Asian Water Cycle Initiative (AWCI)
International Coordination Group (ICG)

Bhutan Preparatory Report

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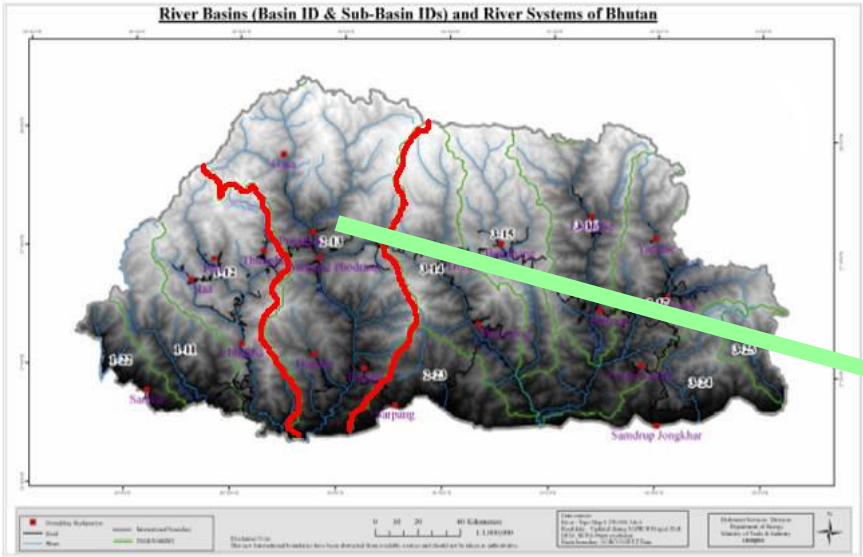
Objectives of Implementation

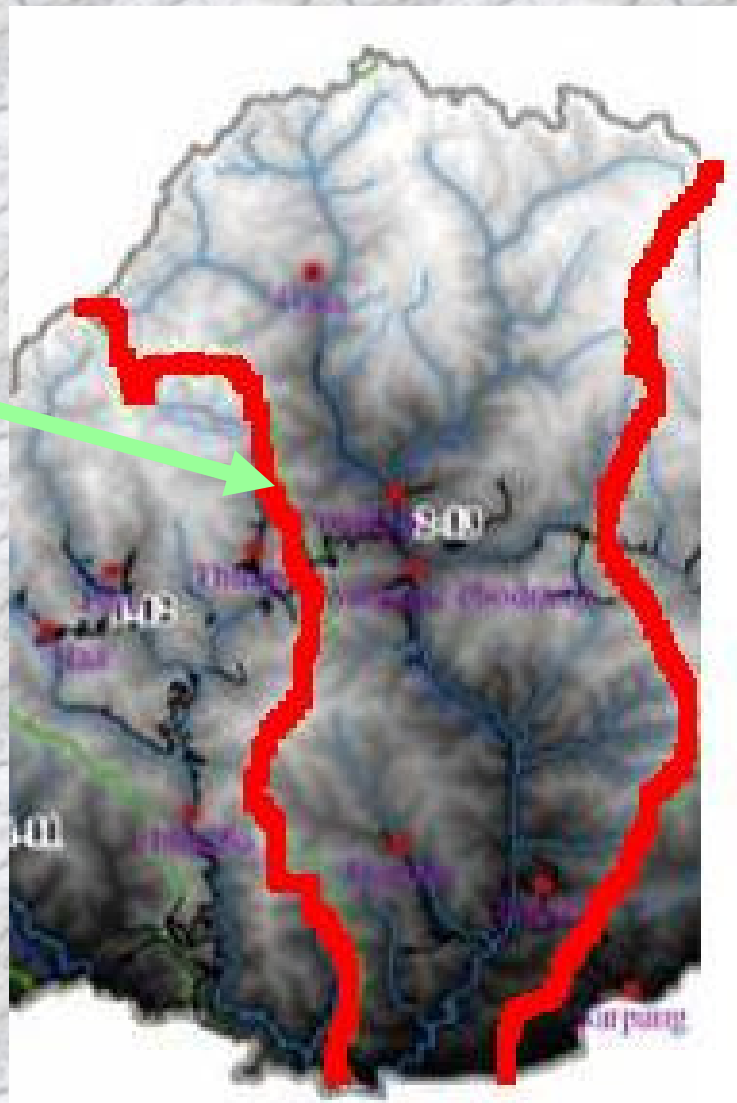
- Development of appropriate information system of systems promoting the implementation of integrated water resources management (IWRM).
- Downscaling of global data and information to a basin scale to aid sound decision making.
- Focus on implement able local activities for the benefits of the society

