Session: C10 Poster: M29A

Improvement of land surface emissivity retrieval using diurnal variation of passive microwave

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Microwave observations at low frequencies exhibit sensitivity to surface and subsurface properties as expressed by surface emissivity. In addition, land emissivity estimates at higher frequencies near the window regions can be extrapolated to microwave sounding frequencies to provide the critical boundary condition in numerical weather prediction (NWP) models. In this study, we developed a global land emissivity product using AMSR-E passive microwave data after removing the effect of the atmosphere. Also, the impact of the difference in penetration depths between passive microwave and thermal temperatures on the retrieval of land emissivity was investigated. There is a difference in phase time and amplitude between physical temperature from IR and MW brightness temperature, especially in arid and semi-arid regions where microwave penetrates deeper than thermal Infrared observations. This causes an inconsistency between day and night (ascending / descending) retrieved emissivities; especially at AMSR-E observations as its overpass time is close to daily minima and maxima (1:30 am/pm). First, the diurnal variation of passive microwave brightness temperature using similar frequencies of different satellites was analyzed. Principal Component Analysis (PCA) is used to explore the spatial variation of passive microwave diurnal cycle. Then, effective temperature at each channel and month of the year is developed using a combination of physical heat transfer and statistical method by constructing the diurnal variation of the passive microwave. This method shows that discrepancies between day and night retrieved emissivities were significantly reduced after applying the revised effective temperature.