



**기상청** Korea  
Meteorological  
Administration



# Hydro - Meteorological Services in Bhutan

**Regional Workshop on Impact-based Forecasts in RA II  
7 - 9 November 2017  
Seoul, Republic of Korea**

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# Outline of presentation

1. Country profile
2. Climatic condition and monsoon pattern in Bhutan
3. Organogram of NCHM
4. Disaster risks in Bhutan
5. Observing station network
6. Hydro-Meteorological services in Bhutan;
7. Conclusion

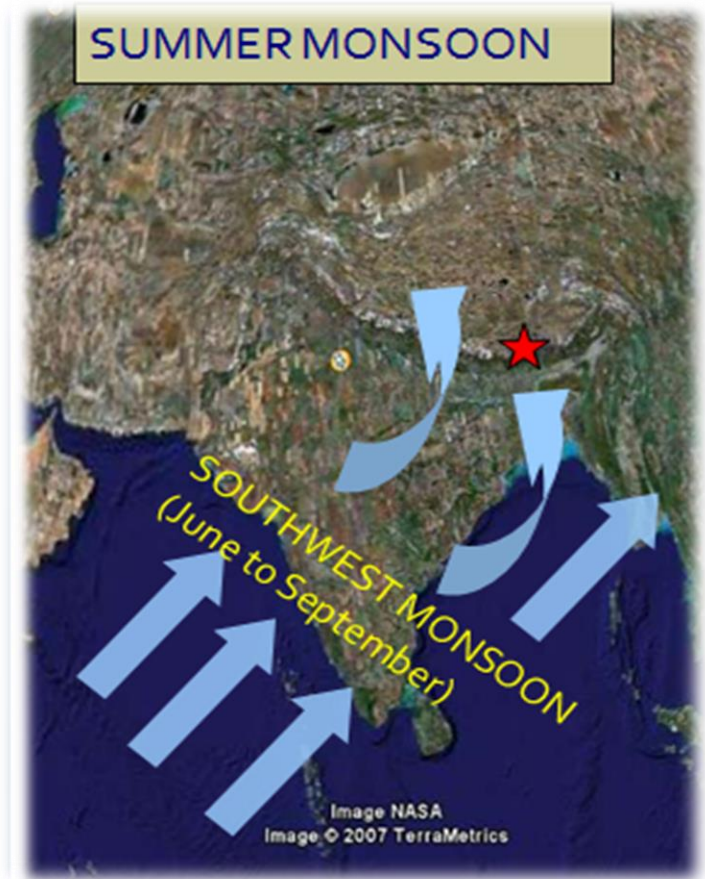
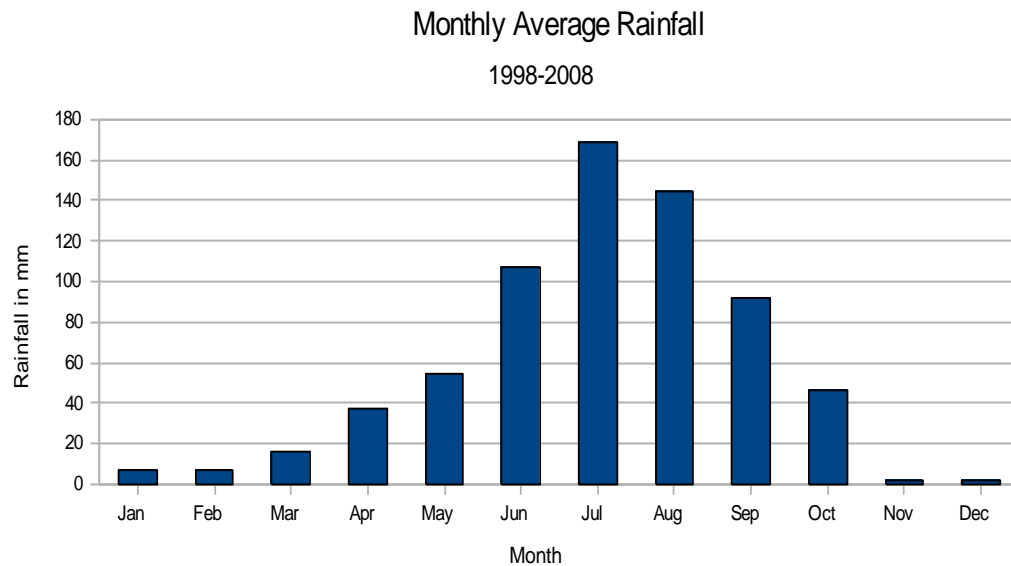
# Country Profile

- Total area - **38,394** Sq. Km
- Population – 810,723 (2017) approximately.
- **79 %** of population is **farmer**
- Altitude : **160 m** to **7500 m** above msl
- Forest Coverage: **70.5%** - Policy is to ensure at least **60%** for all time
- Politic : Constitutional Monarchy since 2008
- Topography : Rugged mountain terrain



