

METEOROLOGICAL OBSERVATION AT TOKYO METROPOLITAN UNIVERSITY IN 2001

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Abstract An observational tower with 15 m high standing on Tokyo Metropolitan University has been providing basic meteorological data since March 1997. Data of air temperature, relative humidity, wind speed and direction, and solar radiation from January to December 2001 are reported in this paper.

Key words: meteorological data, observational tower, climatic characteristics

1. Introduction

An observational tower (15 m high) stands on the east part of Tokyo Metropolitan University (TMU) campus (35°37'N, 129°23'E, and 130 m ASL). Meteorological parameters have been measured on this tower and recorded at intervals of 1-hour since March 1997. In this paper, we report the meteorological data in 2001 and describe climatic characteristics in TMU in the year.

2. Data

On the observational tower, the following items are measured: air temperature (height: 1.5 m and 9.5 m above the ground surface), relative humidity (1.5 m and 9.5 m), wind speed and direction (14.5 m), and global solar radiation (14.0 m). Some soil properties (temperature, heat flux, and water content) are also measured at a depth of 30 cm below the ground surface beside the tower. Details on the instruments were described in Suzuki *et al.* (1999). We report monthly and daily statistics of air temperature, relative humidity, wind speed and direction, and solar radiation from January to December 2001 in this paper. The data are missing from February 4 to March 22 in 2001.

We also use the weather station data collected by Japan Meteorological Agency (JMA) to compare with the TMU data. The weather station, Otemachi, is located at 35°41'N, 139°46'E and 5.3 m ASL. The data was published as the monthly reports of 2001 (JMA 2001).

3. Climate of Tokyo Metropolitan University in 2001

Monthly statistics of the meteorological data were summarized in Table 1 and seasonal

Table 1 Monthly values of meteorological data at TMU in 2001

	Air temperature (°C)						Relative Humidity (%)		Wind Speed (m/s)	
	Monthly Mean	Mean Daily Max.	Mean Daily Min.	Mean Daily Range	Extremes		Monthly Mean	Extremes Lowest	Monthly Mean	Monthly Max.
					Highest	Lowest				
Jan	2.8	8.2	-1.8	10.0	14.7	-6.4	66.4	18.1	2.4	11.1
Feb*	-	-	-	-	-	-	-	-	-	-
Mar*	-	-	-	-	-	-	-	-	-	-
Apr	14.4	21.0	8.5	12.6	26.3	-1.0	80.9	16.5	2.7	14.0
May	18.2	22.7	14.3	8.4	29.0	6.9	85.4	28.8	2.2	10.7
Jun	21.8	25.8	18.7	7.1	32.4	13.3	89.2	36.6	1.7	8.6
Jul	27.3	32.8	23.5	9.2	38.8	20.0	81.0	44.1	2.2	12.2
Aug	25.3	28.9	22.7	6.2	36.5	18.7	89.4	48.9	1.7	11.0
Sep	21.5	25.1	18.5	6.6	30.3	9.4	88.9	38.8	2.0	11.7
Oct	16.5	20.6	12.9	7.8	26.9	8.1	85.9	38.6	1.9	9.2
Nov	10.4	15.4	5.9	9.5	20.4	1.8	81.3	40.2	1.8	8.1
Dec	5.8	11.3	1.3	10.0	15.5	-3.0	70.0	23.8	1.9	9.3

*: The data are missing from Feb. 4 to Mar. 22.

Table 1 (continued)

	Most Prevailing Wind Direction	Freq. (%)	Daily Total Solar Radiation (MJ/m ² /d)		Number of Day (Days)			
			Monthly Mean	Monthly Max.	Daily Min. Daily Max. Air Temp.			All**
					< 0 °C	>= 25°C	>= 30°C	
Jan	N	17.5	9.8	14.5	25	0	0	31
Feb*	-	-	-	-	2	0	0	3
Mar*	-	-	-	-	0	0	0	9
Apr	N	12.1	18.6	25.7	1	0	0	30
May	SSW	12.9	16.7	28.4	0	0	0	31
Jun	N	13.2	13.6	27.7	0	0	5	30
Jul	S	16.8	21.7	28.0	0	9	25	31
Aug	N	13.4	12.2	23.6	0	1	13	31
Sep	N	14.9	11.3	21.5	0	0	1	30
Oct	NNW	17.5	-	-	0	0	0	31
Nov	NNW	13.2	9.6	14.6	0	0	0	30
Dec	WNW	12.2	9.3	12.4	12	0	0	31

** : "All" means the day that obtained 24 hourly data in a day.

variation was plotted in Fig. 1.

