

Observations of sensible heat flux using a Large Aperture Scintillometer (LAS) over the Mongolian grassland

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Introduction

In northeastern Asia, a climatic shift from humid to arid can be found in a relatively narrow zone, and Mongolia places in semi-arid area. As a result of the transitional climate, overgrazing, and global warming, it is concerned about desertification. But the cause or mechanism of desertification is not found clearly. Therefore quantitative analyses about water or heat circle are needed on this area. This study aims to make clear about the spatial distribution of sensible heat flux over the grassland in Kherlen river basin, where it seems that overgrazing is in progress.

The eddy correlation method broadly is used to measure surface fluxes of heat and water. It is often noted that as the eddy correlation method applied to a point measurement has a limited area of representativeness, that is not large enough in a certain application. Recently, a remarkable instrument, scintillometer, which can measure path-averaged fluxes, has become widely used. Scintillimeters have the advantage of being able to measure spatial-averaged fluxes on a straight line as same size as the observed area by controlling the path from the transmitter to the receiver. Most studies in past measured on short paths, 200m or so. Recently a Large Aperture Scintillometer (LAS) was developed, which can adjust the path from 500 to 5000m. This new-type scintillometer, LAS, was applied to measure sensible heat flux at a large scale in the Mongolian grassland.

Observation

Observations were made over a flat grassland field near Kherlenbayan Ulaan village in the Kherlen river basin in northeastern Mongolia during July to October in 2003. By the observations, during July 16th to August 6th, August 16th to 25th, and September 27th to October 6th, we obtained measurements for 13days including 3days from 453m path, 5days from 1505m, 5days from 3000m.

Result and discussion

Comparing the data from scintillometer with that from eddy correlation method measured at near-by area, sensible heat fluxes of the scintillometer(H_{scin}) were about 1.5 times as much as that of Eddy correlation system(H_{sat}). The ratio H_{scin}/H_{sat} and H_{scin}/R_n , where R_n is the net radiation, tend to become smaller as the path length become longer. It can be assumed that it was caused by the real heat flux's distribution, or this scintillometer had a defect that causes overestimation with shorter paths. The sensible heat fluxes by the scintillometer had little relationship with wind direction.

We also observed for 4days with the path of 4570m, and it brought error data which showed that the path length was supposed to have a limitation about 3000m under the condition.