Classification and Regression Tree Analysis of the Relationship between the Yellow Dust Concentration and TOA Reflectance observed with GOSAT CAI Sensor

*Tatsu-hiro Ogawa[1], Hiroto Shimazaki[1]

1.National Institute of Technology, Kisarazu College

Yellow dust, which is also known as yellow sand or Asian dust, is a seasonal meteorological phenomenon commonly observed in East Asia during the months of spring. The dust originates from the deserts of southern Mongolia and northern China and is then carried eastward by prevailing winds, passing over China, North and South Korea, and Japan, as well as parts of the Russian Far East. Although the major components of the dust are sand and materials from the earth’s crust, the possible adverse health effects of high concentration of the dust has been becoming a public concern for the regions in East Asia. To address the problem of transboundary air pollution, collecting and visualizing the data of dust concentrations is of importance as a first step. Satellite remote sensing has contributed to the near real-time monitoring of air pollutants over a broad spatial scale. The Thermal And Near-infrared Sensor for carbon Observation (TANSO) - Cloud and Aerosol Imager (CAI) sensor on board the Greenhouse gases Observing SATellite (GOSAT), which was designed to estimate the types and optical thickness of aerosols, is expected to have capability to detect the Yellow dust concentrations. However, its capability has not yet been confirmed well. This study statistically explored the relationship between the Yellow dust and the top-of-atmosphere (TOA) reflectance of wavelengths from near-ultraviolet (0.380 mm) to near-infrared (1.60 mm) observed by GOSAT CAI sensor, aiming to obtain fundamental information to generate an imagery product that visually enhances the Yellow dust concentrations. First we transformed the radiance in the CAI L1B product to the TOA reflectance, which was considered in this study as a response variable. Second we collected a suite of predictor variables which were expected to have some impact on the variation of TOA reflectance. The predictor variables concerning atmosphere conditions include: (1) the total amount of the Yellow dust above the ground, which was calculated from the estimates of the Chemical weather FORecasting System (CFORS); and (2) the clear-sky confidence level retrieved from the CAI L2 product. The predictor variables regarding land- and sea-surface conditions include: (1) the land-surface reflectance; and (2) sea-surface reflectance data. Both of them were retrieved from the CAI L3 product. Third the response and predictor variables were linked together by match-up processing in terms of time and location. Finally we employed a recursive partitioning approach known as Classification and Regression Tree (CART), where the resulting model could be represented graphically as a decision tree. Preliminary results of the CART analysis with the match-up data showed the relationship between the predictor and response variables to be different for each band. Findings from the resultant decision trees would provide us with a clue of how to deal with each band to generate an imagery product that visually enhances the Yellow dust concentrations over a broad spatial scale.

Keywords: Classification and Regression Tree, Yellow dust, GOSAT CAI