# Climatic condition and monsoon pattern in Bhutan

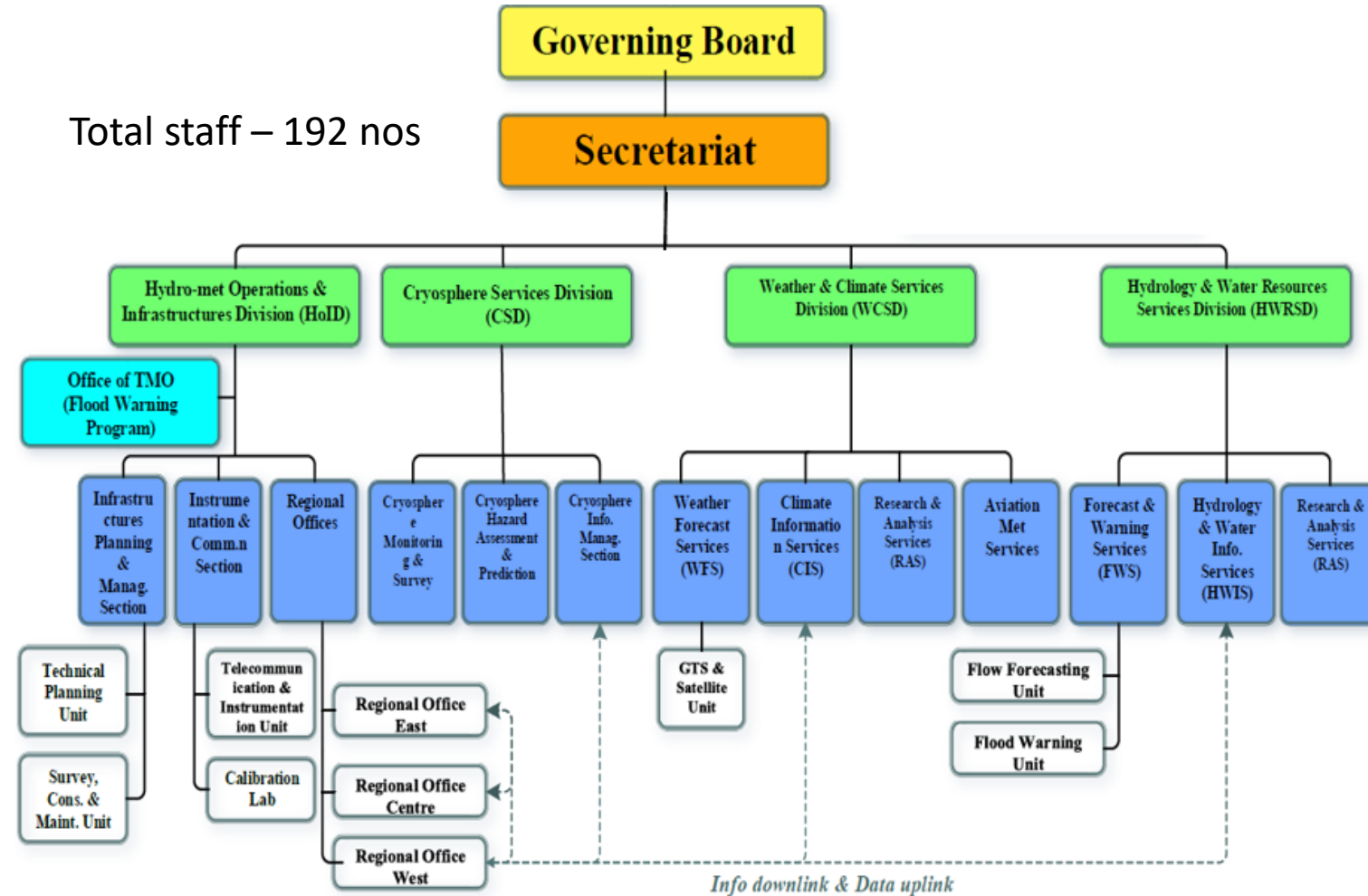
Bhutan Climatic is generally dominated by monsoon winds with dry winter and wet summer monsoon





