

## **The climate at hill-ever-green forest on tropical monsoon region.**

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A field experimental study of energy and water balance in tropical monsoon forest that has clearly dry season has been carried out in the Kog-Ma experimental watershed from February 1997. The Kog-Ma watershed covered by hill evergreen forest situated near Chiangmai and located at an altitude of about 1268-1420m. There are two purposes of this study. First is to evaluate the total evapotranspiration accurately. Second is how the forest tree uses the soil moisture during the no rainfall period of about five months. That is to clarify the relation between the evapotranspiration reduction and an environmental factor empirically.

About four year's continuous observation of micro-meteorological factors above and in the forest canopy for energy balance has been conducted. The measurement items on the 50m tower are, a short wave radiation, a reflection, a downward and an upward long wave radiation, wind speed, air temperature, and humidity, etc.. The soil temperatures and the soil moistures, etc. are measured under the ground. The measurement interval is different with each equipment, but basically the data logged automatically is the mean value each ten minutes. In this research the end in January is assumed to be a start of a year. And because the data until the end isn't obtained, in 2000 it is not complete.

The mean monthly micro-meteorological data was shown in Fig.1. Annual precipitation in 1997 was 1443mm, it was 1285mm in 1998, it was 1880mm in 1999, and it was 1638mm in 2000. The mean annual air temperature is 20.1 . The maximum of mean monthly air temperature appeared in May in 1997, it appeared in April in 1998, it appeared in March in 1999, and in April in 2000. The minimum value appeared in December from 1997 to 1999. In 2000 this value was lowest, and it appeared in December. In rainy season the water vapor pressure is high, 20hPa or more, and contrary the value of the dry season is half of the rainy season. In 1997 and 1998 the period that the water vapor pressure was about 20hPa was from May to October, and it was from April to November in 1999 and 2000. The wet season in 1999 and 2000 is longer than other two years. The mean monthly wind speed is almost 2m/s. The wind

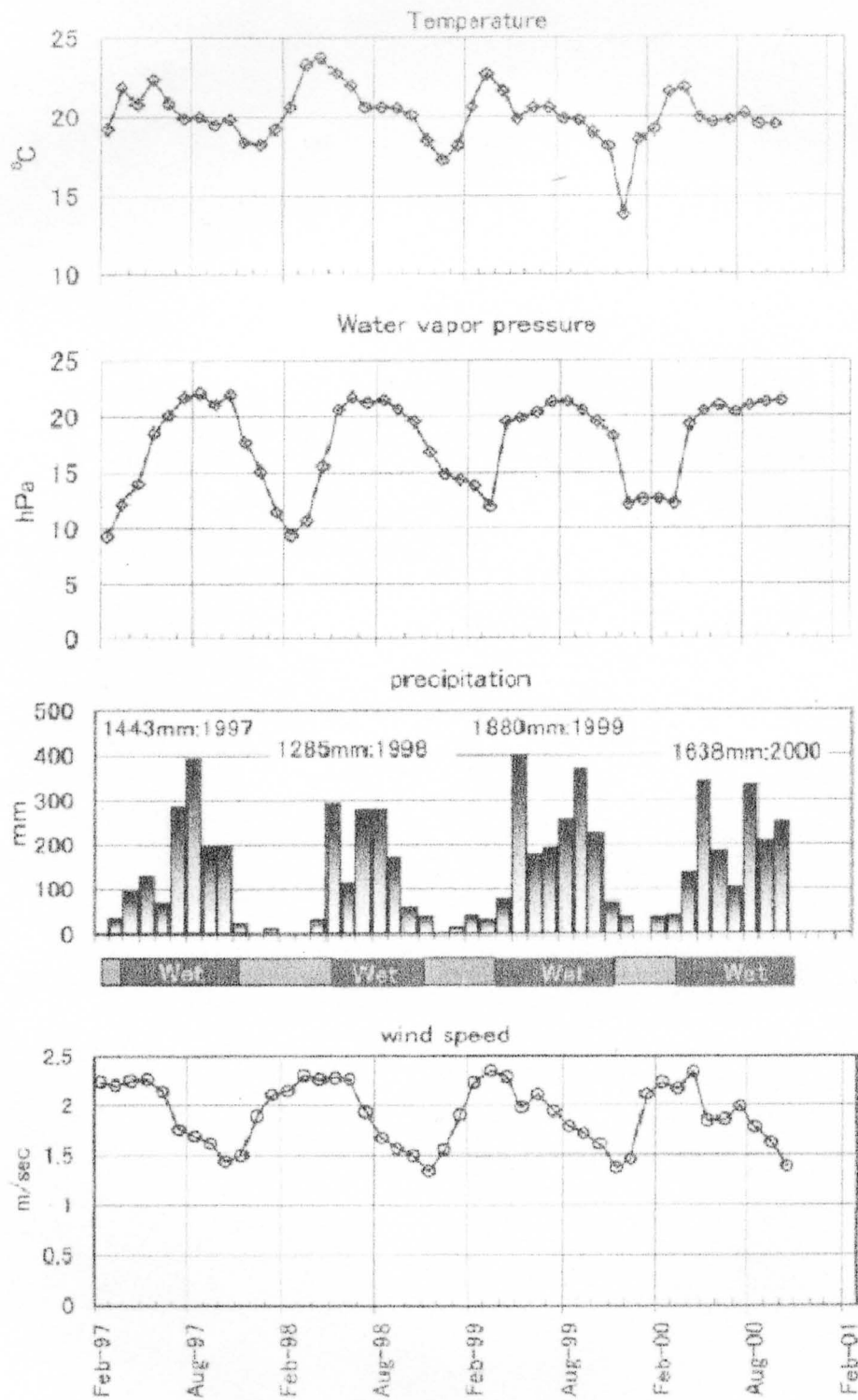
speed between February and April is comparatively strong, and in November is lowest.

