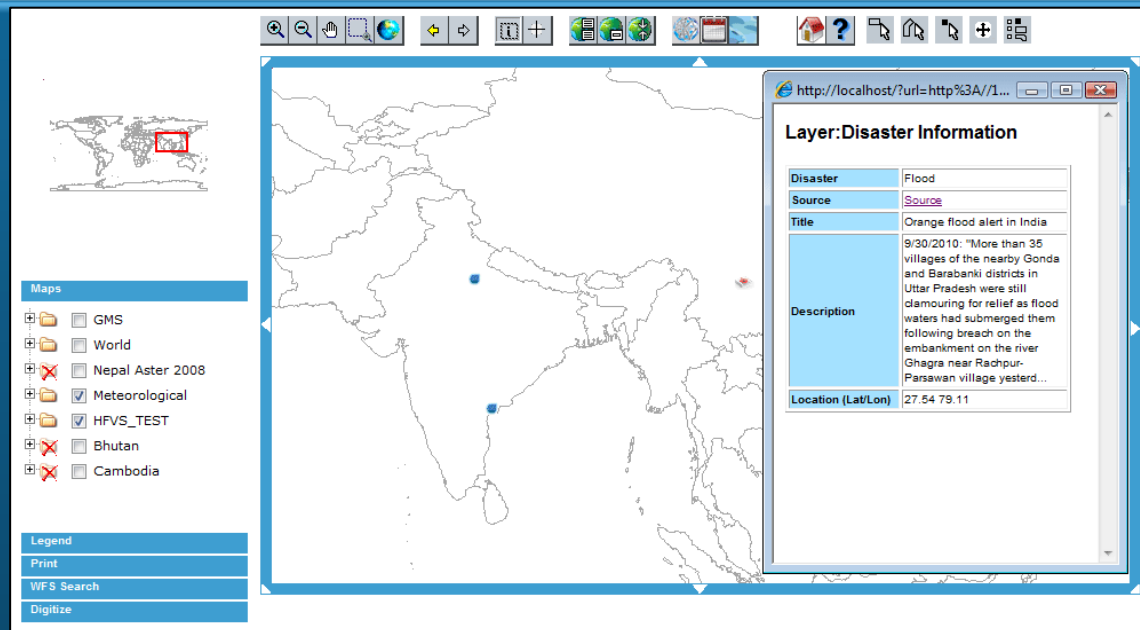
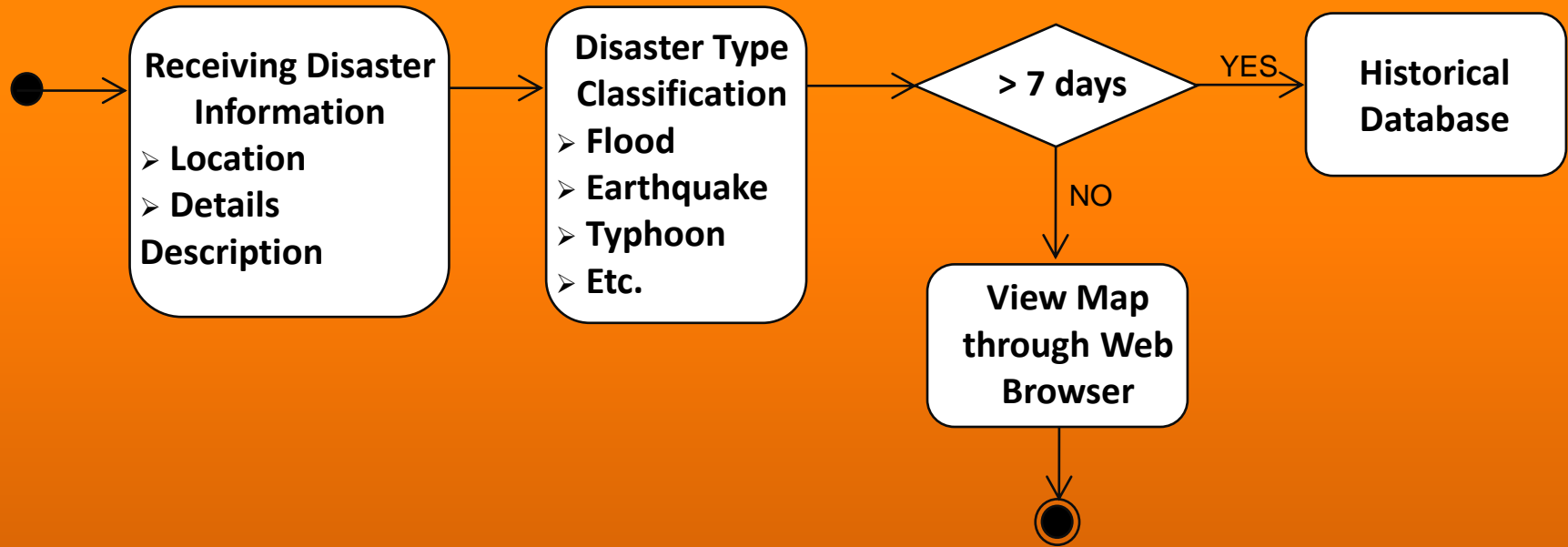
- High resolution radar,
- Passive Microwave radiometer, and
- Visible-infrared radiometer measurement