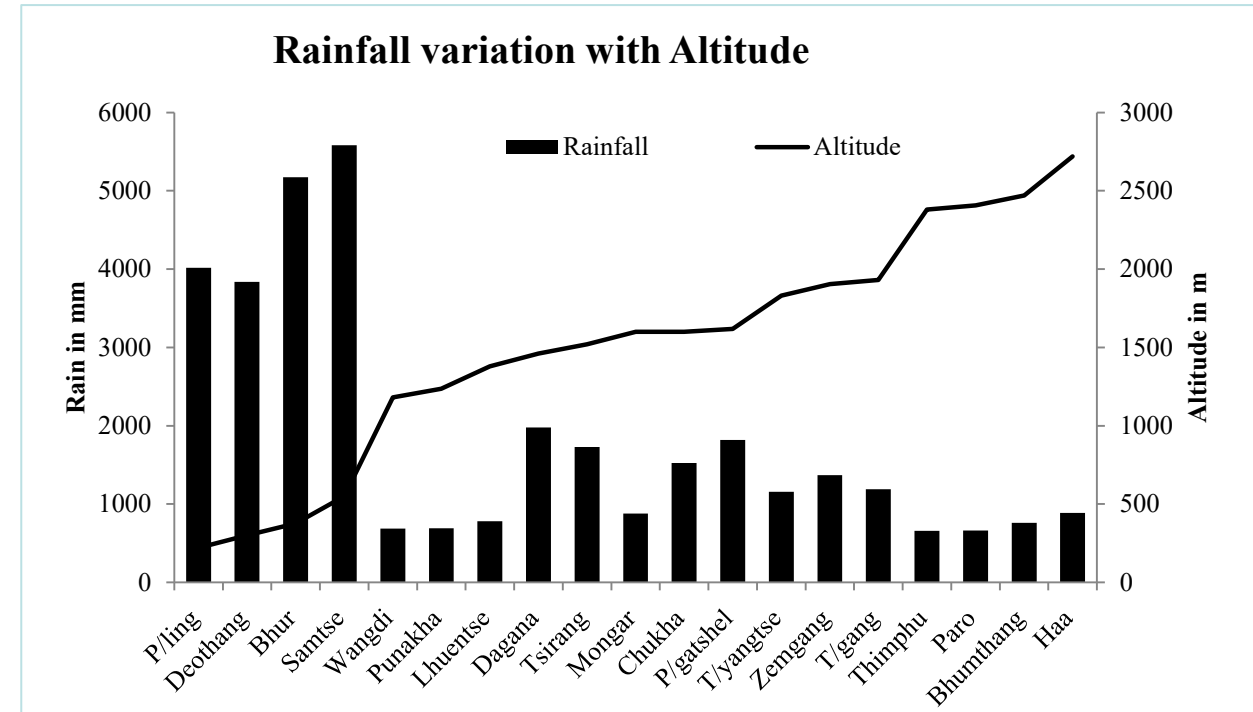
# Organogram of NCHM

- NCHM: **National Centre for Hydrology & Meteorology**
- Autonomous Agency from August 2016: it is an independent organization of the Royal Government of Bhutan
- NCHM is governed by a Governing Board and Board Members (BM) are from the relevant sectors.



# Disasters Risks in Bhutan

- Landslides (Summer)
- Flood
  - GLOF – Glacial Lake Outburst Flood
  - Flashfloods
  - Landslide Dam Outburst Floods
- Wind storm – pre monsoon and post monsoon
- Earthquakes
- Forest Fires
- Pest and Diseases



- Rain varies with altitude
- Southern foothills vulnerable to monsoon related disaster
- Foothills = Fragile and prone to landslides

# Observation station network

- Manual Weather Station

- Agro-met (Class A) – 20 nos



Daily measured parameter

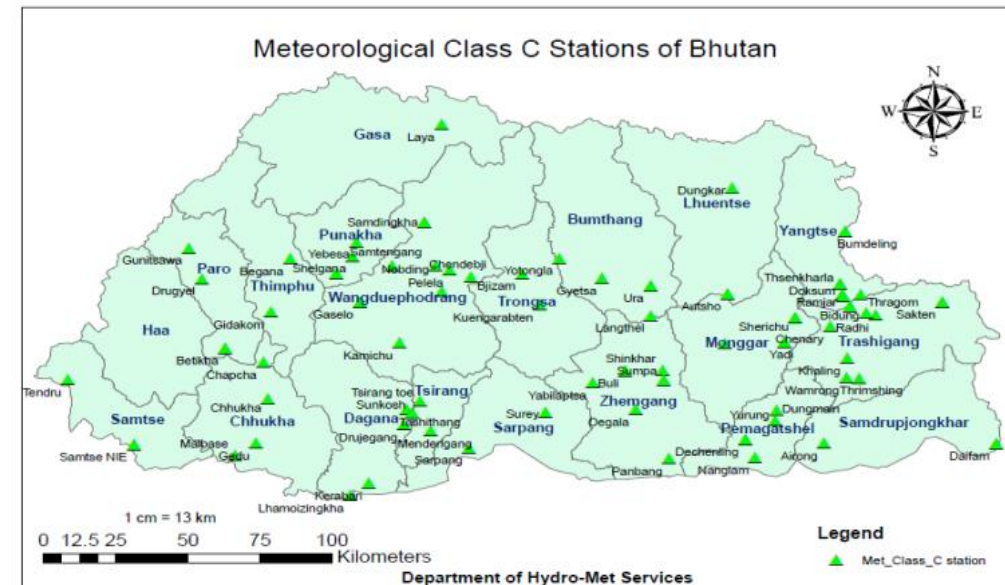
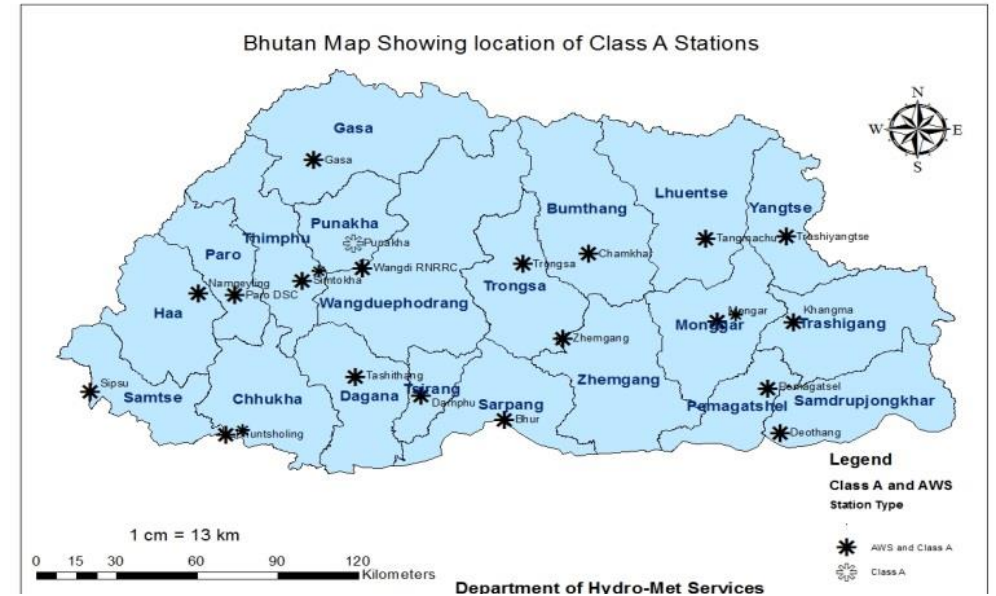
- Rainfall
- Temperature/Humidity
- Wind
- Sunshine duration
- Soil Temperature
- Evaporation