The radiation factors were shown in Fig 2. The amount of the total short wave radiation in 1997 was 5.71GJ/m<sup>2</sup>/yr, it was 6.04 in 1998, and it was 5.14 in 1999. The total in 1999 was lowest among of this three year. Mean monthly albedo was between from 1.1 to 1.6. Average of the albedo was 1.3. The short-wave radiation and the net radiation were presented in Fig 3. These variation curves were different, and the seasonal change was different year by year. The sum of the net radiation in 1997 that calculated water height was 1269mm/yr. This value in 1998 was 1473mm/yr and in 1999 was 1252mm/yr.

Fig.4 shows the seasonal change of calculated *LAI*. The seasonal change of *LAI* is high in the rainy season, and low in the dry season. The range of the seasonal change of *LAI* is between 2.5 and 6. From June to October, the *LAI* keeps high value and in February it become minimum. The seasonal curve of *LAI* increases from March to May, and decreases from November to February. The curve shows a similar trend, though *LAI* for 1998 in rainy season is lower than other rainy season. We think that this is related to a rainfall in 1998 little.

**Table 1 Total amount of precipitation, short wave radiation, and net radiation.**

	1997	1998	1999	2000
<b>Precipitation</b>	1443 mm/yr	1285 mm/yr	1880 mm/yr	1638 mm
<b>Short wave radiation</b>	5.71 GJ/m <sup>2</sup> /yr	6.04 GJ/m <sup>2</sup> /yr	5.14 GJ/m <sup>2</sup> /yr	4.07GJ/m <sup>2</sup>
<b>Net radiation</b>	1269 mm/yr	1473 mm/yr	1252 mm/yr	1065 mm



Mean monthly meteorological data at Kog-Ma, Chiangma

Fig 1 Meteorological factors; temperature, water vapor pressure, precipitation, and wind speed at Kog-Ma, Chaingmai