A joint collaboration of NASA (The National Aeronautics and Space Administration) and JAXA (Japan Aerospace Exploration Agency) mission to monitor and study tropical rainfall.

Flow Operation



Receiving System



IFAS Parameter

Parameter	Source	Remarks
Rainfall	3B42RT (NASA)	Spatial resolution 0.25°x0.25°, Temporal resolution 3 hours
Elevation	GTOPO30 (USGS)	Spatial Resolution: 30 sec
Soil	Soil Texture (UNEP)	http://www.grid.unep.ch/data/data.php
	Soil Water (UNEP)	http://www.grid.unep.ch/data/data.php
Land Use	LandUse GLCC (USGS)	

Case Study: West of Nepal



The screenshot shows the Sentinel Asia website interface. At the top, there is a navigation bar with links for HOME, Announce, About Sentinel Asia, JPT Member, FAQ, Contact US, Links, and Site Policy. The main content area is divided into several sections:

- WEB GIS**: A sidebar menu with options for Emergency Observation, Wildfire Monitoring, Flood Monitoring, MTSAT Imagery, Capacity Building, and Library.
- Welcome To Sentinel Asia Web Site**: A introductory text stating that Sentinel Asia is a voluntary basis initiative led by the APRSAF (Asia-Pacific Regional Space Agency Forum) to support disaster management activity in the Asia-Pacific region by applying the WEB-GIS technology and space based technology, such as earth observation satellites data.
- Emergency Observation**: A list of recent events with dates and locations:
 - 16/Sep/2010 Flash flood in India
 - 29/Aug/2010 Volcano eruption in Indonesia
 - 24/Aug/2010 Flood in Vietnam
 - 12/Aug/2010 Volcano eruption in Indonesia
 - 08/Aug/2010 Mudslide in China
 - 06/Aug/2010 Flood in India
 - 31/Jul/2010 Flood in Pakistan
 - 24/Jul/2010 Flood in Indonesia
 - 24/Jul/2010 Flood in India
 - 21/Jul/2010 Flood in Bhutan
- Current Topics**: A section for the latest news, featuring the 29/Sep/2010 "International Symposium: Benefiting from Earth Observation - Bridging the Data Gap for Adaptation to Climate".
- Images**: Two satellite images showing Earth from space, one with a satellite in orbit and another showing a satellite on the ground.
- Logins**: A login form at the top right with fields for UserID (pre-filled with 'gues9999'), password, and a login button.
- Logos**: A row of logos for partner organizations including JAXA, AIT, and others.
- Footer**: Copyright 2009 Japan Aerospace Exploration Agency, All Rights Reserved.

<http://dmss.tksc.jaxa.jp/>

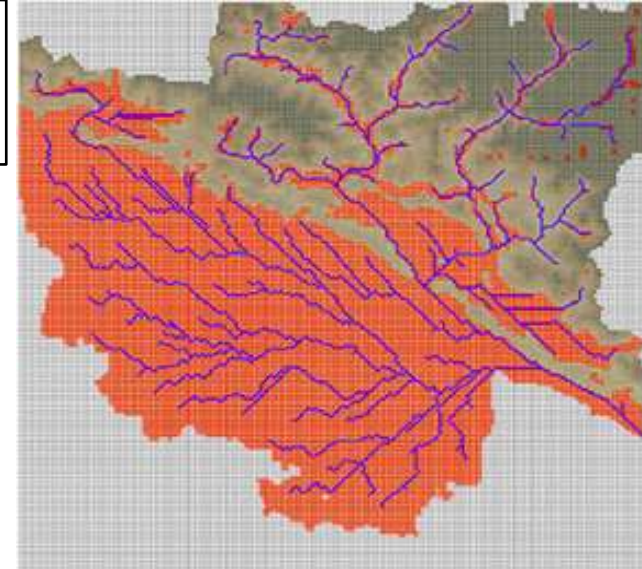
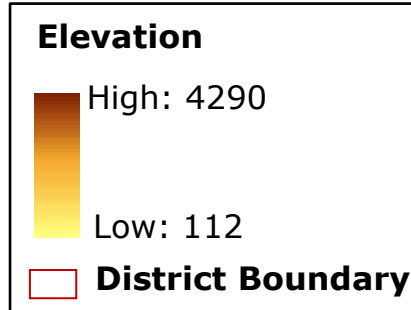
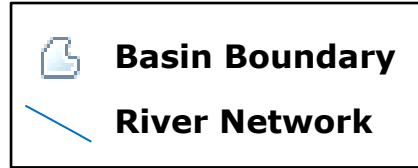
Study Area 4th – 7th October, 2009 in the west of the Himalayan region.