- Climatology (Class C) – 64 nos



Daily measured parameter

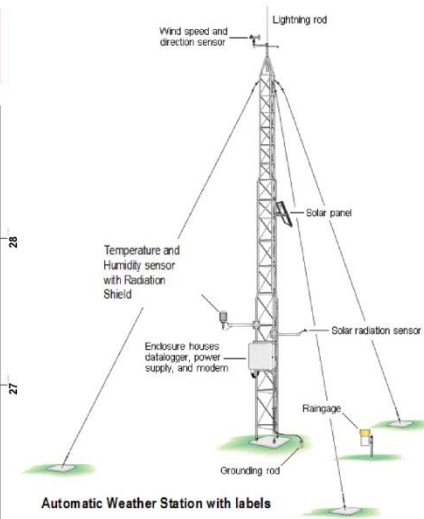
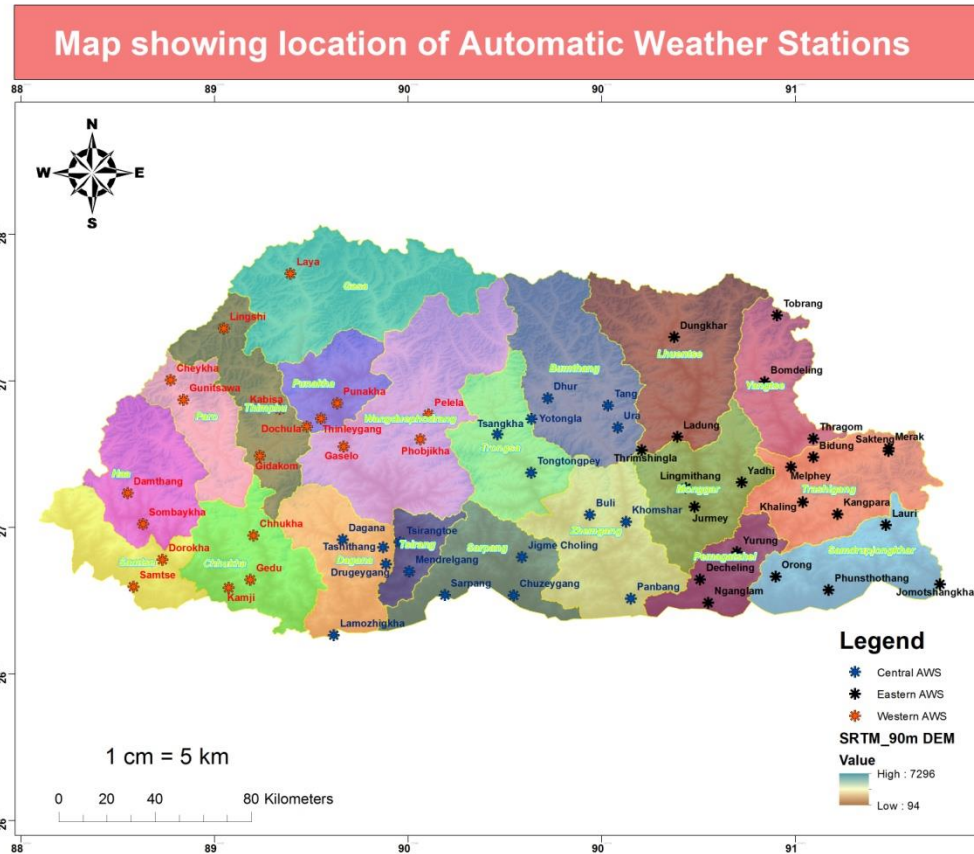
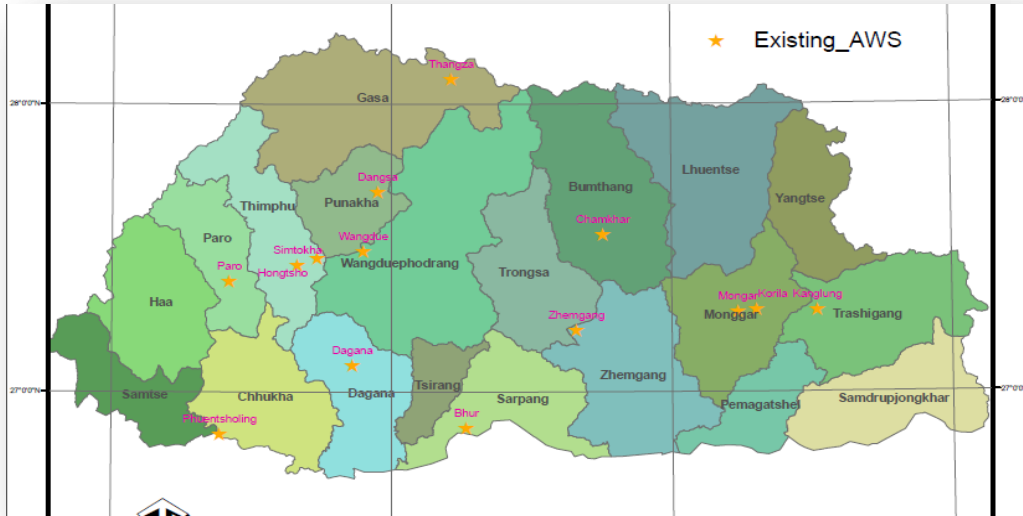
- Rainfall
- Temperature/Humidity



