An Introduction of
Global Flood Alert System (GFAS)

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Kazuo UMEDA
IFNet Secretariat
Director of 2nd Research Department,
Infrastructure Development Institute-JAPAN
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1. Statistics of Flood Disasters (1)

Average numbers of people affected by natural disasters (1973-2002)

Source: World Disasters Report, International Federation of Red Cross and Red Crescent Societies

Source: International Federation of Red Cross and Red Cross Societies
Statistics of Flood Disasters (2)

Source: EM-DAT, CRED

Total Death Toll: (about 470,000 people)

Total Economic Loss: (about 49 billion US$)

Death Toll

- Tidal waves/Tsunami: 49%
- Floods: 20% (Target: to halve)
- Earthquakes: 16%
1. Objective

- To facilitate the use of Satellite Rainfall in FEW

2. System Concept

  collaboration between:

  i) Space Agencies as rainfall data provider

  ii) IDI as system developer, rainfall analyzer, information provider

  iii) IFNet as transmission network

  iv) Hydrological Services, River Authorities

  in charge of flood forecasting and warning
1. IFNet Homepage
2. Email of Heavy Rain to IFNet members in charge of Flood Forecasting and Warning
Outline of the IFNet

The establishment of IFNet was declared on the flood day at the 3rd World Water Forum in Kyoto, March 2003

1. Objectives
   - **Flood Disaster Reduction** by network activities such as information disseminating and sharing.

2. Membership
   - Participation in IFNet is open to all who assent to the objectives.
   - A total of 410 from 73 countries has been registered.
     (as of 1 Jan. 2006)

3. Field of Activities
   - Policy Promotion, Raising Awareness
   - Information Dissemination, Sharing and Exchange
     - IFNet Action Report
   - Flood Early Warning
   - GFAS Project
Global Precipitation Measurement (GPM)

Current Observation System:
TRMM and other Satellites orbiting the earth, and 5 Stationary Satellites

Core Satellite
Dual Frequency Radar
Multi Frequency Radiometer
✧ Observation of rainfall with more accurate and higher resolution
✧ Adjustment of data from constellation satellites

JAXA (Japan)
Dual frequency Radar, Rocket
NASA (US)
Satellite Bus, Micro-wave gauging measurement

8 Constellation Satellites
Satellites with Micro-wave Radiometers
✧ More frequent Observation

Cooperation:
NOAA (US), NASA (US), ESA (EU), China, Korea and others

Global Observation every 3 hours

- Earth heating Phenomena
- Study of Climate Change
- Improvement of forecasting system

- IWRM
- Flood Forecasting
- Forecasting of crop productivity
Characteristics of Satellite Data

(Current observation system has started in 2002.)

1. Features
   - 3-dimensional analysis of rainfall structure.
   - No influence of the topographic features.

2. Data Delivery
   - Observation is made every 3 hours (not hourly) for each grid.
   - Observation grid size is about 600km² (30km by 20km rectangle).
   - Data delivery is near-real-time basis (several hours after observation).
Challenges for Flood Forecasting

Flood forecasting requires real-time accurate hydrological data transmission and run-off analysis. Challenges are:

- **Telemetry System**
  
  Budget constraint for maintenance, spare parts, other social factors etc.

- **Trans-boundary Rivers**
  
  Difficulty in data transmission across borders.

- **Accurate Forecasting for Flash Flood in Small/Medium Rivers**
  
  Detection of localized rainfall, short-term rainfall prediction, etc.
Early warning has much possibility to reduce human loss in large rivers.

Mozambique 2002
Challenges for Flood Forecasting in Small/Medium Urban Rivers

Flash flood disasters are aggravated by the absence of accurate flood forecasting in urban middle/ small rivers

- To establish accurate flood forecasting with enhanced accuracy
Expectations for Satellite Rainfall

Preferable Conditions:
- **Large river basins** where even daily and less dense data could be informative
- **Without any telemetry systems**
- **Trans-boundary Rivers** where prompt data transmission between countries is difficult.

