Cloud Climatology Using GMS Data

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Cloud is an important component for global and local climate. Its distribution and variation express an aspect of atmospheric conditions. Also, cloud directly affects local climate through radiative process. The authors are constructing climatological dataset of cloud cover and radiation budget now. Since the diurnal variation is one of noticeable properties of cloud, it is valuable to show regional and seasonal characters of the variation. Final purpose of the present study is to estimate hourly radiative flux at the surface from geostationary meteorological satellite images.

The data that used in the present study is observed by GMS-5. This GMS-5 image data is processed by Prof. Kikuchi at Kochi University and is described as 0.25 degree * 0.25 degree grid which covers from 70 E 70 N to 70 S 150 W . GMS-5 has three infrared channels, but only ir1 (10.5 - 11.5 micro meters) is used. because this work will be extended to past data by GMS-3 and GMS-4 . The data is analysed hourly from January 1 to December 31, 1996. The cloud determination procedure is developed on the bases of the method that was used in ISCCP (Rossow and Garder, 1993).

The monthly mean map of cloud cover of low, middle and high layer and clear sky radiation temperature is described. In Fig. 1, total cloud cover map shows that contrast between summer and winter is remarkable on the Asian continent, that clouds due to cold serge is dominant near Japan islands on winter, that cloud stays on Sichuan basin through the year, and that cloud band extends from the Asian Continent to Japan Islands in July. In Fig. 2, clear sky radiation temperature map shows large seasonal variations on the continents and small variations on the ocean. It means this map can be used as a kind of index of surface temperature.

The diurnal variation of these elements on particular regions is described in Fig. 3, Fig. 4, Fig. 5 and Fig. 6. The diurnal variations at Hua-Bei plane in China is most interesting. The variation of cloud cover is very stable in July (Fig. 4). For clear sky radiation temperature, it shows different variations between summer and other seasons (Fig. 6). In July it looks stable like that in the ocean, and in other seasons it looks like that in semi-arid land. It is derived that much precipitation in July and vegetation opposed to change the surface temperature quickly.

Rossow, W.B. and L.C. Garder, 1993: Cloud detection using satellite measurements of infrared and visible radiances for ISCCP. J. Climate, 6, 2341-2369.

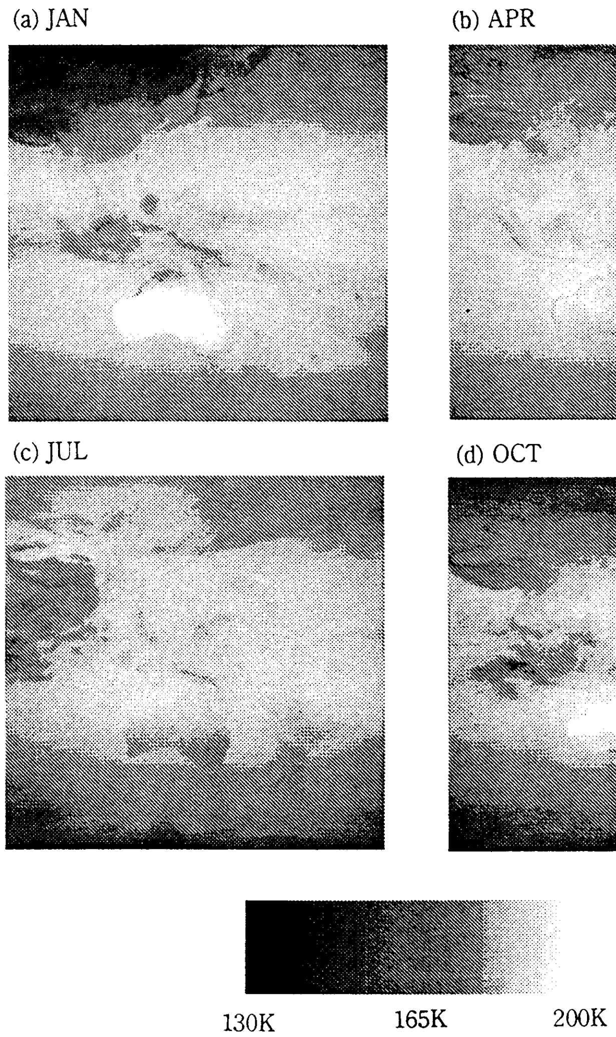

Fig. 2. Clear sky radiation temperature. Each figure shows monthly averaged clear sky radiation temperature at each season. Figures in January and April cover 60N80E - 60S160W, and figures in July and October cover 70N70E - 70S150W.

