

Article ID: 1006-8775(2006) 01-0085-02

ANALYSIS OF THE CHARACTERISTICS OF RAINFALL AND LINEAR TREND IN MENGLUN, XISHUANGBANNA, SOUTHWEST CHINA

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Key words: Xishuangbanna; rainfall; rainy days; linear trend**CLC number:** P426.61.4 **Document code:** A

1 INTRODUCTION

As one of the main factors affecting input and use of precipitation by forests, rainfall also makes a difference on partitioning of gross precipitation over the canopy, equilibrium of water amount in river basins and water cycling processes^[1-4]. In view of its poorly-defined four seasons in contrast to well-defined dry and wet spells in addition to its inland location, understanding of precipitation characteristics and tendencies is important for the study on local forestry hydrology. Relevant research has been documented, but few have dealt with multiple time scales at the hourly, daily, monthly and annual intervals. With the 1992 – 2003 automatic record of precipitation in Menglun, Xishuangbanna analyzed, its characteristics and trends are summarized to help in the study on forestry hydrology.

2 BRIEF INTRODUCTION TO THE STUDY

Locating on the northern boundary of the tropics (21°56'N, 101°15'E), Menglun, Xishuangbanna sits about 580 m ASL and is dominated by tropical monsoon climate. Precipitation changes significantly over the year and is relatively dry from November to April and relatively wet from May to October.

The data of rainfall obtained by a routine meteorological observation in a weather station in Menglun, which is in a national nature reserve stretching for dozens of kilometers and surrounded by tropical seasonal rainforests and economic forests, and

gives background values well representing the tropical forest in Xishuangbanna. The data are in the units of year, month, day and hour.

3 DATA AND ANALYSES

The annual characteristics and tendencies of precipitation are analyzed. It is found that the annual mean daytime rain, defined to begin from 8:00 L.T., is slightly less than nighttime rain (starting from 20:00) and both daytime and nighttime rain vary in a “Λ” pattern. The maximum occurs in July. Except for June and July when daytime rain is much more the nighttime one, nighttime rain is more than or comparable to daytime rain. It shows that nighttime rain is abundant in the area and particularly so in the months of the dry season.

By season, the rainfall and rain duration for the dry season appear mostly between early morning and sunrise while for the rainy season rainfall usually takes up a larger percentage in the afternoon though rain occurs over longer duration in the late hours of the night. Their minimum for dry and wet seasons both appears around midday. It can be seen that the characteristics of tropical monsoon climate are quite remarkable in this area.

In the tendency of precipitation change, (1) rainfall, rain days and thundersdays, (2) nighttime and daytime rain, and (3) diurnal precipitation are studied.

4 DISCUSSIONS AND ANALYSES

Received date: 2004-12-20; **revised date:** 2006-02-20

Foundation item: Development Plan for Key National Foundation Research (Project 973 and 2003CB415100); Natural Science Foundation of Yunnan Province (2003C0002Z)

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The Menglun area has a mean annual rainfall of 1555.1 mm from 1992 to 2003 and differs distinctly between the dry and rainy seasons, generally consistent with multi-year mean^[5]. Monthly rainfall shows typical single-peak curves with comparable distribution of daytime and nighttime rain. Annual maximum rainfall appears centrally after midday in June, July and August, a typical feature of tropical monsoon climate. Compared with the Hainan Island, which is on the same latitudes and with dominance of maritime climate with abundant rainfall that varies substantially over the year and prevalence of heavy and unusually heavy precipitation^[6], Xishuangbanna is an inland area and dominated by continental climate with far less rainfall, especially so in terms of the amount of heavy rain.

The study area shows a tendency of rising in rainfall and rain day statistics over the past 12 years while falling in the thunderstorm days. Rainfall is varying more dramatically from year to year with daily rainfall ≥ 50 mm on the increase but mild change in rain rates. The coverage rate of forests has risen substantially since the 1980's^[7], but rapid decrease of tropical rainforest and replacement with large areas of planted trees have affected the local climate^[7]. The planted trees, which are structurally simple, cannot regulate the climate as well as the tropical rainforest which has multiple kinds of trees. It is possible that the unstable local precipitation trends is related with it. In addition, the change of rainfall distribution between seasons may have effect on the local agricultural produce, and increase of rainfall amount from year to year may expose the area to more frequent disasters of floods. Although large-scale water vapor is not taken into account in this study, ENSO does have some effect on the variation of local precipitation on the interdecadal scale^[8].

There have been studies on the variation characteristics of precipitation for different regions^[9-10]. Xishuangbanna, which is one of the main areas with tropical rainforest in China, is of tropical monsoon climate with remarkable seasonal change, which is different from the typical type^[11]. Subject to the geological location in the northern edge of tropics and extreme elevated altitudes above sea level, the local tropical rainforest has the normal structures and communities, but specie, as a transition to tropical forests in South Asia, is different from humid tropical rainforests in the equator^[12]. Compared with other tropical areas, therefore, the local rate of canopy interception is relatively large^[13] and the partitioning of precipitation by canopy is different. More study is

needed of the interaction between precipitation characteristics and partitioning of precipitation by canopy.

Acknowledgements: Our data are by courtesy of the stationary research station for the ecological system of tropical forest in Xishuangbanna, research network for ecological systems in China.

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