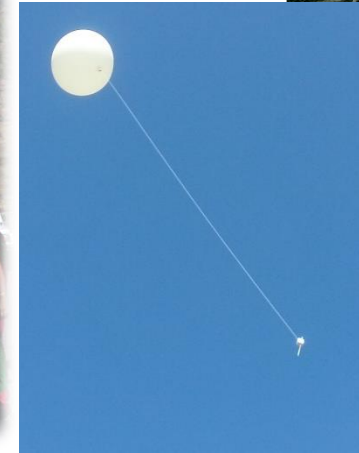


# Observation station

- Automatic Weather Station (AWS) – no. 80



- Upper Air Observation - 1





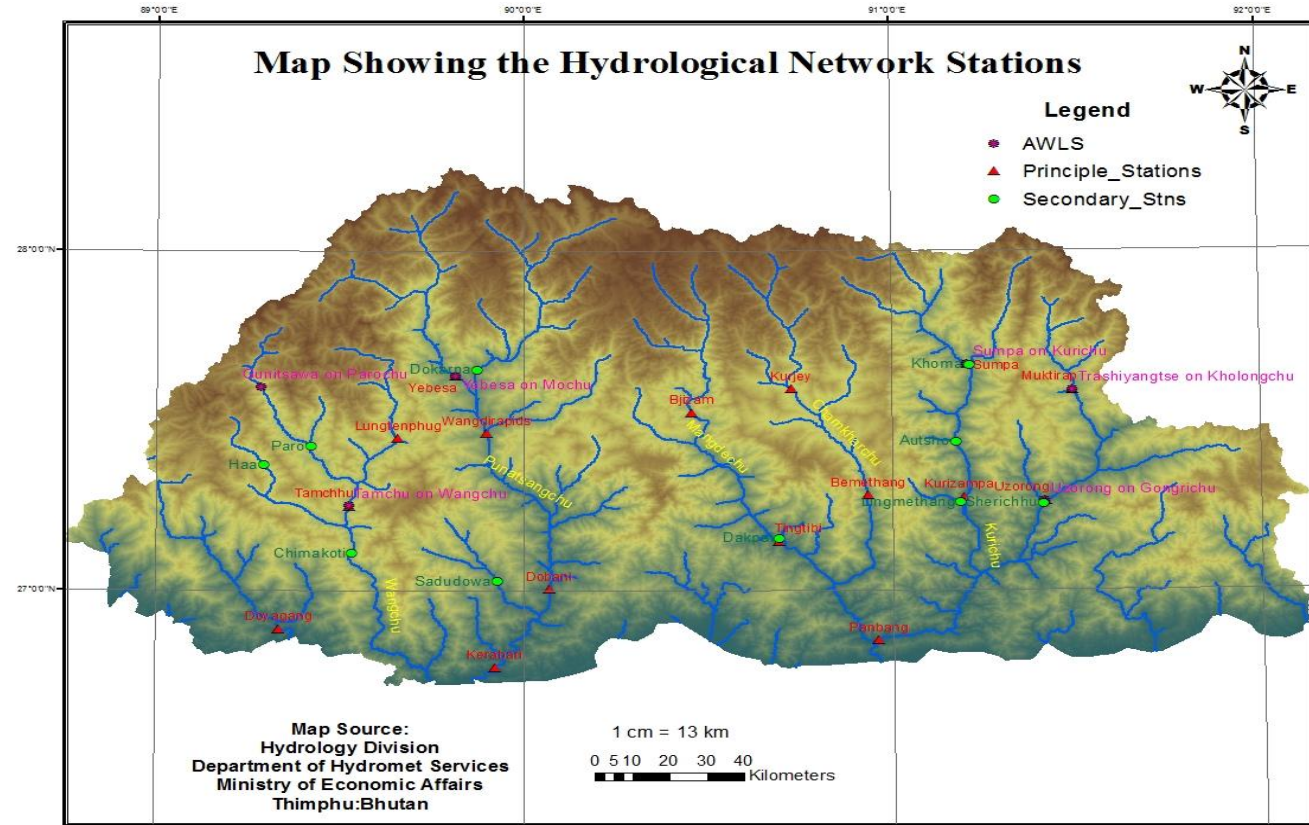
# Hydrological Network

## 1. Hydrological Network:

- Principal Station 15
- Secondary Station 09

## 2. Flood Warning Network:

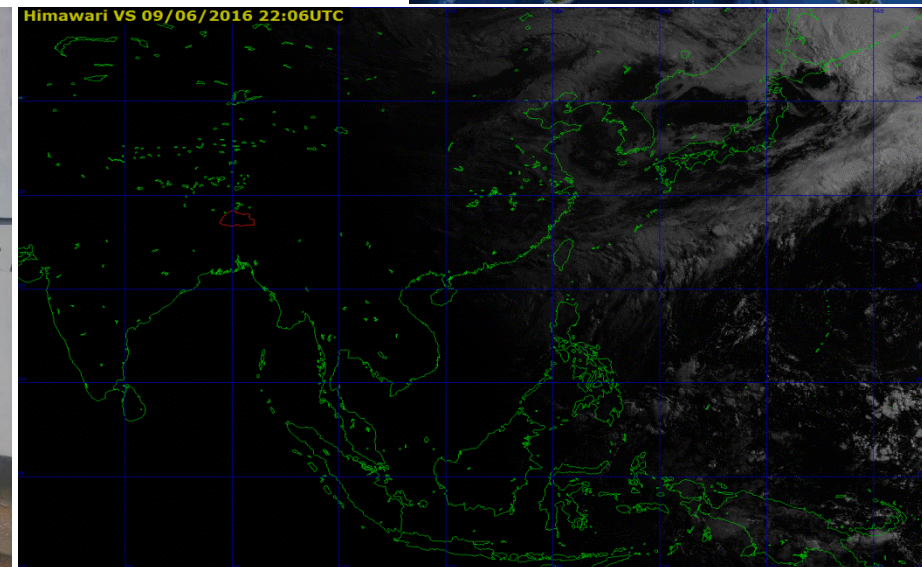
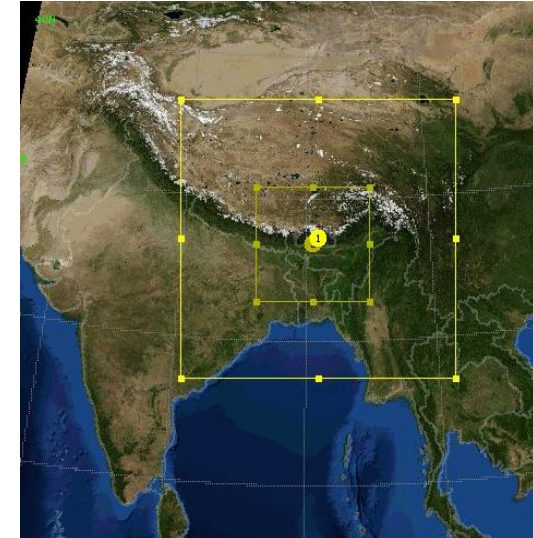
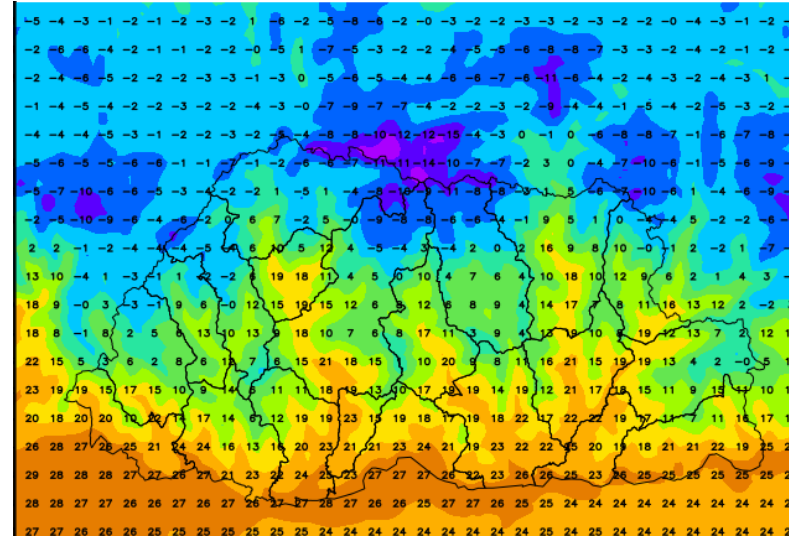
- Flood Warning Station 15



