Soil moisture characteristics in sand and gobi deserts in the Taklimakan Desert, China

Dept. of Environmental systems, Wakayama University	Member	○Masahide Ishizuka
Meteorological Research Institute, JMA		Masao Mikami
Xinjiang Institute of Ecology and Geography, CAS		FanJiang Zeng
Dept. of Environmental systems, Wakayama University	Member	Hiroyuki Ii
Xinjiang Institute of Ecology and Geography, CAS		Ximing Zhang

1.Introduction

The number of 'Kosa' event is getting increased in the recent three years (2000-2002) than the former years (1967-1999) since the Japan Meteorological Agency started observations in the countrywide (JMA, 2002) [1]. Serious Kosa sometimes bring large influence and damage to our social life and human activities. Therefore, to clarify the reasons, 1) why the frequency of Kosa was increased?, 2) what kind of ground surface conditions effect the sand/dust outbreak?, is the urgent subject for the global environment.

ADEC (Aeolian Dust impact Experiment on Climate) project is the Sino-Japanese cooperative research to focus on the mechanism of dust outbreak, the long transport of dust particles and the GCM forecasting of Kosa (Mikami, 2002) [2]. Among many subjects, the land surface condition is important parameterization as well as the description of regional and global climate change. One of our research aspects is to understand the relation between soil moisture and dust outbreak. In this study, we carried out *in situ* soil moisture measurement at Qira in the Taklimakan Desert in 2002.

2.Location

Taklimakan Desert is the second biggest desert in China (270,000 km^2, see Fig.1). Qira is located in the southern branch of the Taklimakan Desert. Sand and gobi deserts in which the different soil types are widely distributed in the Taklimakan Desert. Gobi desert is entirely flat plain, on the other hand, sand desert is hilly like sand dune.

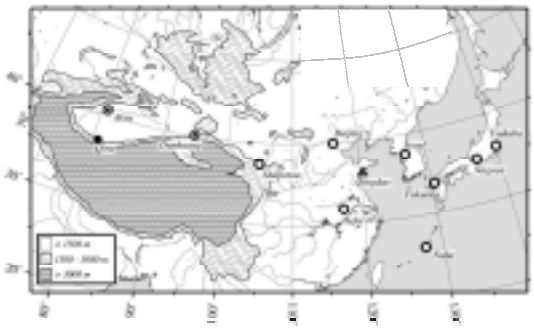

Figure 1: Map of China and Eastern Asia

3.Method

Soil samples were taken in both deserts at three times in 2002; 1) from the end of March to 15th April, 2) 13th July and 3) 7th-10th November. Sampling locations for the measuring of soil moisture are in the square areas of 20 m x 20 m. Soil moisture was measured using a direct gravimetric technique. Meteorological data such as wind speed, air temperature, radiation and so on were measured using the Automatic Weather measurement System (AWS). Topography measure was carried out using surveying equipment (Leica Geosystems AG, TPS400).

4.Results

4.1 Heterogeneity

Spatial variability of soil moisture (V.W.C.) was larger in gobi desert: the standard deviations at the depth of 5 cm were 3.50 % in gobi desert and 0.02 % in sand desert in April (see Fig.2), 0.76 and 5.29 in July, and 0.14 and 3.43 in November. It is assumed that the difference of heterogeneity of soil moisture between both deserts is caused by the difference of soil structure. Especially, the smaller grains are dominant in gobi desert.

4.2 Vertical distribution

Surface soil above 5cm depth was dry and soil moisture did not changed under the 5 cm depth in

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Address: Wakayama University, 930 Sakaedani, Wakayama, 640-8510, Japan Tel/FAX: +81-73-457-8367

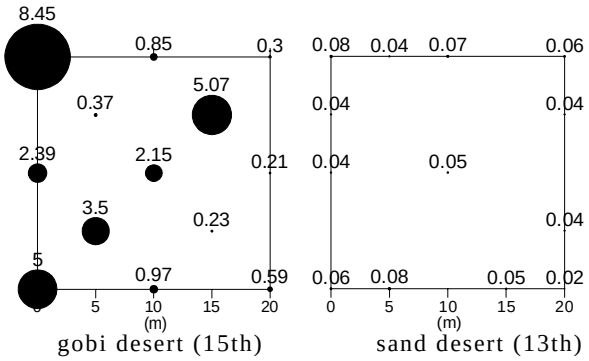

Figure 2: Horizontal distributions of soil moisture (V.M.C. (%)) at the 5 cm depth in Qira in April 2002.