Demonstration Project Proposal

- **Criteria:**
  - **Potential for socio-economic benefits to those living in the basin and from the perspectives of hydrological science**
  - **Data availability**
    - Data type
    - Station density
    - Watershed information
  - **Additional data availability**
    - Upper air observation
    - Near-real time
    - Water quality data
  - **Basin size**
    - **100 km^2 – 1,000,000 km^2**

Demonstration Project Proposal





SALIENT FEATURES

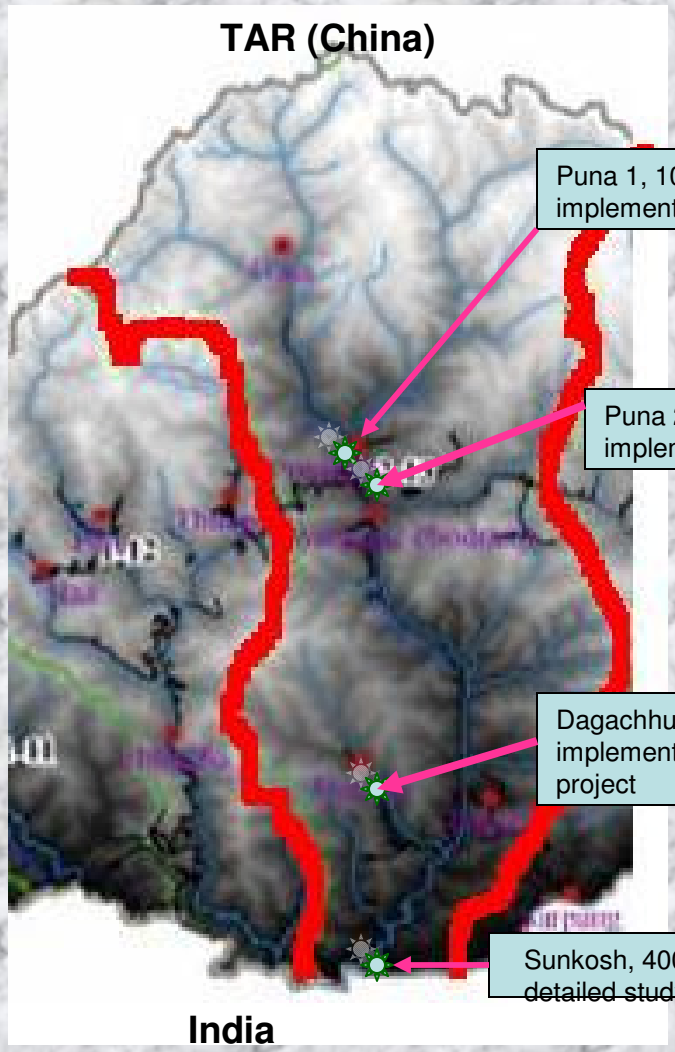
Basin Name: Punatsangchhu

Main River: Punatsangchhu

Basin Area:8000 km.sq.