# Hydro - meteorological services in Bhutan

NCHM provides following weather and climate services;

- 24 to 72 hours weather forecast
  - WRF – 72 hours forecast runs
  - Runs every 6 hours 00, 06, 12, 18 UTC
  - Initial conditions - GFS models NCEP, NOAA
  - Nested domain 15 km and 3 km resolution
  - Vertical= 45 levels
- Himawari 8 satellite
- GTS



# Hydro - meteorological services in Bhutan

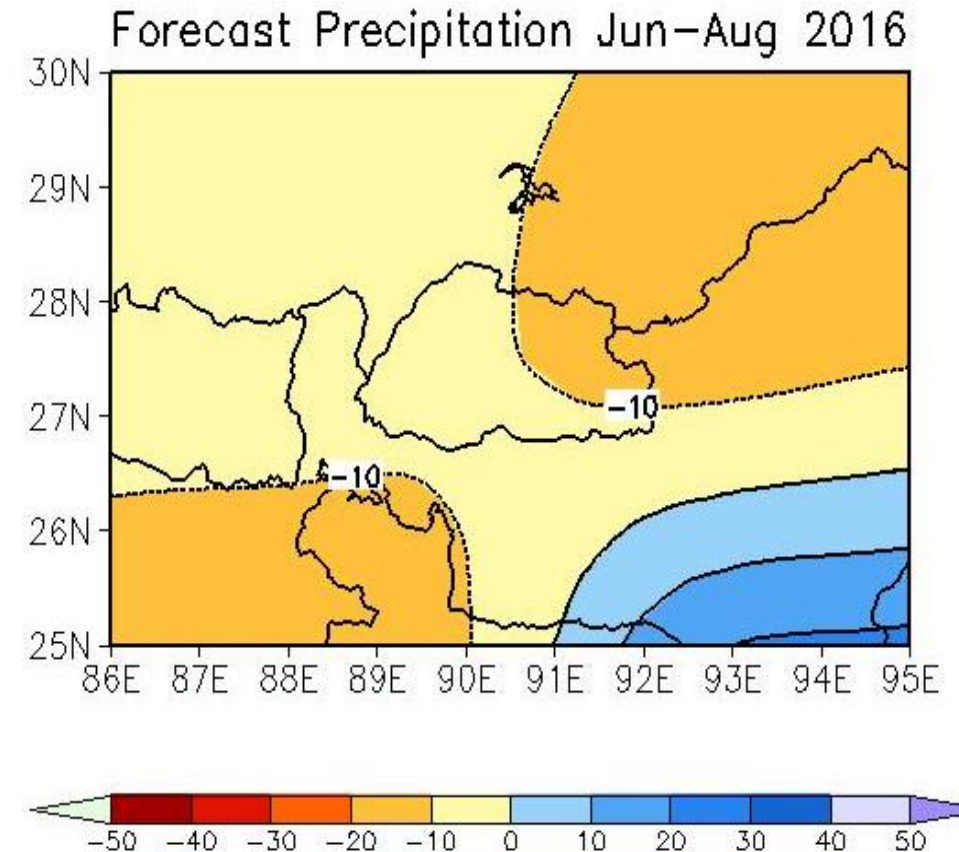
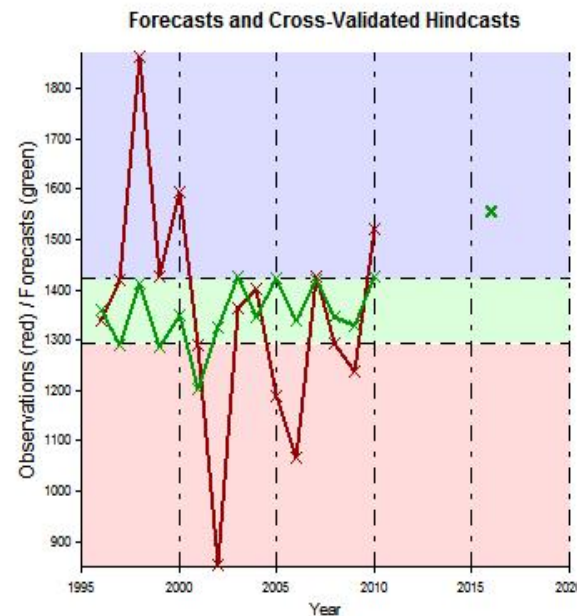
## Seasonal Climate Information

