1st Steering Committee Meeting (SCM 1)

SOUTH ASIA FLASH FLOOD GUIDANCE (SAsiaFFG) Project

New Delhi, India
26-28 April 2016

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Presentation Outline

- Introduction & Organization Structure
- Current Hydro-meteorological Networks
- Hydro-Meteorological data
- Weather Forecasting and Nowcasting
- Flood Early Warning System
- Products & Services
- Collaboration agencies
- Challenges
- Conclusion/Remarks
Location Map of Bhutan

88.7° - 92.2° East
26.7° - 28.4° North
Organization Chart

Organigram of new Department of Hydrology and Meteorology Services (DHMS)
Ministry of Economic Affairs
(Approved by RCSC Order No. RCSC/HRMD/7/2011/316 dated 21 July 2011)

Department of Hydro-met Services (DHMS)
Director

Planning Coordination and Research Division
Chief Hydro-Met Officer
- Program Coordination Section
- Information Management and Research Section

Hydrology Division
Chief Hydrology Officer
- Operation & Maintenance Section
  - Data Processing Unit
  - Construction and Instrumentation Unit
  - Sediment Laboratory

Meteorology Division
Chief Meteorology Officer
- Operation & Maintenance Section
  - Data Processing Unit
  - Instrument and communication Unit
  - Flood/GLOF Warning Unit
  - National Weather, Flood Forecasting and Warning Center (NWFFWC)
    - Weather Forecasting Unit

Snow & Glacier Division
Chief HO (Glaciologist)
- Operation & Maintenance Section
  - Data Processing Unit
  - Construction and Instrumentation Unit
  - Glacier Monitoring Section
  - Snow Monitoring Section

Regional Hydro-met Office
- Regional Office (West)
- Regional Office (Centre)
- Regional Office (East)

Note:
HO: Hydrology Officer
MO: Meteorology Officer
OA: Office Assistant
TMO: Technical Maintenance Officer

www.dhms.gov.bt
Infrastructure

National Weather & Flood Warning Warning Center (NWFWC)

Facilities installed inside the NWFWC
Mission

- Provide weather, water and climate data, forecasts and warnings for the protection of life and property and enhancement of national economy.

- One of the important mandate is weather & flood forecasting and early warning.
Presentation Outline

- Introduction & Organization Structure
- Current Hydro-meteorological Networks
Network and Current Status

1. Hydrological Network:
   – Principal Station           15
   – Secondary Station        09

2. Meteorological Network:
   – Class A Met Station              20
   – Class C Met Station      61
   – Automatic Weather Station  20

3. Flood Warning Network:
   – Flood Warning Station            15
Automatic Water Level Station (Contact Type)
Automatic Water Level Station (Non-contact)
Automatic Weather Station Network

Photo 4: Automatic Weather Station installed at Semtokha, Thimphu along with rain gauge

Photo 7: AWS installed at Chamkhar, Bumthang

Photo 8: AWS installed at Kanglung, Trashigang
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Data Availability (Historical) since 2012

- Precipitation data: (hourly, daily, monthly) for past 5 years from current real-time rain gauge available.
- Pan evaporation data: (daily, monthly) from few stations.
- Soil moisture data: (daily, weekly, monthly) – No
- Streamflow discharge data: local streams with drainage areas less than 2000 km² – (hourly, weekly, monthly) = not available, but only lean data for some stream (once in a year).
- Snow data: snow depth, snow water equivalent & snowfall – available since 2013 for only few stns.
Current Data Availability (Real Time)

- Real-time rain gauge data: (hourly, daily) = both
- Surface Weather data: (Temp, RH, WS, WD, Pressure, Solar Radiation (few) and Cloud Cover)
- Snow data: snow depth, snow water equivalent & snowfall – from few stations on high passes
- Real-time soil moisture data: Not sure when it can be made available
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Weather forecasting & Nowcasting

✓ Nowcasting = No

✓ Weather forecasting system in Bhutan Officially started = October 2007

✓ Weather forecast system are based on (Temperature forecast) = trained by Sr. JICA volunteer

✓ Later Satellites images used for weather forecasting in Bhutan = kalpana-1, IMD

✓ Total weather forecaster at DHMS = 6 Nos. (System operational by 24/7 = March 2016)
Provide Forecast (72 hrs)

Source: DHMS
Satellite Image of kalpana-1, IMD for Visualization & interpretation