Monthly mean air temperature (MMAT) varied between 2.8 °C in January and 27.3 °C in July, hence annual range of monthly mean temperature was 24.5 °C. It is noteworthy that maximum MMAT occurred in July in 2001, although it has usually occurred in August. This extremely high temperature in July was observed in whole Kanto area, and MMAT at Otemachi (central Tokyo) in July was approximately 3 °C higher than normal (JMA 2001). MMAT at TMU in July was 1.1 °C higher than that in 2000 (Nakano and Mikami 2001), and the number of day that the daily maximum air temperature was higher than 30 °C was 25 days. On the other hand, it was cooler than normal in August, and the number of day that the daily maximum air temperature was higher than 30 °C was about half of that in July (13 days).

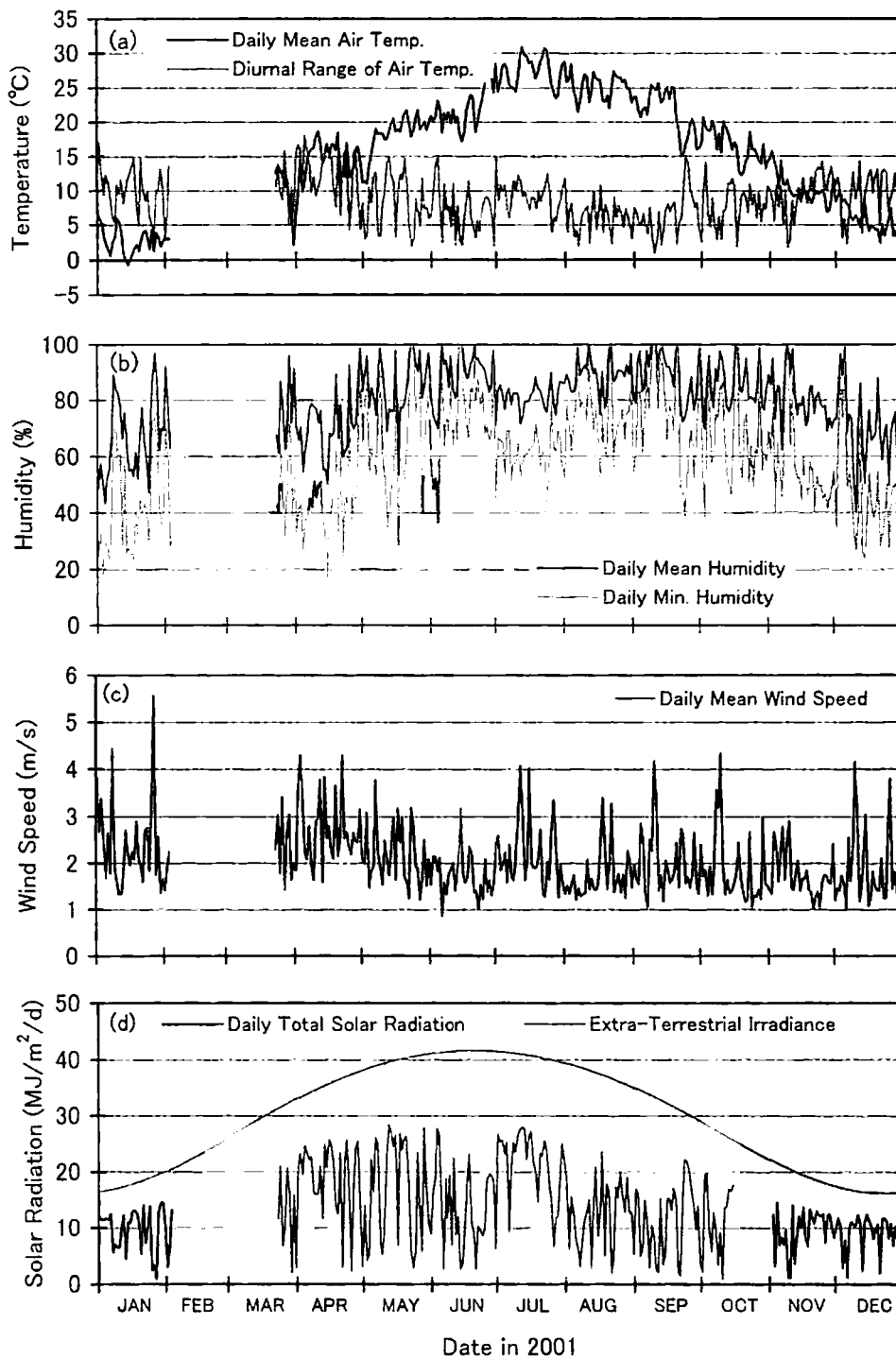


Fig.1 Daily values of meteorological data at TMU in 2001. (a) Temperatures. (b) relative humidity, (c) wind speed, and (d) solar radiation.