IFAS Output Product



Elevation



River Network



Land Cover (GLCC)



IFAS Output Product (Continued)



2009-10-04 00.00

2009-10-04 04.00

2009-10-04 08.00



2009-10-04 12.00

2009-10-04 16.00

2009-10-04 20.00



2009-10-05 00.00

2009-10-05 04.00

2009-10-05 08.00



2009-10-05 12.00

2009-10-05 16.00

2009-10-05 20.00



2009-10-06 00.00

2009-10-06 04.00

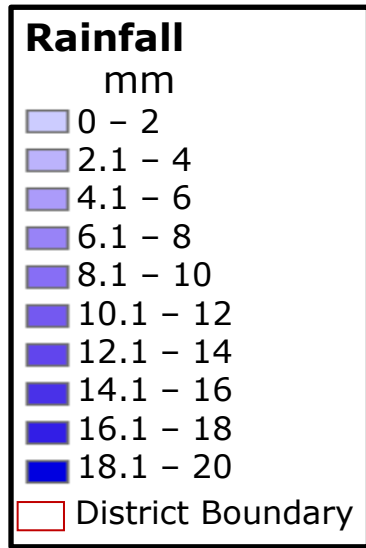
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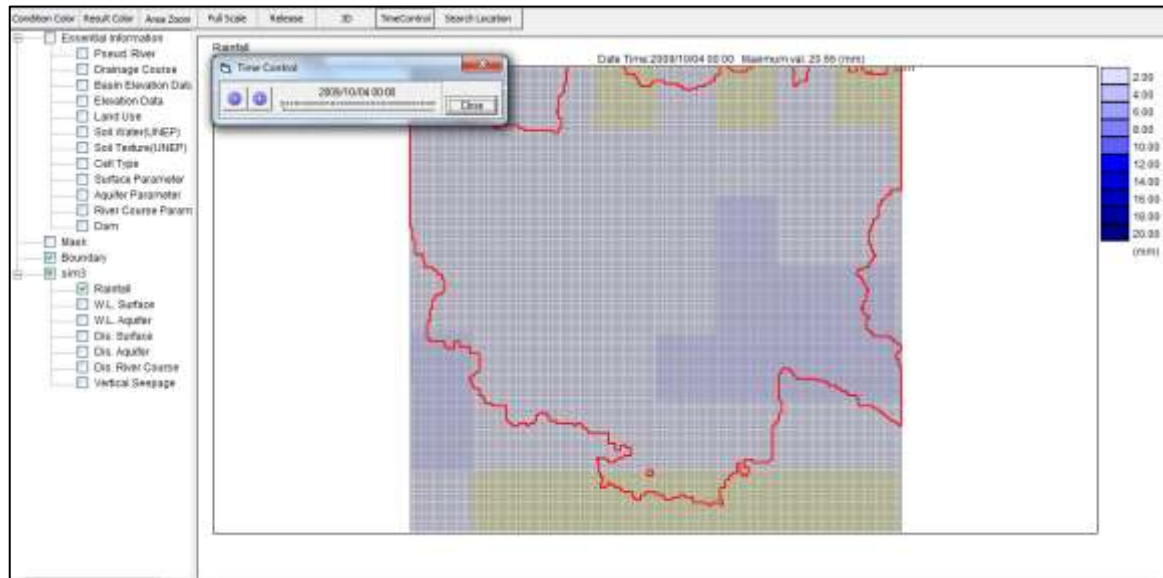
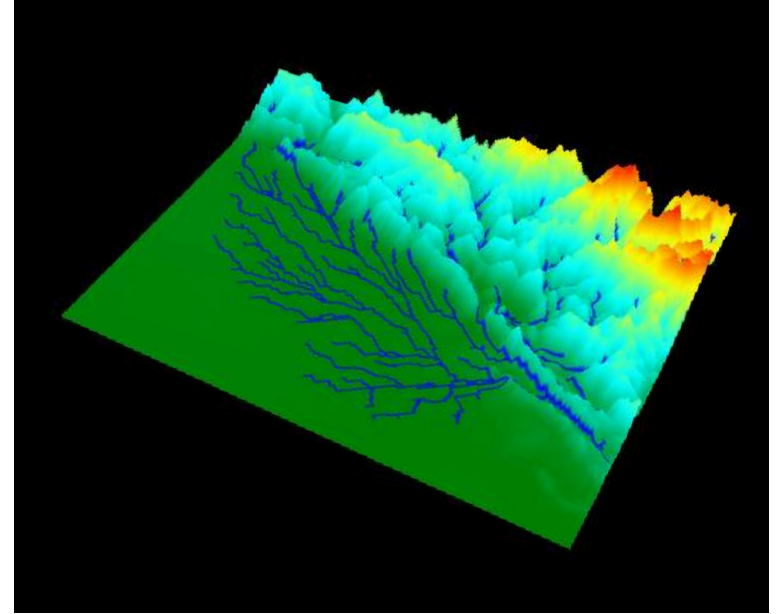
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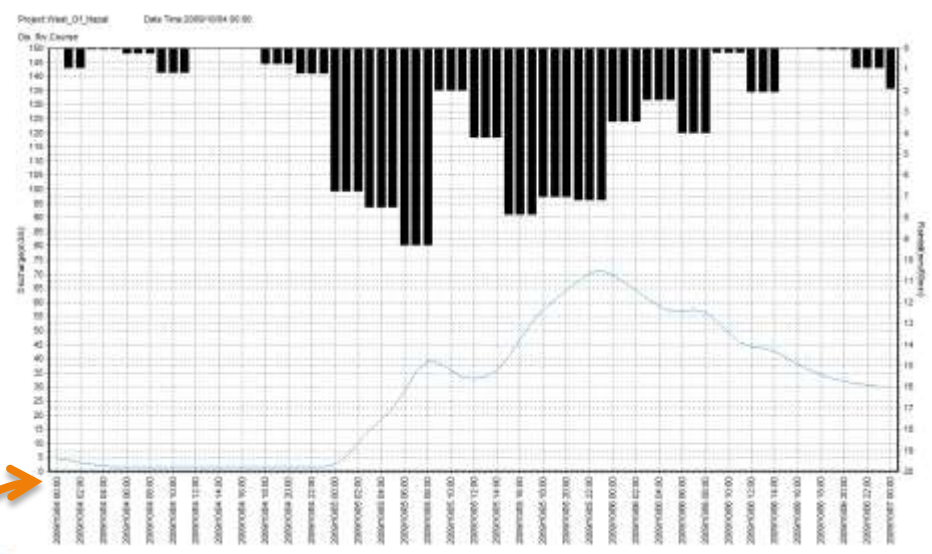
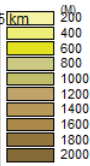
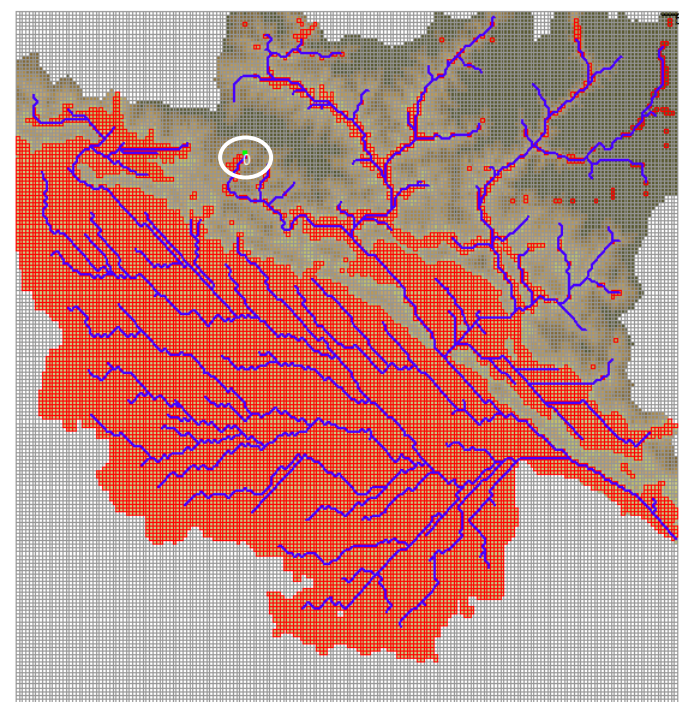


IFAS Output Product (Continued)