Source: IMD, 2015
Weather Research & Forecasting (WRF) Model Products

Small Area:
- 2m temperature: 00 06 12 18
- 1h precipitation: 00 06 12 18
- Total precipitation: 00 06 12 18
- Max 10m Wind: 00 06 12 18
- Clouds: 00 06 12 18
- Wind gust: 00 06 12 18
- 2m Dew Point: 00 06 12 18
- Mosaps: 00 06 12 18
- 0 TC: 00 06 12 18
- dhec: 00 06 12 18

Large Area:
- 2m temperature: 00 06 12 18
- 1h precipitation: 00 06 12 18
- Total precipitation: 00 06 12 18
- Max 10m Wind: 00 06 12 18
- Clouds: 00 06 12 18
- Wind gust: 00 06 12 18
- 2m Dew Point: 00 06 12 18
- Mosaps: 00 06 12 18
- 0 TC: 00 06 12 18
- dhec: 00 06 12 18

Soundings:
- Bumthang 00 06 12 18
- Paro 00 06 12 18
- Semshur Jorungkhar 00 06 12 18
- Samdrup 00 06 12 18
- Surang 00 06 12 18
- Thimphu 00 06 12 18

Products for a Valid Time, Small Area
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Source: DHMS
Himawari -8 satellite receiver

- Receiver installed in March 2016
Visualization & Processing

- Till march satellite images were subjectively analyzed through human eyes.

- The Meteorological Satellite Center has developed a Computer Aided Learning System (MSC-CAL) called “SATAID” (Satellite Animation and Interactive Diagnosis) for improving images analysis skill.
A Satellite Image Synthesized with Cloud Wind Vector Data (The image contains Upper Wind and Lower Wind, Water Vapor Wind, and altitudes)
Database

✓ For Met: Climsoft

✓ For Hydro: Hydata

✓ New Central DMS is under development phase (ICIMOD, FMI, RTS)
GTS Reporting

✓ Data exchange on GTS with New Delhi and Bangkok
Radiosonde station

✓ Launched at Paro International Airport = 2 times a day for the month of AMJ (started with the support of Indian Space Research Organization (ISRO), IMD, India.)
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2009 Cyclone Aila caused damages of approximately $17 million for farmland and infrastructure (GNHC, 2013).
Flood Warning System

- Flash Flood Warning System = Not exactly

- However, we have: GLOF & Rainstorm Early Warning System in 3 sub-basins.
GLOF Early Warning System in Pho chhu Sub-basin

GLOF Early Warning System in Mochu and Punatshangchhu Basin

Legend
- Control Center
- Dam
- Sensor
- Slope

Elevation
- Maldzong
- Pho chhu
- Mochu
- Punatshangchhu
Flood Warning….Cont.

✓ Total human resources working in GLOF & Rainstorm Early Warning System at DHMS = 12 Nos. (for 4 control rooms monitoring 24/7)
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Product & Services

• Provide Data based on user need (upon requisition)
• Forecast Information (media, print media, TV, Radio and mobile weather apps under development)
• Seasonal outlook (monsoon and winter) two times a year
Dissemination: currently Website www.hydromet.gov.bt
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Collaborating agencies

- Legal System

  - The Article 8 of the Constitution of Bhutan
  - The Disaster Management Act of Bhutan, 2013
  - Water Act of Bhutan, 2011
Implementation Structure

[Goal]
Reduce flood disasters through flood forecasting and warning

[Purpose]
Build Capacity of DHMS in flood forecasting using appropriate model/Tools & Technology

[Output 1]
Flood forecasting and warning capacity enhanced
[DHMS, DoEs, Hydropower company, Local Govt. Communities]

[Output 2]
Communities sensitized and educated about flood
[DDM, DHMS, Local Govt. and Communities]
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Challenges of DHMS

- Low density of hydrological and rainfall monitoring network
- Real time telemetry hydro-meteorological stations are in the early stage of development.
- Limited trained professional in the field of hydrology and meteorology to carry out weather & flood forecasting and warning.
- No flood forecasting system and use of modelling tools are just being initiated earlier
- No standard Flood hazard maps are available
- No Standard Operating Procedures (SOP) at national as well as local level for effective communication or dissemination of flood warning
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Conclusion/Remarks

• Optimistic that FFG system will provide us adequate provision of knowledge & technology transfer

• We wish to avoid any “black-box” modeling situation

• Capacity development of DHMS in Flash Flood is our priority

• Joint regional initiative of WMO, NOAA, HRC and IMD with funding support from USAID/OFDA will continue and takes us to next level
THANK YOU & TASHI DELEK!