- Summer Monsoon Season (Jun – Sept)
- Winter Season (Dec - Feb) – on trail

Forecasts:										
Probabilities:										
Year	Probabilities			Odds			Relative Odds			
	B	N	A	B	N	A	B	N	A	
2016	6	20	74	0.07	0.25	2.81	0.14	0.50	5.62	

Forecast ranges:			
Year	Forecast	Lower	Upper
2016	1555.295	1385.125	2012.659





# Preparation and Dissemination of Seasonal Climate Information

- Regional Level: South Asian Climate Outlook Forum (SASCOF)
  - 10<sup>th</sup> SASCOF hosted in Bhutan, 24-26 April 2017
- Bhutan is actively participating since its inception - 2010



# Preparation and dissemination of seasonal climate information

## National Level: National Climate Outlook Forum (NCOF)

- **19-21 Oct 2015: 1<sup>st</sup> NCOF & National Stakeholder Consultation**

- Regional experts and WMO delegates were the resource person for the forum.
- Stakeholders from various priority areas of **agriculture, water, health, disaster risk reduction and energy** attended the forum.

- **12-13 May 2016: 2<sup>nd</sup> NCOF**

- Financial assistance from RIMES. Resource persons from RIMES and IITM, India.
- Local participants from various priority areas of **agriculture, water, health, disaster risk reduction and energy** attended the forum.

- **26 May 2017: 3<sup>rd</sup> NCOF**

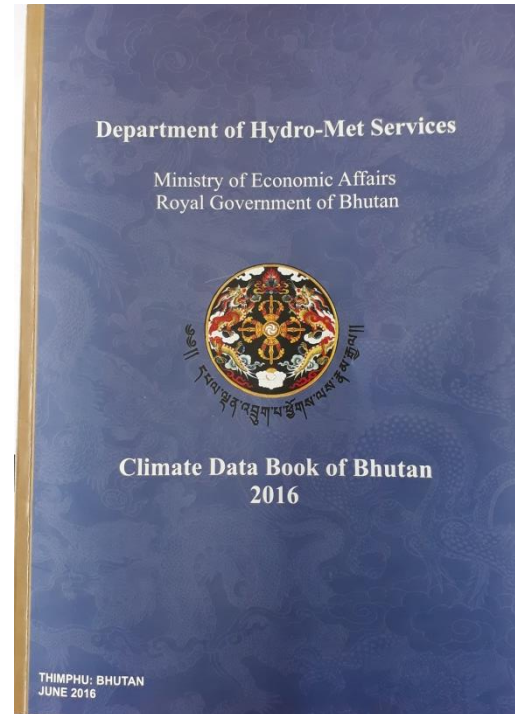
- Financial assistance from RIMES. Resource persons from RIMES and IITM, India.
- Local participants from various priority areas of **agriculture, water, health, disaster risk reduction, Energy and ASTROLOGER** attended the forum.






# Hydro - meteorological services in Bhutan

Provision of historical hydrological and climate data



  
**HYDROMET DATA REQUEST FORM**

*Sign and Return to: National Center for Hydrology and Meteorology, Thimphu, Bhutan*

Name of the Person & Office : \_\_\_\_\_  
Agency : Govt/Private/Corporation/Institution/Individual (please tick any)  
Address : \_\_\_\_\_  
Phone number : \_\_\_\_\_  
Email : \_\_\_\_\_

SN	Data Parameters	Site/Station/River/ Gewog/District	Data Period (eg:1992-1995)	Frequency (Daily/Monthly/ Annually)	Remarks <b>(Official Use)</b>
1					
2					
3					
4					
5					

**Attach additional sheets if required**

**Purpose:**  
Type of Study/Project: Research ( ), Project ( ), Thesis ( ), Others (Specify) \_\_\_\_\_  
Name of Study/Project : \_\_\_\_\_  
Summary of the Project/study : \_\_\_\_\_

**Attach official letter/documents**

**Feedbacks**  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Visit [www.hydromet.gov.bt](http://www.hydromet.gov.bt) for more information