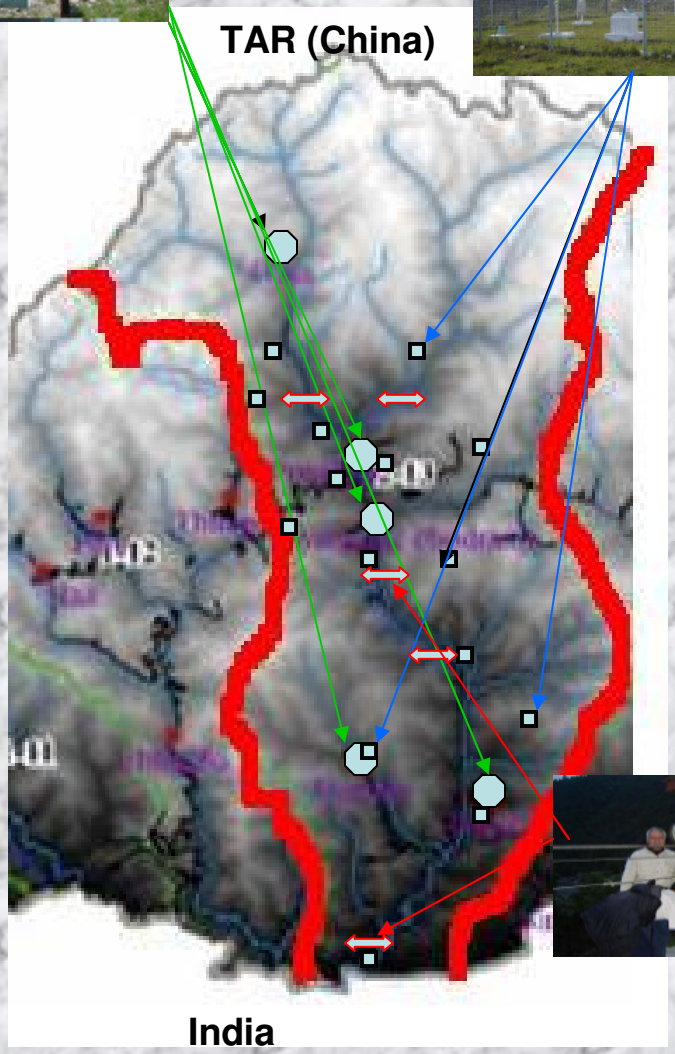
Altitude levels: 100 masl – 7500 masl

Adherence to Criteria



- Benefits can be accrued as hydropower development initiated in this basin
  - Economic benefits through employment, establishment of business ventures
  - Add-on benefits through establishment of schools, hospitals, agriculture centers etc.
- Hydrological Science Perspectives
  - GLOF prone basin and therefore, appropriate for GLOF studies
  - Affect of land use on river flows as all aspects of land use are in the basin
  - Climate change impacts on glacier melt and subsequent change in flow regimes of rivers

Adherence to Criteria



Data Types

1. Data type:

-Discharge, water level, rainfall, AWMS data (rainfall,

radiation, air pressure, temperature, wind speed, wind direction, humidity) are available