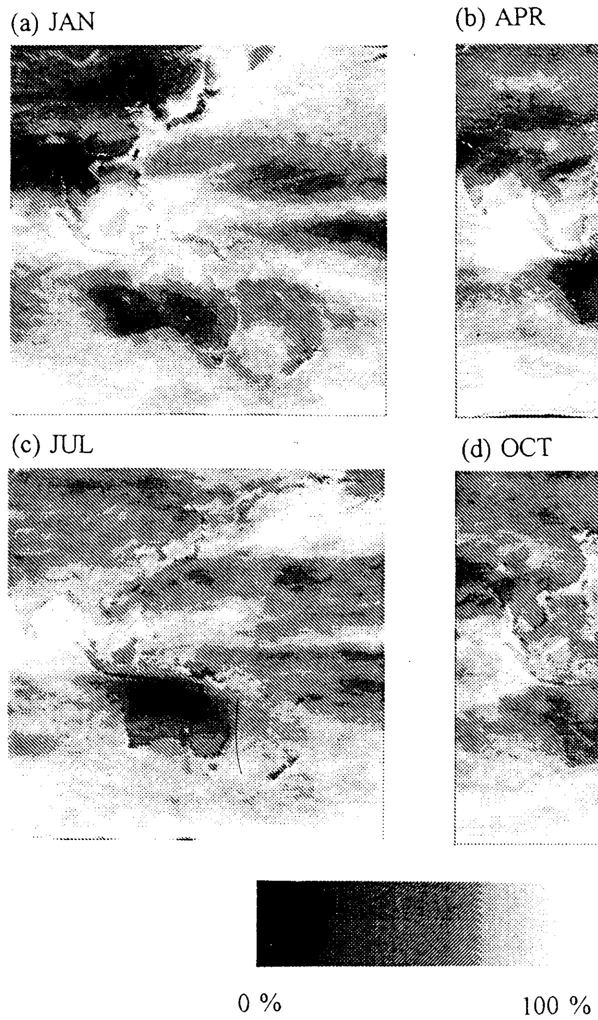

Fig. 1. Total cloud cover. Each figure shows monthly averaged total cloud cover at each season. Figures in January and April cover 60N80E - 60S160W, and figures in July and October cover 70N70E - 70S150W.