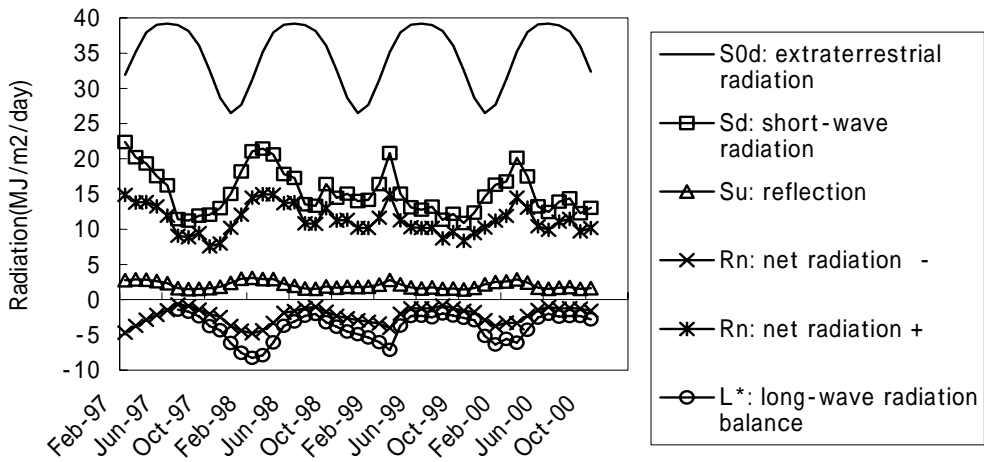


Fig 2 radiation at Kog-Ma, Chaingmai

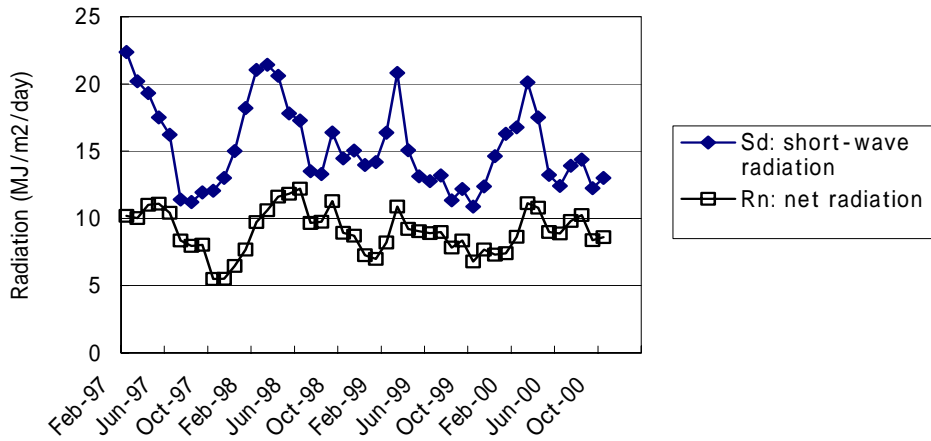


Fig 3 Short wave radiation and net radiation at Kog-Ma , Chaingmai

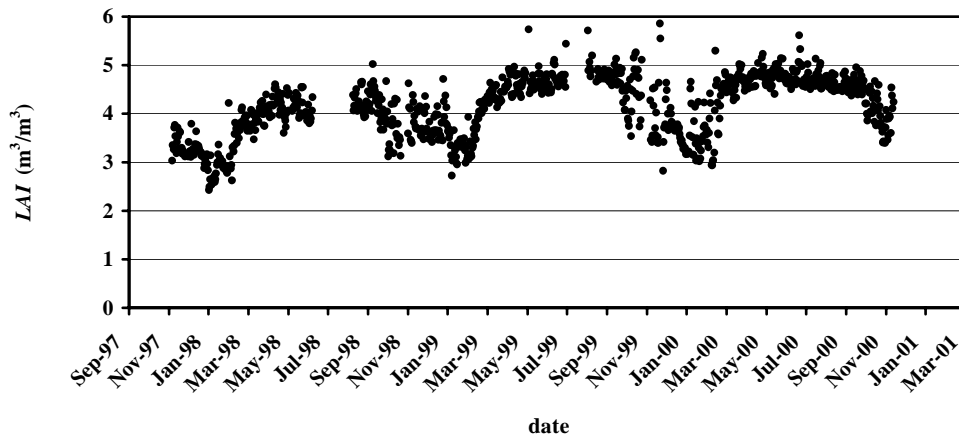


Fig 4 Seasonal change of calculated LAI.