Other Possibilities:
- To improve accuracy of the current flood forecasting system using ground station and radar rain-gauge
3. 1\textsuperscript{st} Phase Trial Run in 2006

Purpose: Satellite \textbf{Data Verification} for Flood Forecasting (comparison with ground rain-gage data)

Data source: NASA (3B42RT)

- Quasi Real-Time of Every 3 Hours
- Observed by TRMM and others

Outputs:
1. Daily Rainfall Map and Rainfall Data in text
   - (0.25 deg. grid in the band 0-360 deg. longitude, 60-60 N-S latitude)
2. Probability Daily Rainfall
   - (1/5, 1/10 return periods)
3. Indication of Heavy Rain Area
   - (area of over a certain probability)
4. E-mail Delivery of Heavy Rainfall Notice on Request

Delivery: Early March 2006 through IFNet Website/e-mail
Daily Rainfall Map
0.25 deg. grid in the band 0-360 deg. longitude, 60-60 N-S latitude, with global and regional enlarged view

Text Daily Rainfall Data
0.25 deg. grid in the band 0-360 deg. longitude, 60-60 N-S latitude
Notes:
This is a sample map showing 5 year return period rainfall of 40-40 N-S, but the real map will show in the band of 60-60 N-S.

Map showing 5 year and 10 year return period of daily precipitation

Indication of Heavy Rain Area

Map showing areas exceeding 5 year and 10 year return period daily precipitation


Note:
This is a sample map showing areas exceeding 5 year return period rainfall. Was observed.

- Rainfall Areas
- Areas exceeding 1/5 return period Rainfall
Enlarged maps for 9 Regions

- Europe & North Africa
- Middle East
- South Africa
- South Asia
- Southeast Asia
- East Asia
- North America
- South America
- Oceania

Regional Map Sample (South Africa)
E-mail Delivery of Heavy Rainfall Notice on Request

Sending notice e-mails to registered agencies when a rainfall over certain threshold is observed.

E-mail SAMPLE:
Heavy rain information to ZZ basin. Mean basin precipitation* of YY mm/day, which exceeds 5 year return period rain, was observed. Please check it on IFNet website!
http://xxxxxxxxxxxxxxxxxxxxxxxxxx

Agencies hoping to receive Email:
RID, Thailand
Department of Hydrology and River Works, Cambodia
MCTPC, MAF, Lao PDR

* Currently, we can calculate the “mean basin precipitation” in typical 60 basins.
Optimization of GFAS during Trial Run

1. **Verification** of Satellite Rainfall

   Verification of
   - Satellite Rainfall by comparing with ground rain-gage
   - Rainfall Return Period of 1/5, 1/10 by adding more data

2. **Grasp on User’s Needs**

   - More enlarged maps for single river basin
   - Other rainfall period than daily
     (half day, 2 days, 3 days etc.)
   - Other return period than 1/5, 1/10
     (2 years, 30 years etc.)
   - Other criteria for sending e-mail
     (number and place of grid exceeding certain probability, etc.)
Visions for the Future

1. Run-off Model

Data: satellite and existing rainfall observation, global mapping
Purpose: Flood forecasting, water resources planning/management

2. Enhanced Applicability of Satellite Rainfall

(Expectations for Space Agencies)
Smaller mesh, frequent data renewal for middle/small river basins
A runoff calculation is performed using data through GPM after runoff model based on global mapping data is developed. This calculation will make it possible to forecast not only discharge and water level but also inundating state of flood at representative spots.

The forecasting result obtained through runoff calculation will be use to flood alert system as well as various water managements such as flood control and water resources management.
Thank You

IFNet Secretariat

c/o Infrastructure Development Institute (IDI)-Japan
5-3-23 Kojimachi, Chiyoda-ku, 102-0083 Tokyo, JAPAN
Tel: +81-3 3263 7986  Fax: +81-3 3230 4030
info@internationalfloodnetwork.org
www.internationalfloodnetwork.org
Present Approach to Satellite Rainfall

- **Survey** on the possibility of the satellite rainfall in river management
- **Verification** of satellite rainfall in comparison with ground rain-gage data
- **Trial run** of GFAS (Global Flood Alert System by IDI-Japan) Information
Measures to Reduce Human Loss

- **Structural Measures:**
  - Levee, Flood Control Dam, Flood Way
  - Retarding Basin, etc.

- **Non-structural Measures:**
  1. In Emergency (Early Warning System)
     - Flood Forecasting
     - Flood Warning
     - Evacuation Advice/Order
  2. In Normal Time
     - Flood Hazard Map
     - Flood Fighting Drill,