2. Spatial density as per WMO:

-5 automatic weather monitoring stations

-15 rainfall stations

-5 river gauging stations

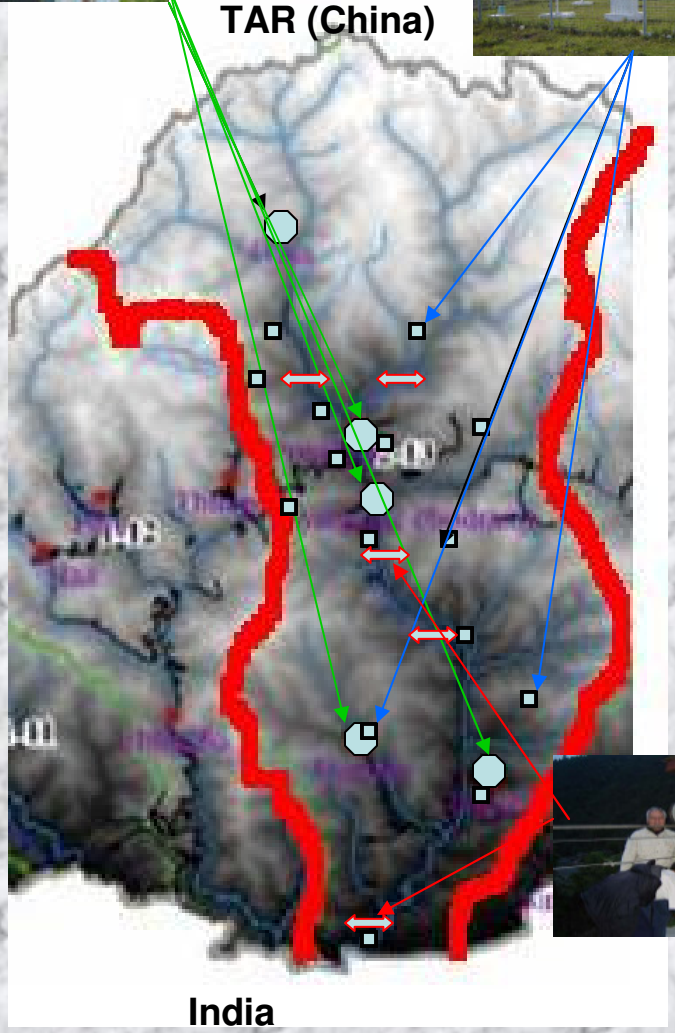
Below WMO standards regarding density but local specifics need to be considered

3. Watershed characteristics:

-Land use, soil type, vegetation and physical characteristics available

Adherence to Criteria

TAR (China)



India

Additional data:

1. Upper air observations:

Not done

2. Near-real time data:

Real time data being made available from AWMS and river gauging stations

3. Water quality data:

To monitor the health of the rivers, water quality monitored on a regular basis and therefore, data available

Capacity Building

Water Resource Management Issues in Bhutan:

- Floods including flash floods due to:
  - Glacial lakes burst (GLOF)
  - High intensity rainfall (especially during monsoon)
  - Landslide dam burst
- Drought

The Bhutanese Need

- Flood Forecasting and Early Warning Systems at the Regional, National and Local Levels

Resource Needs

- **Material resources**

–Strengthening of the observational network

- Hardware & software support at the implementation level

- **Human resources**

- Capacity building in data integration, modeling and downscaling to local conditions

Bhutan-Water Resource Management – Capacity Building

	Flood Forecasting and EWS	**Degree of applicability**	**Collaborators**
1. Data integration service 2. QC service	2 2	Applicable Applicable	CEOP
1.Global DB (Digital Atlas, Dam) 2. Training and research workshop	1 1	Potentially applicable Potentially applicable	GWSP
1.Flood inundation modeling 2. Loss estimation 3. Rainfall downscaling and forecast	2 1 2	Applicable Potentially applicable Applicable	UNU

Bhutan-Water Resource Management – Capacity Building

	Flood Forecasting and EWS	Degree of applicability	Collaborating programmes
1. Global flood alert system	2	Applicable	
2. Flood hazard mapping training	1	Potentially applicable	
3. River and dam engineering training	1	Potentially applicable	ICHARM
4. Master course on flood mitigation	1	Potentially applicable	
1. River basin management training	1	Potentially applicable	
2. Flood hazard mapping and training	2	Applicable	
3. Flood emergency management and training	2	Applicable	MRC
4.Mathematical modeling training	1	Potentially applicable	
5. Satellite rain estimation training	1	Potentially applicable	

Bhutan-Water Resource Management – Capacity Building

	Flood Forecasting and EWS	**Degree of applicability**	**Collaborating programmes**
1. Flood and drought management	1	Potentially applicable	China
1. WGs and projects	1	Potentially applicable	PUB
1.Mini-projects 2. Sentinel Asia	2 2	Applicable Applicable	 JAXA/AIT
1. Enhanced observation	1	Potentially applicable	MAIRS

Data Policy

- . As a member of WMO, release of data probably has to be in compliance with WMO Resolution 40 (CG-XII) and WMO Resolution 25 (CG-XIII)


TASHI DELEK