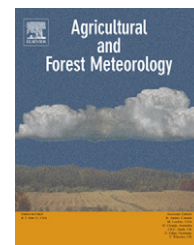


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Temporal characteristics of pan evaporation trends under the humid conditions of northeast India

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ABSTRACT

This paper analyses the temporal characteristics of pan evaporation (E_{pan}) trends by using Mann–Kendall non parametric test and a parametric test under the humid conditions for eleven sites of northeast India. Decreasing E_{pan} trends have been observed mainly in pre monsoon and monsoon seasons. On examining total rainfall's relationship with E_{pan} , it is observed that almost all sites do not show a concurrent decrease in E_{pan} and an increase in rainfall. Trend analysis of other meteorological parameters indicates decreases in sunshine duration and wind speed in different seasons over most of the sites and an increase in relative humidity over four sites in winter and pre monsoon seasons. The likely causative meteorological parameters of E_{pan} changes by stepwise regression are also identified. The findings of this study suggest that mainly two parameters i.e. sunshine duration followed by wind speed strongly influenced E_{pan} changes at various sites from different regions in different seasons.

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1. Introduction

Evaporation is an important climatic parameter that affects both plant and animal life. Pan evaporation (E_{pan}) changes are of great significance for water resource planning, irrigation control and agricultural production. It is routinely measured by various agencies in India because of its widespread applications. Several researchers (Sarkar and Thapliyal, 1988; Thapliyal and Kulshrestha, 1991; Kothiyari and Singh, 1996; Arora et al., 2005) have carried out studies on changes in rainfall and temperature around India. In contrast a little attention has been given to changes in evaporation barring one study of Chattopadhyay and Hulme (1997).

Trends in E_{pan} have been analyzed for many regions resulting in differing conclusions. Increasing trends in E_{pan} have been

reported in Israel's central coastal plain (Cohen et al., 2002) and in northeast Brazil (da Silva, 2004). However, decreasing trends were reported by Peterson et al. (1995) and Golubev et al. (2001) in the United States and former Soviet Union, by Roderick and Farquhar (2004) in Australia, by Jun et al. (2004) in Japan, by Liu et al. (2004) in China, by Tebakari et al. (2005) in Thailand and by Burn and Hesch (2007) in Canadian Prairies.

Northeast India has great economic dependence on crops like paddy, tea and forest products. Any major changes in the water budget may have major consequences on hydrologic processes. The studies relating to the evaporation over northeast India are very important for irrigation planning. Thus, this study was carried out with the objective of studying the temporal variation of E_{pan} on annual and seasonal basis over the humid climate of northeast India.

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Fig. 1 – Location of the sites selected for the trend analysis.

2. Methods and material

2.1. Details of study area

In this study, eleven sites (Agartala, Chuapara, Gungaram, Margherita, Nagrifarm, Nagrakata, Pasighat, Silcoorie, Thakurbari, Tocklai and Uiam) were selected (Fig. 1). Endowed with a sub tropical type of climate, the northeast region forms a distinct climatic zone within the Indian landmass with a remarkable variability of weather and climate. It is one of the heaviest rainfall regions in the world. The mean temperature

over this region varies from 5 to 30 °C and the mean relative humidity remains in the range of 70 to 85% during most of the period. The data of eleven sites were collected from various governmental agencies like Tocklai Tea Research Station (Jorhat), India Meteorological Department (Pune) and Indian Council of Agricultural Research Complex for North Eastern Hill Region (Barapani, Meghalaya). The eleven sites have different record length of various meteorological parameters. The details of the eleven sites selected for this study and the duration of meteorological data used in the trend analysis are given in Table 1.

Table 1 – Details of sites.

S No.	Name of site	Region of site	Lat. (N)	Long. (E)	Alt., m amsl	Duration of data
1	Agartala	West Tripura, Tripura	23°53'	91°15'	16	1953–2000
2	Chuapara	East Dooars, N. Bengal	26°44'	89°28'	190.8	1980–2000
3	Gungaram	Terai, N. Bengal	26°38'	88°48'	123.6	1977–2000
4	Margherita	Upper Assam	27°16'	95°32'	183	1979–2000
5	Nagrifarm	Darjeeling, N. Bengal	26°55'	88°12'	1158.2	1965–1988
6	Nagrakata	Dooars, N. Bengal	26°54'	88°55'	228.6	1965–2000
7	Pasighat	East Siang, Arunachal Pradesh	28°06'	95°23'	155	1957–1991
8	Silcoorie	Cachar, Assam	24°50'	92°48'	39.6	1965–2000
9	Thakurbari	North Bank, Assam	26°48'	92°42'	92.45	1973–2000
10	Tocklai	Jorhat, Assam	26°47'	94°12'	96.5	1965–2000
11	Uiam	Barapani, Meghalaya	25°34'	91°53'	980	1984–2003

Lat, long, alt, m amsl denote latitude, longitude and altitude, metre above mean sea level, respectively.

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