Diurnal change of cloud cover at Mongol

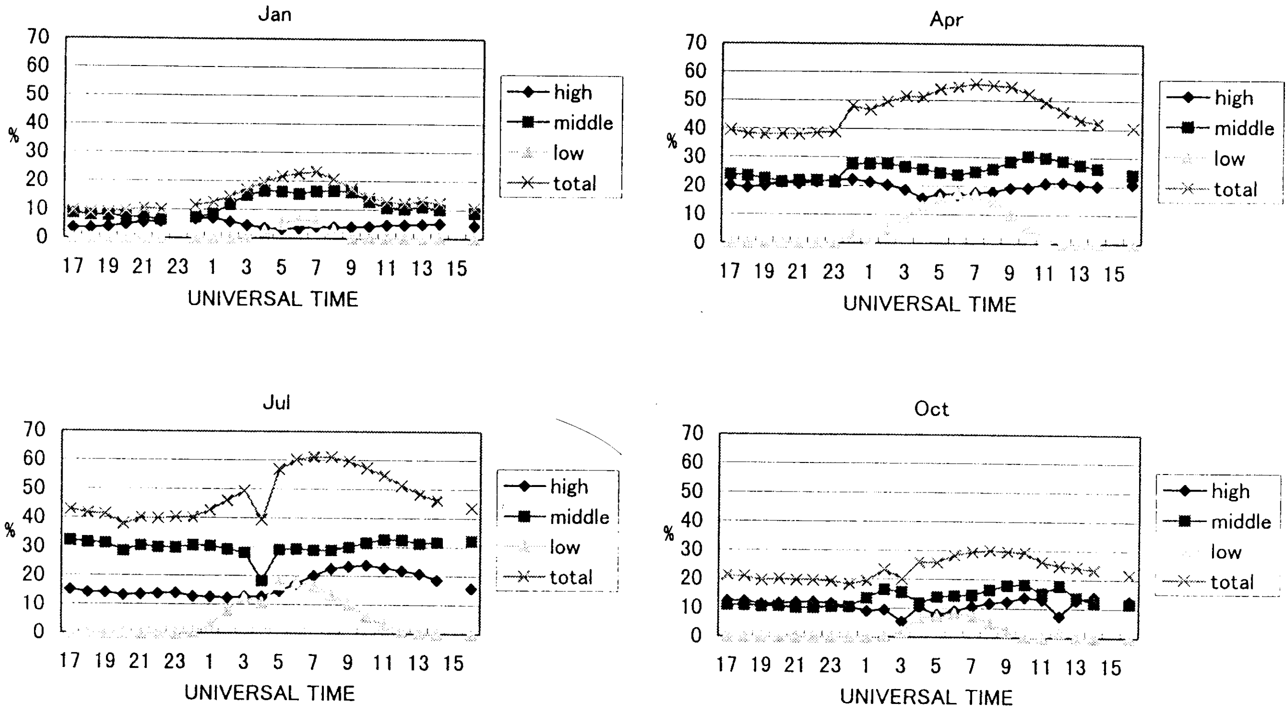

Fig. 3. Diurnal change of cloud cover at Mongol (38N100E - 43N110E). This is the case of semi-arid surface. Each figure shows monthly averaged diurnal change at each season. Time series starts from 0 hour at local time in the horizontal axis.

