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1. Policy title

This Policy shall be called the “Hydro-met Policy of the Kingdom of Bhutan 2023” and come into effect from the day of the approval by the cabinet and remain in force until revised.

2. Rationale

Bhutan’s economy is highly dependent on climate-sensitive sectors such as agriculture, hydropower, and forestry. Climate change will have long term impacts on the economy and the sustainable development goals. The most significant impact of climate change in Bhutan is the formation of supra-glacial lakes due to the accelerated retreat of glaciers with increasing temperatures. This will have a huge impact on national water security and risk of downstream flooding. Bhutan is also highly prone to a range of hydro-meteorological hazards, including flash floods, riverine floods, landslides, landslide dam outburst floods, cloudbursts, windstorms, and other extreme weather events. Climate change is mainstreamed into development plans and programs for strengthening climate resilience and, addressing hydro- meteorological hazards are identified as priority issues. Climate science has become important for policy and planning of adaptation and mitigation strategies to support socio-economic development. Bhutan’s heavy reliance on agriculture, hydropower and tourism makes information on weather, climate, and water resources critical. Therefore, understanding the sciences of meteorology, climate and water resources or hydrology and its applications has become ever more important for Bhutan. There is an urgent need to strengthen the National Hydrological and Meteorological Service (NHMS) provider as an institution and as a competent public service provider.

The Royal Government of Bhutan has created the National Center for Hydrology and Meteorology (NCHM) as an autonomous, technical, and scientific agency in 2016 based on the Organization Development (OD) Exercise carried out by Royal Civil Service Commission (RCSC), subsequently approved by the Cabinet during its 92nd *Lhyengye Zhungtshog* held on 11th December 2015. NCHM is mandated for observation, management and collaboration, research, modeling, and prediction to provide services on hydrology, meteorology, cryosphere, and climate change to make development plans, and prepare for,



mitigate, and respond to natural and extreme hydro-met events

NCHM aspires to advance scientific research and technical capabilities to support development and better meet the needs of the society. There is a need for policy that governs and regulates development and operations of hydro met sciences and services facing the following issues.

- i. Multiple agencies have set up hydro-meteorological observation stations and collected data without adherence to measurement standards leading to duplication, and poor coordination among stakeholders often leading to poor accountability.
- ii. Displacement of observation stations and hydro met infrastructure located within the premises of other agencies compromising quality and long-term time series data collection.
- iii. Lack of framework or guidelines for standardization of hydro-met instrument and quality management system (QMS) hampering quality of data, data exchange and effective service delivery.
- iv. There is no guideline to engage and regulate emerging private hydro-met service providers.
- v. Currently hydro-met data and services are provided free of cost and there is no mechanism to charge for data and services.
- vi. Challenges in complying with the International Civil Aviation Organization (ICAO) and World Meteorological Organization (WMO) regulations as there is no policy guidance for compliance with international standards and agreements.
- vii. There is neither a policy nor a guideline for exchange and dissemination of hydro-met data with national and international communities. To address these existing and the emerging challenges, a dedicated hydro-met policy is required.



2.1 Vision

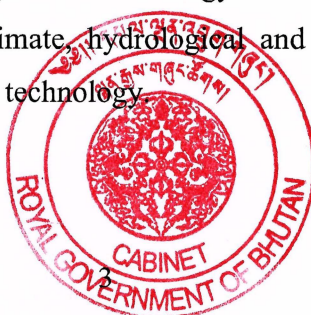
Building a well prepared and responsive nation to hydro meteorological threats and opportunities through access to high quality and accurate meteorology, climate, cryosphere, and hydrological information

2.2 Policy objectives

This policy shall be the guiding document for the development, enhancement, and provision of services on meteorology, hydrology, and cryosphere in the Kingdom of Bhutan. The objective of this policy is to ensure reliable and quality hydromet services for socio-economic development, disaster risk reduction, protection of lives and properties.

