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The Relationship between Outbreak of Asian Dust and Ground Condition

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In East Asia, Dust is called yellow sand, and spring in particular has much outbreak. Not only from a scientific viewpoint but also from a standpoint of environmental problems, it is considered as an important problem to discuss the generation factor. It is thought that although dust is a natural phenomenon, the human activities are related to the outbreak.

According to the observed total days of dust in Japan, which has been made public by the Japan Meteorological Agency, the observation days are greatly different depending on the year. The number of dust events observed in Japan increased in 2000, and continued to 2002, following sharp drop in 2003. There must be some causes in such a rapid change. It is thought that the factor includes both an atmospheric side and the ground level side. In this study, we will focus on the state of the ground level, aim to clarify the change in the ground condition, which corresponds to the changes in the dust observation days. So, we discussed the relationship between outbreak of dust and the ground condition, with monitoring the state of ground level by satellite data and analyzing the changes in meteorological condition.

As satellite data, we used SPOT/VEGETATION 1-km spatial resolution data, which can be downloaded free of charge from the following URL <http://free.vgt.vito.be/>. Each data file is composed 10-day maximum-value composite (MVC) NDVI bands. The sensor has 4 spectral bands: blue, red, near-infrared (NIR) and mid-infrared (MIR). We can extract the information on the snowfall and vegetation from these bands data. The red and NIR bands are used to characterize vegetation with normalized difference vegetation index $NDVI = (NIR - R) / (NIR + R)$. The foliation of vegetation made the period of a map each year by expediently using $NDVI = 0.1$ as a threshold, and the red and MIR bands are used to characterize snow with normalized difference snow index $NDSI = (MIR - R) / (MIR + R)$. A value of 0.2 was used as a threshold based on Kondoh and Suzuki (2005) for the identification of the snowfall region and non-snowfall region.

In the semiarid area in east Asia, the period of bare land is able to be calculated to make a map by taking the difference of thaw and foliation in each year. There seems to be a good correlation between the two when the length of the bare land is compared with the dust observation total days each year. So, we select the meteorological observation station in Inner Mongolia of China, to do the same. As the results, when the length of bare land was long, the frequency of dust observation was high.

As a statistic of the yellow sand outbreak using SYNOP data, in the year of the longer bare land duration, the thaw was earlier, and the average temperature of spring was higher. Therefore, it is thought that is related between the earlier thaw and the higher temperature of the snow melting period. On the other hand, the foliation in the year of earlier thaw is later. In East Asia spring is dry season when precipitation is a little. In the semiarid area, the growth of herbs depends on the moisture condition (Kondoh et al., 2005). Therefore, in the year of earlier thaw, it is possible that dryness controls the germination and growth of the herbs vegetation.

As a result of having added more detailed examination, it became clear that an earth surface characteristic to be concerned with yellow sand outbreak every area was different, that, in addition, inter-annual variations was big. Therefore, adding the examination of the topography condition and the consideration of ecology zone, the reexamination result of the yellow sand outbreak condition will be reported from a viewpoint of time and space.

Keywords: Asian dust, outbreak, remote sensing, ground conditions, vegetation, snow