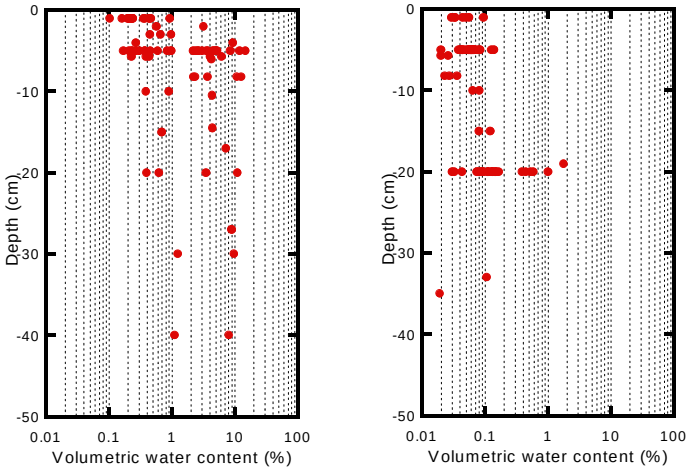

Figure 3: Vertical distribution of soil moisture in July 2002.

gobi desert (See Fig.3). On the other hand, the maximum value appeared at the 20 cm depth in sand desert. The difference of soil properties makes soil moisture different in the vertical direction between gobi and sand deserts.

4.3 Sand dune topography and soil moisture

Sand desert is not flat and the ground height is changing day by day due to sand particles movement by the wind. Figure 4 illustrates soil moisture distribution in sand desert. Soil moisture is larger in lower ground and/or in a slope with a northern exposure. Radiation exposure and gravity flow effect the soil moisture in sand desert. Therefore, the topography is important to the soil moisture distribution in sand desert.

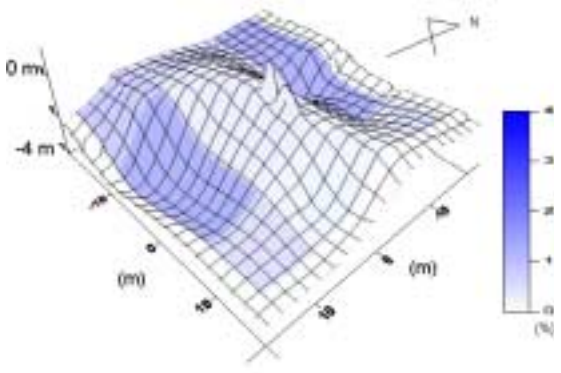

Figure 4: Topography of sand dune in sand desert

4.4 Seasonal variation

The monthly mean volumetric water contents are shown in Fig.5. Surface soil moistures were less than 0.05% in sand desert and 0.34% in gobi desert in April. Land surface was very dry in April 2002. This situation is correspond to increase of occurrence frequency of dust storm in spring in the Taklimakan Desert (Yoshino, 2002)[3]. Moreover, soil moistures at the depth of 20 cm in sand desert and at the surface in gobi desert increased from April to November due to the rainfall in summer and autumn. The soil moisture was wet at the 5 cm depth in sand desert due to a rainfall in July.

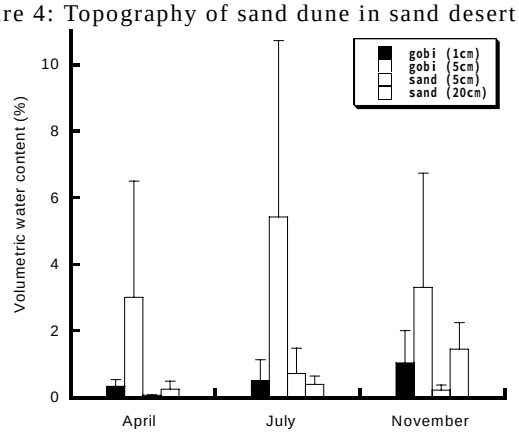

Figure 5: Monthly mean spatial averaged soil moisture in gobi desert and sand desert in April, July and November 2002. The upward vertical error bar means the standard deviation of the data.

5. Conclusion

It was clarified that the soil moisture in gobi desert was larger than that in sand desert. This means the difference of soil property effects soil moisture distribution. This knowledge would provide important information for the dust outbreak mechanism and the estimation of dust supply from the ground to the atmosphere.

【References】 1) Japan Meteorological Agency: (http://www.jma.go.jp/JMA_HP/jma/press/0204/15a/kosa.pdf), 2002.4.15 (in Japanese). 2) Mikami, M. and others: *Journal of arid land studies*, Vol.11, No.4, pp.211-222, 2002. 3) Yoshino, M. (2002): *Journal of arid land studies*, Vol.11, No.4, pp.253-258.