Diurnal change of cloud cover at Hua-Bei Plane

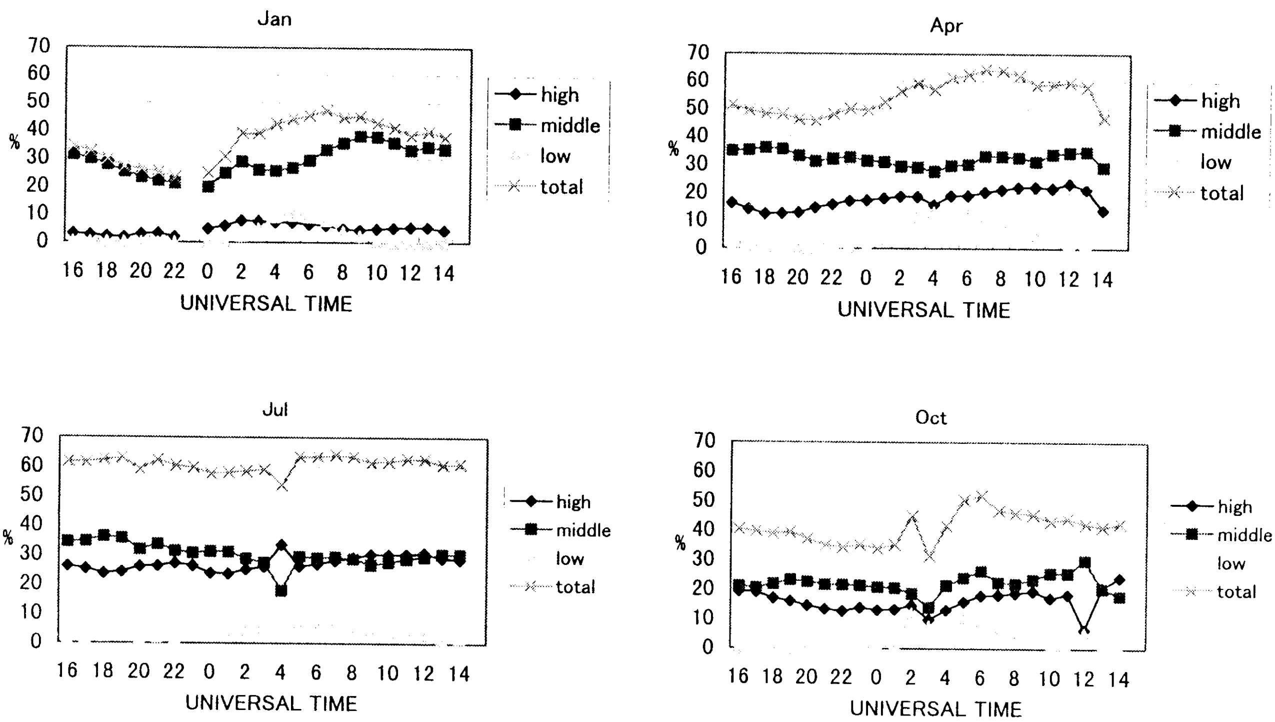

Fig. 4. Diurnal change of cloud cover at Hua-Bei plane (32N114E - 37N117E). This is the case of vegetated surface. Each figure shows monthly averaged diurnal change at each season. Time series starts from 0 hour at local time in the horizontal axis.

