HYDROMETEOROLOGICAL PARAMETERS FOR CATCHMENT

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ABSTRACT

Hydrometeorology is a branch of meteorology . The boundaries of hydrometeorology are not clear-cut, and the problems of the hydro meteorologist overlap with those of the climatologist, the hydrologist, the cloud physicist, and the weather forecaster. It involves the measurement, analysis and modeling of atmospheric and land surface processes tied to the hydrologic cycle. Other concerns of hydro meteorologists include the determination of rainfall probabilities, the space and time distribution of rainfall and evaporation, the recurrence interval of major storms, snow melt and runoff, and probable wind tides and waves in reservoirs. The whole field of water quality and supply is of growing importance in hydrometeorology, as is flooding.

INTRODUCTION

In the hydrologic cycle water is transported in the air, over the land and below the surface of earth. Meteorology deals with the atmospheric portion of the hydrologic cycle, that is, with the transportation of water in the air. For this reason meteorology is often defined as the science of the atmospheric phenomena. Hydrometeorology is defined as the study of the atmospheric processes which affect the water resources of the earth and are of interest to the hydrologic engineers. A broader definition of hydrometeorology was given by the World Meteorological Organization (WMO fourth congress-1963) in stating that hydrometeorology concerned with the study of the atmosphere and land phases of the hydrologic cycle with the emphasis on the inter-relationships involved

METEOROLOGICAL PARAMETERS

ATMOSPHERIC PRESSURE: This is usually measured by Fortins Barometer. The atmospheric pressure is always expressed in mill bars. A curve joining points of equal atmospheric pressure is called an isobar. With the help of the isobars drawn on the synoptic charts, one can easily locate a region of high pressure or a region of low pressure.

WIND VELOCITY: Air in motion is called the wind. The horizontal component of the air movement parallel to the earth's surface is generally referred to as wind.Wind velocity is measured by the cup anemometer
WIND DIRECTION: The wind direction is the direction from which it is blowing and it is measured by an instrument called the wind vane

TEMPERATURE :The temperature is usually measured with mercury-in-glass type of thermometer in degree Celsius.

HUMIDITY: Relative humidity, also known as simply humidity, is usually measured by the psychrometer . The continuous recording of humidity with time is done by an automatic recording instrument called the hydrograph. Sometimes the hydrograph is also equipped with thermograph to record the variation of both humidity and temperature on the same graph. Then it is called a thermo hydrograph.

RADIATION

The shortwave radiation, both direct and diffused, reaching the earth's surface is measured by an instrument called the pyranometer .

PRECIPITATION AND EVAPOURATION : Precipitation is the moisture in any form that reaches the earth surface from the atmosphere. It is the process by which the water from land and water bodies escapes into atmosphere.

CATCHMENT CHARACTERISTICS OF TAWANG:

- The proposed HE project site is located on the perennial river of tawang chhu.
- The Tawang chhu river is fed by glaciers of the great Himalayan range and flows towards Bhutan by crossing international boundary after cruising for about 45km in India.
- Total catchment area up to the proposed barrage site is 45 sq km.
- The permanent snow line is considered at around 5000m.
- Rain fed area : 2053 sq km.
- Snow fed area : 884 sq km.
- Tawang Chhu emerges after the confluence of Mago Chhu and Nyukcharong Chhu rivers at an elevation of 2240m.

GENERAL CLIMATIC CONDITIONS:

- Monthly meteorological data is available at Bomdila and Tawang station in and around the basin.
- On the basis of available data at two stations:

1.Mean maximum temperature – 31.1 Degree Celsius.
2.Mean minimum temperature - -4.4 Degree Celsius
3. Humidity – 48% to 100%
4. Average annual rainfall – 2053mm
(on the basis of three rain gauge station Murga bridge, Yusum , Tawang)

Water Flow Pattern

Water flow in Tawang Chhu follows seasonal rhythm like other Himalayan rivers where lean period is from December to February and peak discharge occurs in July –August. Tawang river is snow fed river where monsoonal rains enhance the melting of snow and lead to high discharge in monsoon season. The annual average of water discharge was recorded to 42.5 cumec at China Bridge which increased to 89.0 cumec at barrage site in Tawang Chhu. For Mago Chhu annual average of water discharge was 40.8 cumec. For the period of

17 years (1992-2008) maximum water discharge of 299.6 cumec was recorded in the month of August.