3 Policy statements

- 3.1 The Royal Government of Bhutan (RGoB) shall strengthen the National Center for Hydrology and Meteorology governance (NCHM) and recognize it as the nodal agency for hydrology, meteorology, aviation meteorology, climatology, climate and cryosphere sciences and its application.
- 3.2 The National Center for Hydrology and Meteorology shall establish, maintain, operate, and modernize hydro-met infrastructure and related Information and Communication (ICT) facilities to ensure effective delivery of services.
- 3.3 The Royal Government of Bhutan shall provide adequate resources for establishment, operation, and maintenance of hydromet stations, modernizing hydro-met observations, early warning systems and scientific facilities through innovative financing including adoption of cost recovery mechanism for data and specialized services, to ensure sustainability of hydro-met network and its operation.
- 3.4 The National Center for Hydrology and Meteorology shall maintain and provide reliable, accurate, and quality weather, climate, hydrological and cryosphere information, and services through use of state-of-art technology



- 3.5 The Royal Government of Bhutan shall ensure access to reliable and quality hydromet data and services for all times.
- 3.6 The Royal Government of Bhutan shall adopt hydro-met data exchange and dissemination mechanisms for regulating data exchange.
- 3.7 The National Center for Hydrology and Meteorology shall ensure adoption of standards for observation, instruments, data collection and forecasting in compliance with the known international and national standards to ensure quality services.
- 3.8 The Royal Government of Bhutan shall promote research and development to enhance knowledge and understanding of science in hydrology, meteorology and Cryosphere and its applications.
- 3.9 The Royal Government of Bhutan shall ensure adequate and competent human resources to abreast with emerging science and technology.
- 3.10 The Royal Government of Bhutan shall foster and ensure partnership with national, regional, and international stakeholders for establishment, capacity building, enhancement and utilization of hydro-met technology, knowledge, and data exchange.

4 Alignment to current policies and legislations

4.1 The Constitution of the Kingdom of Bhutan

This policy supports the realization of the Article 5, section 2 of the Constitution which mandates RGoB to protect, conserve and improve the pristine environment and safeguard the biodiversity of the country; prevent ecological degradation; secure ecologically balanced sustainable development; and ensure a safe and healthy environment. Further, this policy will compliment Article 7, Section 3 of the Constitution that mandates the citizens' right to information.

4.2 Climate Change policy of Kingdom of Bhutan 2020

This policy is a foundation to achievement of overall vision and objectives enshrined within the Climate Change Policy of the Kingdom of Bhutan 2020. Section 3.1 of this policy



supports Climate Change Policy which mandates NCHM to provide national sources of hydro- meteorological data, services, and advice to meet the needs of the general public, emergency services and other specialized users.

4.3 Water Act 2011

This policy complements the Water Act of Bhutan, 2011. Section 4 (a) of the Act mandates that the water resources are protected, conserved and/or managed in an economically efficient, socially equitable, and environmentally sustainable manner. This policy helps realize the purpose of the Act by providing scientific data and technical support for assessment of national water resources, weather, water availability, glaciers and glacial lakes inventory, hazards and risk assessment, flood and GLOF risks and hazards, river flow regime change based on climate projection scenarios for strategic planning and governance of water resources. Further, it complies with section 11 (a) of the Act which states that all citizens shall have access to water related information.

4.4 Disaster Management Act 2013

The hydromet policy ensures provision of Early Warning Services, which strengthens the implementation of the Disaster Management Act. Further, the policy is also in pursuant to Prime Minister, the ex-officio chairperson of the National Disaster Management Authority, vide order C-2/2019/369 on December 5, 2019 which designates NCHM as Early Warning Service provider.

4.5 Civil Aviation Act of Bhutan 2016

Pursuant to section 61 (3) of the Civil Aviation Act of Bhutan 2016, the Bhutan Civil Aviation Authority (BCAA) has designated NCHM as the National Aeronautical Meteorological Service Provider within Bhutan. The hydromet policy reinforces this act by supporting to ensure efficient flight operation and aviation safety.

4.6 National Environment Protection Act 2011

This policy complements Section 83 (a) of the National Environment Protection Act 2007, which mandates collection of national environmental information gathered through regular



monitoring of the quality of air and water, according to the quality standards and sampling/evaluation methodologies.

5 Implementation procedure

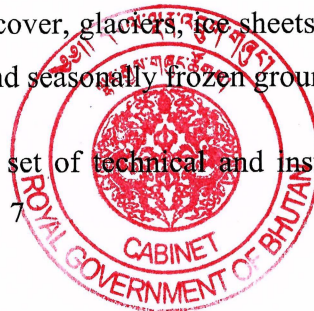
5.1 The National Centre for Hydrology and Meteorology shall develop strategies and road maps, policy action plan, guidelines and Standard Operating Procedures, manuals and liaise with stakeholders for its implementation

