Summary of the Final Report of Research Results

1) Title of the proposed research

Standardization of NDVI products produced from the TANSO-CAI sensor and applications of them to land observations

2) Principal Investigator (PI) and Co-Investigators (Co-Is)

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4) Summary of the Final Report of Research Results

Main results were obtained in the following two issues.

① Derivation of inter-calibration formulas between CAI-NDVI, MODIS-NDVI, and AVHRR-NDVI with radiative transfer simulation

We derived inter-calibration formulas between CAI-NDVI, MODIS-NDVI, and AVHRR-NDVI with radiative transfer simulation by considering the effects of SRF (Spectral Response Function) differences. Both of the fitness for regression analyses for deriving inter-calibration formulas were quite good with high determination coefficient greater than 0.99. The standard errors of NDVI between CAI and AVHRR, CAI and MODIS are 0.015 and 0.031 respectively. AVHRR-NDVI was slightly worse compared to CAI-NDVI because AVHRR NIR channel include strong water absorption band. When the derived formulas were applied to real satellite data to evaluate effectiveness of the formulas, it was found that there remains some discrepancies between CAI-NDVI and MODIS-NDVI after correction of SRF differences. These remaining discrepancies would be due to STSG (Sun-Target-Sensor-Geometry) conditions.

② Effects of atmosphere and sun-target-sensor geometry on CAI-measured reflectance and NDVI

Effects of atmosphere and sun-target-sensor geometry on CAI-measured reflectance and NDVI were assessed using a coupled 1-D atmosphere and 3-D canopy radiative transfer model. Surface landscapes were simulated by a 3-D forest canopy model. The following atmospheric conditions were assumed: (1) atmospheric profiles: mid-latitude summer and winter, (2) aerosol types: continental clean, average, and polluted, and (3) aerosol optical thickness at 550 nm: 0.1, 03, and 0.5. Reflectances at top of atmosphere (RTOA) and top of canopy (RTOC) were calculated at the viewing angles from 0 to ±47°. The results showed that RTOA was larger than RTOC in band-2 due to scattering, while RTOA was smaller than RTOC in band-3 due to absorption. As a result the NDVI at TOA was smaller than that at TOC both in winter and summer. The variation magnitudes of NDVI at TOA across the CAI swath were 0.09 in summer and 0.26 in winter relative to the value at nadir. Among three atmospheric parameters, the effects of aerosol optical thickness were the largest and should be properly corrected for standardization of CAI-measured reflectance and NDVI.

5) List of publications relating to the proposed research

M. Tamura, K. Oyosi, M. Maki, Standardization of NDVI Products Produced from the TANSO-CAI Sensor and Applications of Them to Land Observations, 1st Meeting of GOSAT RA Principal Investigators, 2008, Tokyo.

M. Tamura and K. Oyoshi, Standardization of NDVI products produced from the TANSO-CAI sensor and their applications to land observations, Abstract Collection of the Second Meeting of GOSAT RA Principal Investigators, 13, 2010, Kyoto.

M. Tamura, Effects of atmosphere and sun-target-sensor geometry on CAI-measured reflectance and NDVI, The 4th GOSAT RA PI meeting, 2012, Pasadena.