SNOW COVER

A large portion of the catchment of Tawang basin receives precipitation in the form of snow. The estimation of snowline is important to delineate the areas contributing snowmelt from the area, which accounts for rainfall storm runoff during monsoon. In Himalaya snow accumulates during the winter season between Octobers to March while the snow melts generally between May to July. In the interior ranges above 5000 m., snow accumulation exceeds snowmelt and the excess snow contributes to the permanent glaciers. The snow that accumulates in winter and melts away in next few days is considered as temporary snow, which shall not contribute much to the runoff. In absence of meteorological data and any further information, the permanent snowline in Tawang basin has been assumed as 5000 m as same has been adopted in the adjoining Mangde Chhu catchment, where it has been adopted on the basis of lapse rate and zero degree isotherms computation. Thus, a snowline elevation of 5000 m has been adopted for computing the rain fed and snow fed areas in the catchment.

RAINFALL

The rainfall of the project area is controlled by two geo climatic factors viz. its location in high altitude and seasons of the Himalayan belt. Average annual rainfall calculated from three rain gauge stations at Murga Bridge, Yusum and Tawang is 2053 mm. The following Table 3 provides rainfall data at three stations viz. Murga Bridge, Tawang and Yusum. At Murga Bridge, data is available from Jan 2000 to May 2005, at Tawang data is available from March 2004 to 2008 and at Yusum, data is available from March 2003 to May 2005 . At Yusum the overall rainfall intensity is high during monsoon (May to September)
(average 402.35 mm). The rainfall starts from June and ceases in November. At Yusum, maximum rainfall (569 mm) is received in the month of July, at Tawang maximum (386 mm) is received in the month of July, while at Murga Bridge maximum (273.2 mm) is received in August. The rainfall pattern during monsoon at Yusum area shows bimodal, viz. high rainfall is recorded in June (379.3 mm) and July (569 mm), while this pattern is not observed in case of Murga Bridge station. The annual precipitation received at Yusum (2665 mm) is higher than at Murga Bridge (1710 mm) and Tawang (1784 mm). During the winter maximum rainfall is received in the month of February at all the three sites Murga Bridge, Tawang and Yusum. Considerable portion of the basin receives precipitation in the form of snow. Snow accumulates during October to March, and it melts during April to July.

RAINFALL - RUNOFF ANALYSIS

The average run-off coefficient for Murga bridge (nearby barrage site) for the period of 2000-2007 is computed to be 0.60, which measures 0.63 after deducing the snowmelt contribution. The rainfall – run off correlation has also been carried out by taking into account the snowmelt contribution, which is deduced from the total observed run off to compute the contribution of the rainfed catchment .WIND SPEED / WIND DIRECTION

The topography of the catchment area is characterized by rugged and mountainous topography, thus climatic factors vary from valleys to up hills. No detailed data on the wind Aspects are available, however, India Meteorological Department provided wind data for winter season (www.ind.gov.in/section/nhac/disforecast/tawang.htm). Average wind speed was

measured to 6.0 km/h while average wind direction was 228 deg.

SEDIMENTATION

. The suspended sediment data observed by CWC is available at Yusum site from August 2002 to April 2007 and at Murga bridge site from May 2001 to May 2007. NHPC has also established its sediment observation site at Jang near Tawang HE Project Stage-I barrage axis. Annual sediment load at Yusum and Murga Bridge sites has been computed on the basis of available data observed by CWC. Theaverage annual suspended sediment load at Murga bridge site works out to be 0.121 Mtons / year, of which coarse, medium and fine constitute 0.004 MTons (3.2%), 0.02 MTons (14.6%) and 0.10 MTons (82.2%), respectively. Assuming 20% of the sediment load is transported as bed load, the total annual sediment load (suspended + bed load) comes out to be 0.14 Mtons / year. On the basis of this sediment load, the silt rate of Tawang H.E. Project Stage-I comes out to be 49.3 tons/sq. km/year. Using the estimated bed profile and cross sections, the revised storage capacity has been calculated to be 69.8 Ham at FRL and 41.9 Ham at MDDL. The ultimate live capacity between FRL and MDDL works out to 27.90 Ham, considering no reservoir flushing.

CONCLUSION

In this above case we have study the meteorological parameters of the Tawang catchment, such as characteristics of catchment ,climatic conditions, rainfall, runoff ,etc.We have studied that the hydrometeorology is the study of the transfer of water and energy between land and water body surfaces and the lower atmosphere.

REFERENCE

1. Environmental Impact Assessment – Hydrometeorology, Tawang H.E Project Stage-1