Diurnal change of cloud cover at Australian Desert

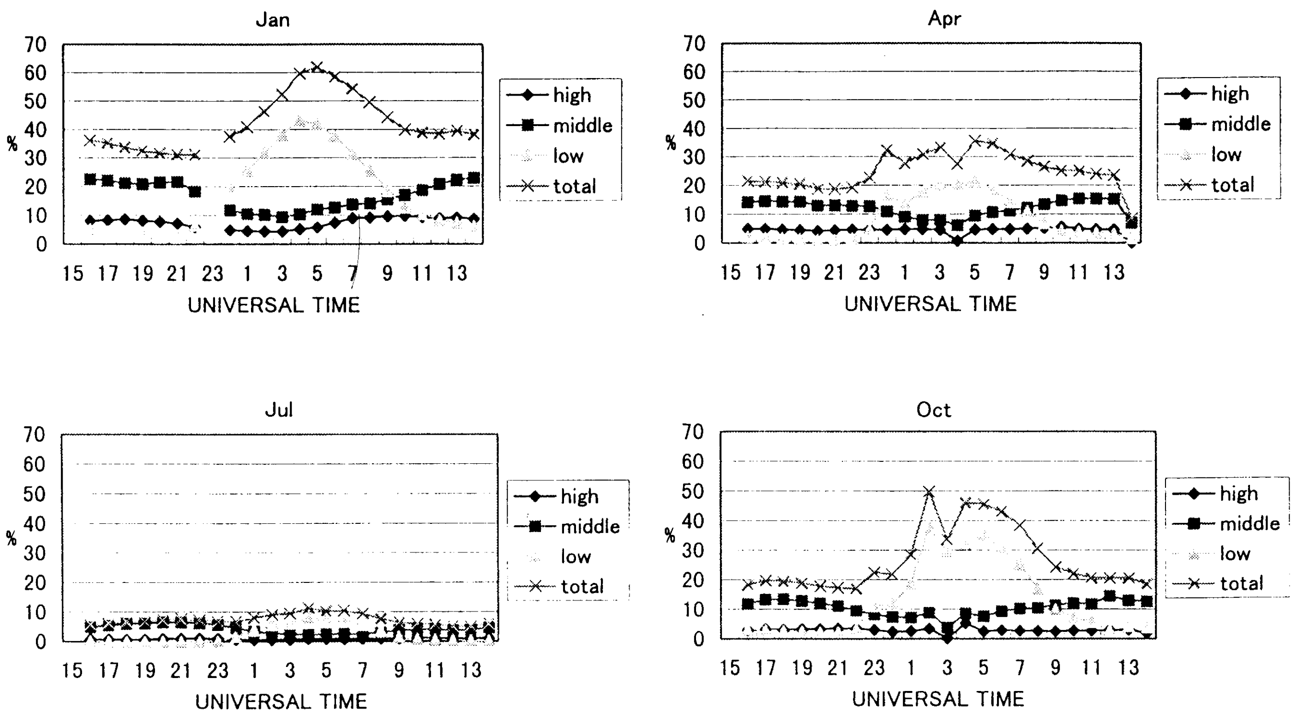

Fig. 5. Diurnal change of cloud cover at Australian Desert (18S130E - 23S140E). This is the case of arid surface. Each figure shows monthly averaged diurnal change at each season. Time series starts from 0 hour at local time in the horizontal axis.

Diurnal change of clear radiation temperature

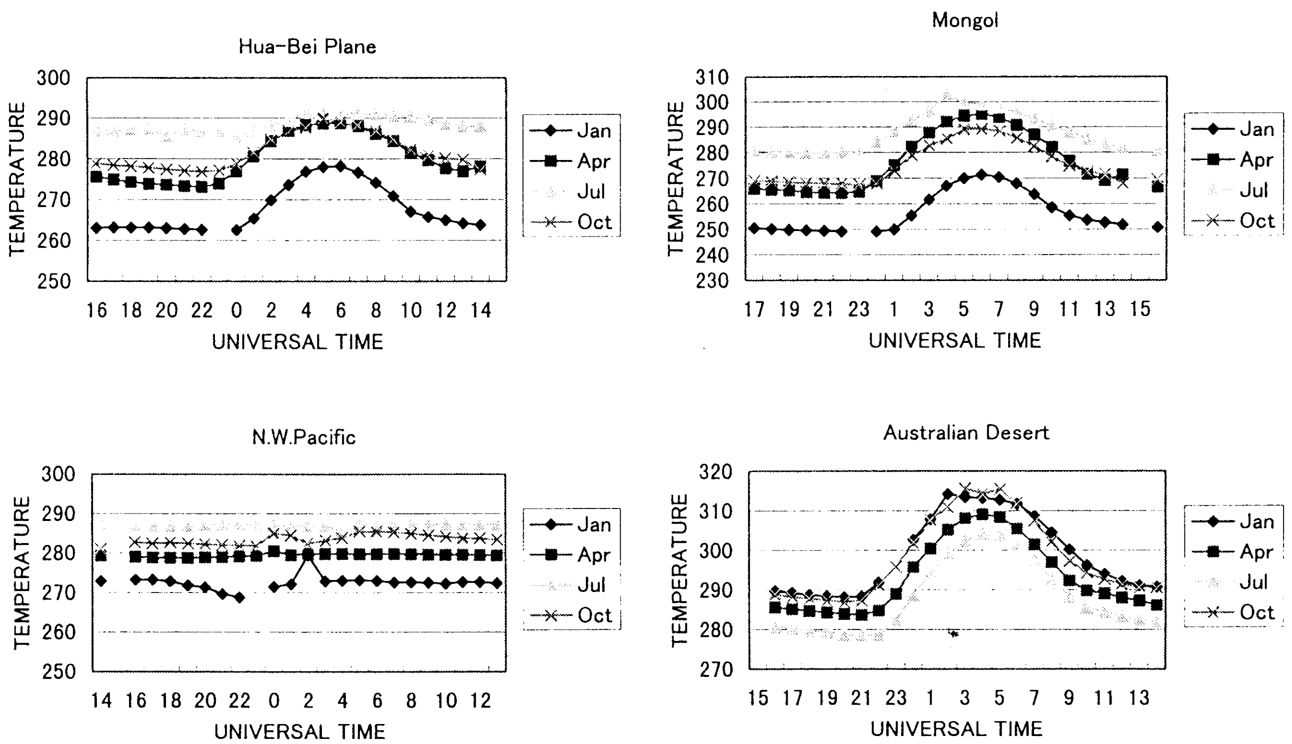

Fig. 6. Diurnal change of clear sky radiation temperature. Each figure shows monthly averaged diurnal change at each region. Time series starts from 0 hour at local time in the horizontal axis.