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Atmospheric Correction of Sentinel-2 Satellite Images for Improvement of Vegetation Indices

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Extended Abstract

As global warming becomes serious with the increase of greenhouse gases, interest in the impact of climate change on the global environment and human life is increasing. In addition, local abnormal climate phenomena frequently appear according to climate change, and changes in the ecosystem are starting to be detected. Indicators that reflect climate change are diverse, such as agriculture, plant and animal distribution, biological seasons and ecology, and health. Here, the impact on agricultural production in particular seems to be very important [1]. Satellite products such as NDVI (Normalized Difference Vegetation Index), LAI (Leaf Area Index), FPAR (Fraction of Photosynthetically Active Radiation), and PET (Potential EvapoTranspiration) that reflect the growth and vitality of vegetation exist. Through this, changes in agricultural land or forests can be identified. At this time, strict atmospheric correction for high-resolution satellite data is essential in order to use accurate product.

The radiation energy measured in the satellite sensor has errors due to the atmospheric effects such as scattering, absorption, reflection of atmospheric factors in the process of being reflected to the sun-surface-sensor. Since the influence of atmosphere in remote sensing causes uncertainty in surface observation, accurate atmospheric correction is an essential pre-processing step for surface characteristic analysis and environmental monitoring [2]. When simulating RTM (Radiative Transfer Model), atmospheric composition information about satellite observation time is required for calculating optical properties by gas or particles. At this time, unlike gas molecules, the distribution of aerosol and water vapor is very variable in time and space, so the process of removing the influence of aerosol and water vapor from the atmospheric correction of optical images is the most important [3]. In particular, it is estimated that the transfer of aerosol from continent is significant in Korea, and the process of removing its effects (atmospheric correction) is very important due to the recent increase in high concentration of fine dust.

However, in most high-resolution satellite image atmospheric correction studies, the frequency of use of high-resolution AOD (Aerosol Optical Depth) data was low, and analysis of AOD data suitable for the study area was not conducted. Although the AOD product calculated through various sensors and algorithms can be used, the satellite product value differs mainly due to differences in the research period and area, calculation method, and quality of the original AOD data [4]. In particular, since the Korean Peninsula region is greatly affected by various aerosols (yellow dust or pollutants) from the continent, it is thought that the difference in observation values will appear distinctly depending on the satellites and sensors even for the same time and space. To compensate for this, MODIS MAIAC (Multiangle Implementation of Atmospheric Correction) AOD product, which is known to be the most suitable for Korea, was used [5].

In addition, there is no case of direct comparison of errors according to AOD data (point or raster) under the same conditions in atmospheric correction studies of high-resolution satellite images. Therefore, the accuracy of atmospheric correction processing for Sentinel-2 satellite images is compared under high-accuracy point AOD and raster AOD conditions. The RTM used in this study is 6SV, which is known to have higher accuracy than other RTMs such as MODTRAN and SHARM [6]. To analyze the difference in accuracy according to the version of 6SV, the same atmospheric correction will be performed for 6SV1.1 and 6SV2.1. The correction results for each case will be analyzed with reflectance for each band and NDVI values.

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