3D View



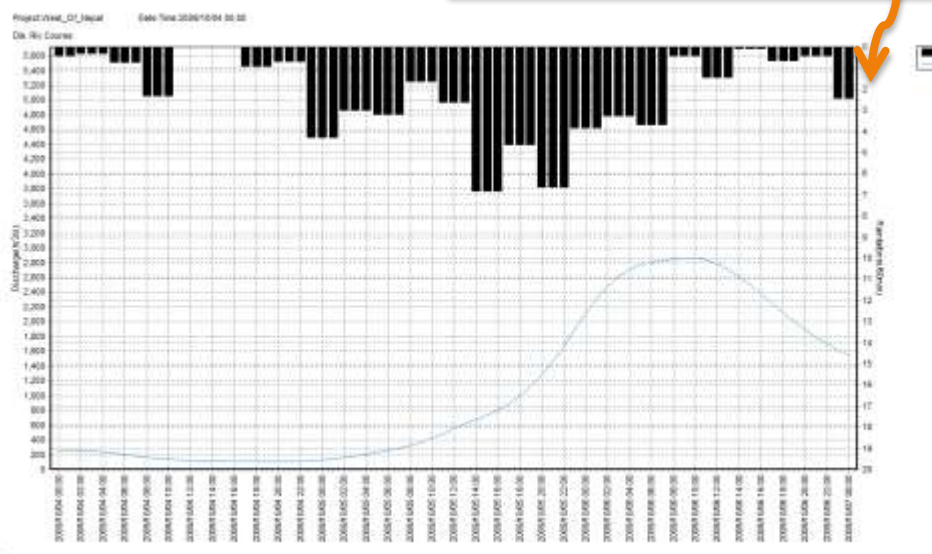
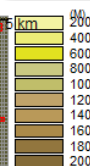
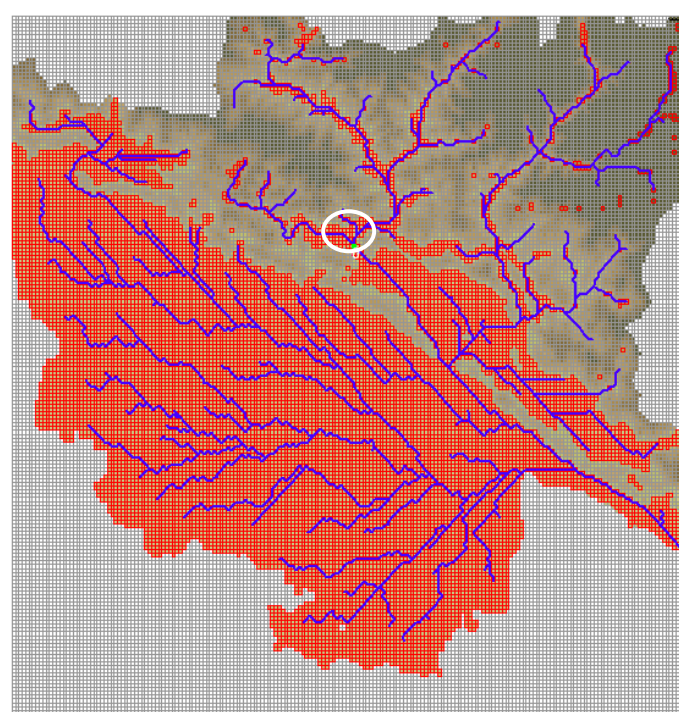
Rainfall over Time



01202
01202

**Peak of Discharge 70 cm/s
October 5th, 2009 at 10 PM.**

**Peak of Discharge 2800
cm/s October 6th, 2009 at
10 AM.**



01204
01204

Hydrograph

Conclusion

- **IFAS is a freeware - save operation cost**
- **Result data derived from the IFAS is displayed over the web-based - increase local recognition on critical disaster information**
- **Provide better visualization of flood occurrence - Flood extent affected areas local infrastructure such as houses, roads, etc. in order to be prepared for mitigation and recovery plans.**
- **The data format can be converted and transferred to a compatible GIS software.**

Discussion

This paper reviewed flood monitoring and early warning system by utilization of available software and integrating communication means readily available as web-based system. The spatial based information system is intended to enhance the functionality for certain research project. It does not attempt to replace any existing system.

This system is conceived as a centralized server based service model. The system and processing model are managed in the server platform and distribute information through the World Wide Web, which can be accessed anywhere by numerous means i.e. mobile devices and computers. Users generally do not find these conditions to be limited or troublesome.

Future Work

- **Further enhance precision and usability of the early warning system.**
- **Downscaling analysis will also be explored to investigate local-scale impacts.**



Thank you