# Hydro - meteorological services in Bhutan

- Aviation Meteorological Services
- Climate Projection

# Hydro - meteorological services in Bhutan

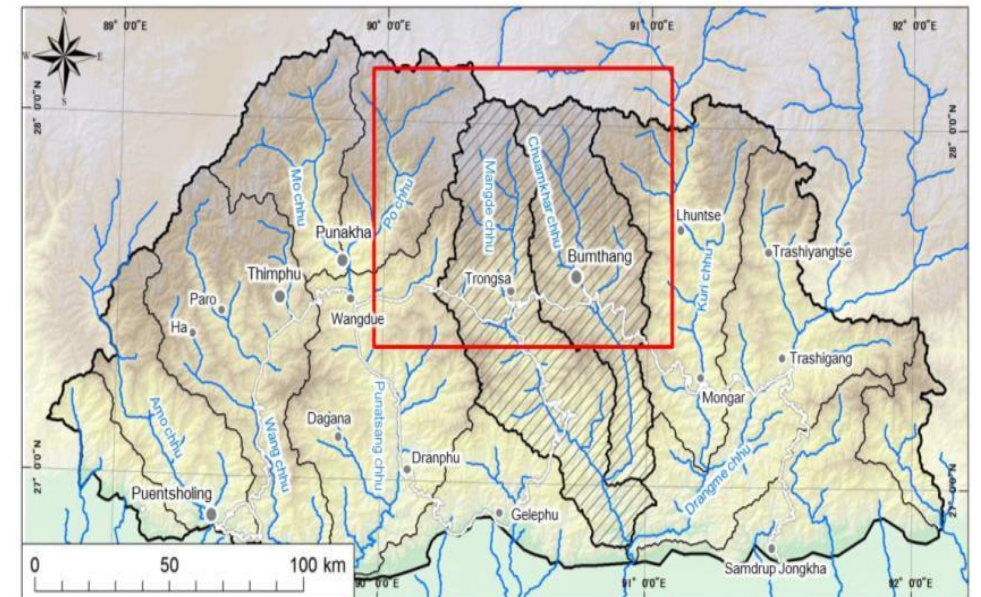
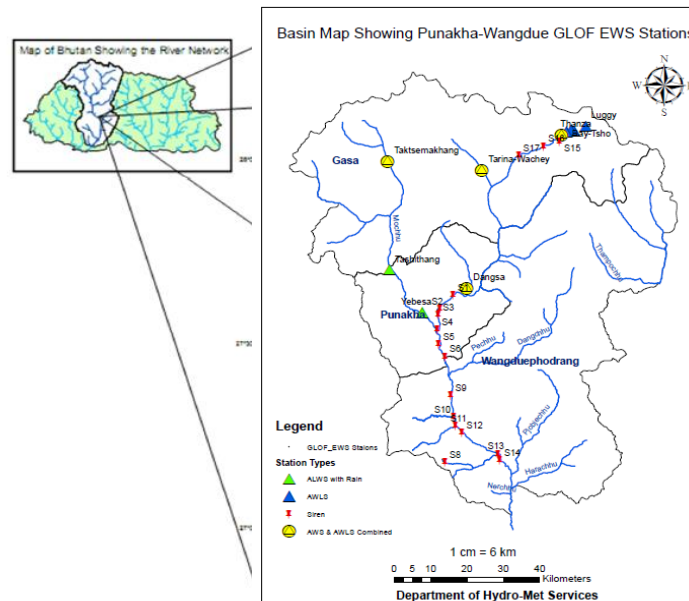
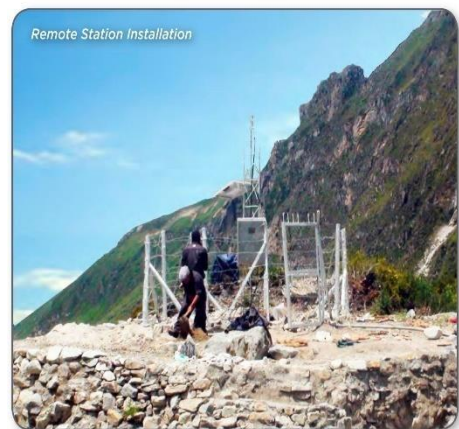
- GLOF & Rainstorm Early Warning System

## Punatsangchu

- GLOF EWS Punatsangchu Basin
  - 10 AWLS and AWS
  - 18 Sirens
- Communication
  - Iridium Satellite
- 24/7 control room monitoring

## Bumthang/Chamkhar

- GLOF Rainstorm EWS along **Chamkharchu** and **Mangdechu** Basin
  - 3 AWLS & AWS
  - 6 Sirens
- Communication
  - HF & DCP



# Weather information dissemination

- Currently NCHM does not have capacity to provide impact based forecast information.
- Weather monitored 24/7
- Extreme weather events (cyclone, thunderstorm, snow, heavy rain) forecast information are issued via press release.
- Information disseminated via



**KUENSEL**  
THAT THE PEOPLE SHALL BE INFORMED

**WEATHER NOVEMBER 14 2016**

Phuentsholing

30 °C  
20 °C

	Max	Min	
Gasa	11	-1	
Trongsa	21	4	
Bumthang	17	3	
Sarpang	29	19	

Source: Meteorology Division, DHMS, MOEA  
For any weather information: Call hotline 339673



3 DAYS FORECAST **AUG 13** AUG 14 AUG 15

Location	Max	Min	Location	Max	Min	Location	Max	Min
Gasa	25 °C	14 °C	Bumthang	25 °C	15 °C	Trongsa	24 °C	15 °C
Tsirang	25 °C	20 °C	Wangdue	32 °C	20 °C	Punakha	33 °C	22 °C
Dagana	23 °C	13 °C	Zhemgang	26 °C	17 °C	Chhukha	27 °C	18 °C



# Conclusion

- Impact-based weather forecast is necessary for Bhutan.
- Provision of medium range weather forecast
- Provision of sub-seasonal forecast
- Collaborative research with international, regional and national institutes
- Institutional capacity development

Paro Taktshang



Punakha Dzong



Thank you

Tashichhodzong, Thimphu