5.2 The policy shall be integrated into development plans and programs including annual work plans



6 Definitions

- i. **Agrometeorological Services:** All agrometeorological and agro-climatological information that can be directly applied to improve and/or protect the livelihood of farmers in agricultural production may be considered to belong to agrometeorological services.
- ii. **Aviation Meteorological Service Provider:** The designated authority of a state to provide or to arrange for the provision of meteorological services for international air navigation as required under Chicago Convention.
- iii. **Aviation Meteorological Services:** Services designated to provide the meteorological information required for air navigation.
- iv. **Common Alerting Protocol:** The Common Alerting Protocol (CAP) is a digital format for exchanging emergency alerts, allows a consistent alert message to be disseminated simultaneously over multiple communications pathways for public safety
- v. **Climate:** Climate is defined as the average weather -or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities- over a period ranging from months to thousands or millions of years.
- vi. **Climate Change:** A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.
- vii. **Climate Services:** Information and products that enhance users' knowledge and understanding about the impacts of climate change and/or climate variability so as to aid decision-making of individuals and organizations and enable preparedness and early climate change action.
- viii. **Cryosphere:** The components of the earth system at and below the land and ocean surface that are frozen, including snow cover, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost, and seasonally frozen ground.
- ix. **Early Warning Systems (EWS):** The set of technical and institutional capacities to



forecast, predict, and communicate timely and meaningful warning information to enable individuals, communities, managed ecosystems, and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.

- x. **Glacier:** A perennial mass of ice, and possibly in form of snow, originating on the land surface by accumulation and compaction of snow and showing evidence of past or present flow.
- xi. **Hazard:** The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.
- xii. **Hydrology:** Science that deals with the waters of the earth: their occurrence, circulation, and distribution, their chemical and physical properties and their reaction with the environment including their relations to living things, thus addresses both the hydrologic cycle and water resources.
- xiii. **Hydro-meteorology/hydromet:** Includes the science of hydrology, meteorology, and cryosphere.
- xiv. **Hydro-met Data:** includes meteorology, hydrology, cryosphere, and related environmental data.
- xv. **Hydro-met Services:** including all the services related to meteorology, hydrology and cryosphere science and its applications.
- xvi. **Quality Management System:** QMS is a structured framework that an organization implements to ensure consistency, efficiency, and continuous improvement in its processes, products, and services, meeting customer expectations and regulatory requirements while fostering a culture of excellence and accountability.
- xvii. **Hydro-met Service Provider:** Agency or organization designated by the Government as the National Authority for observations, research, modeling, and prediction to provide services related to meteorology, hydrology, and cryosphere.



- xviii. **Meteorology:** A science that deals with the atmosphere and its phenomena with a major focus on weather forecasting.
- xix. **Weather Forecasting:** Weather forecasting is the application of science and technology to predict the conditions of the atmosphere for a given location and time.
- xx. **National Meteorological and Hydrological Service (NMHS):** The National Authority responsible for providing meteorological, hydrological, and related services in the country.
- xxi. **Public Weather Service:** Public weather service refers to forecasts, warnings, and meteorological information to ensure public safety, support planning, and enhance awareness.
- xxii. **Hydromet infrastructure:** Network of stations, communication, ICT, Data Centre Offices, National Weather and Flood Warning Centre (NWFWC), Control rooms, EWS network stations, Calibration lab, Sediment and Water Quality laboratories.
- xxiii. **Hydromet services:** Services on meteorology, hydrology, climate change, Cryosphere and include aviation meteorology



7 Annexures

7.1 List of Services provided by NCHM

The services provided by NCHM shall keep on updating based on needs and changing technology.

7.1.1 Weather and Climate services

- i. Meteorological observation and monitoring services
- ii. Climate data and analysis services
- iii. Short range and long-range weather forecast services
- iv. Weather advisories and warnings
- v. Climate monitoring and prediction services
- vi. Agrometeorological services
- vii. Aviation meteorological services
- viii. Climate change projection and information services
- ix. Weather modeling and research

7.1.2 Hydrology and Cryosphere services

- i. Hydrological and cryosphere observations, monitoring and data services
- ii. Hydrological and cryosphere data and analysis services
- iii. Flood and flow forecasting services
- iv. Snow and glacier monitoring services
- v. Glacial lake monitoring services
- vi. Risk and hazard assessment, and mapping services
- vii. Hydrological modeling, prediction, and water resources availability assessment services
- viii. Ambient water quality monitoring services
- ix. Hydrology, water resource and cryosphere research



7.1.3 Early warning services

- i. Extreme weather early warning services
- ii. GLOF early warning systems
- iii. Flood early warning Services