Table 2 Monthly values of meteorological data at Otemachi in central Tokyo in 2001

	Air temperature (°C)						Relative Humidity (%)		Wind Speed (m/s)	
	Monthly Mean	Mean Daily Max.	Mean Daily Min.	Mean Daily Range	Extremes		Monthly Mean	Monthly Extremes Lowest	Monthly Mean	Monthly Max.
					Highest	Lowest				
Jan	4.9	8.6	1.7	6.9	13.8	-2.4	47	12	3.6	11.5
Feb	6.6	10.7	2.8	7.9	19.7	0.0	48	16	3.3	10.7
Mar	9.8	14.4	5.7	8.7	22.8	1.1	51	12	3.6	12.4
Apr	15.7	20.4	11.3	9.1	26.2	1.0	56	11	3.6	11.3
May	19.5	23.0	16.4	6.6	27.5	8.7	69	15	3.2	9.8
Jun	23.1	26.6	20.3	6.3	33.7	16.1	70	21	2.8	8.9
Jul	28.5	33.0	25.2	7.8	38.1	21.9	63	27	3.2	9.6
Aug	26.4	30.0	23.6	6.4	36.3	19.6	71	23	2.9	8.7
Sep	23.2	26.4	20.4	6.0	32.6	13.2	68	25	3.2	17.7
Oct	18.7	22.5	15.5	7.0	28.5	11.3	62	23	3.2	9.0
Nov	13.1	16.7	9.5	7.2	21.8	6.0	55	22	2.8	9.4
Dec	8.4	12.0	4.9	7.1	16.7	0.9	46	10	3.1	10.5

Monthly mean relative humidity was higher than 80% from April to November and it was 70% or less in January and December. Relative humidity sometimes reached 100% at night or on rainy days in every season. Daily minimum humidity was less than 20% in January and April.

Monthly mean wind speed was approximately 2 m/s throughout the year, while the value in April was relatively high (2.7 m/s). Normally the most frequent wind direction was northerly in winter and southerly in summer, reflecting the monsoon. However, north wind prevails in June and August in 2001.

Monthly mean of daily total solar radiation ranged from 9.3 MJ/m²/d in December to 21.7 MJ/m²/d in July. The solar radiation in 2001 was characterized by a contrast between high value in July and low value (12.2 MJ/m²/d) in August. Ratio of solar radiation at the ground level to that at the top of the atmosphere was 0.53 in July; this value is similar to that in wintertime (0.55 in January and 0.56 in December). On the contrary, the ratio in August was 0.33, which is same as that in the Bai-u season (0.33 in June).

4. Comparison with Central Tokyo

Meteorological observation at Otemachi in central Tokyo is made by JMA. We used the JMA data in 2001 to investigate the differences of meteorological factors between the central Tokyo and the suburbs (TMU).

As shown in Tables 1 and 2, MMATs were lower at TMU than at Otemachi throughout the year. The difference was largest (2.7°C) in November and smallest (1.1°C) in August. The difference of mean daily maximum temperature between TMU and Otemachi was largest in summer and smallest in winter. On the contrary, the difference of mean daily minimum temperature was largest in winter and smallest in summer. As a result, the difference of diurnal temperature range in winter between TMU and Otemachi became largest of all seasons.

The number of days with 'winter day' (the daily minimum air temperature is below 0 °C)

Table 2 (continued)

	Most Prevailing Wind Direction	Daily Total Solar Rad. (MJ/m ² /d)	Number of Day (Days)			
		Monthly Mean	Daily Min. Daily Min. Daily Max.			All*
			Air Temp. < 0 °C	Air Temp. ≥ 25°C	Air Temp. ≥ 30°C	
Jan	NNW	9.0	4	0	0	31
Feb	NNW	10.9	0	0	0	28
Mar	NNW	13.4	0	0	0	31
Apr	SW	17.9	0	0	0	30
May	SW	15.9	0	0	0	31
Jun	SW	14.0	0	1	6	30
Jul	SW	21.5	0	15	27	31
Aug	ENE	11.6	0	7	16	31
Sep	ENE	10.9	0	2	3	30
Oct	NNW	10.6	0	0	0	31
Nov	NNW	8.7	0	0	0	30
Dec	NNW	8.5	0	0	0	31

*: "All" means the day that obtained 24 hourly data in a day.

at TMU was much larger than that at Otemachi. On the other hand, the numbers of days with 'tropical night day' (the daily minimum air temperature is 25 °C or above) and 'mid-summer day' (the daily maximum air temperature is 30 °C or above) at TMU were quite less than those at Otemachi.

The values of monthly mean relative humidity at TMU were 16% (May) to 26% (November) higher than those at Otemachi. Wind speed was approximately 1 m/s lower at TMU than that at Otemachi. Daily total solar radiation at both sites showed similar values throughout the year.

Phenomena such as rise of daily minimum air temperature, especially in winter, and fall of relative humidity are regarded as climatic changes with urbanization. Our data revealed the urbanization in central Tokyo by comparison between the suburbs (TMU) and the central Tokyo (Otemachi).

The original data (hourly values), daily mean and monthly mean values were all stored as digital information. To get and use these data, please contact the corresponding author by e-mail (nakanot@comp.metro-u.ac.jp).

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