Characterization of Different Land Classes Using Microwave Land Emissivity over the Indian Subcontinent for Microwave Remote Sensing of Atmosphere over Land

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Despite the ability of satellite borne microwave radiometers to measure the atmospheric parameters, liquid water and the microphysical properties of clouds, they have serious limitations over the land owing its large and spatially heterogeneous emissivity compared to the relatively low and homogenous oceans. This calls for determination of the spatial maps of land-surface emissivity with accuracies better than ~2%. In this study, the characterization of microwave emissivity of different land surface classes over the Indian region is carried out with the forthcoming Indo-French microwave satellite program Megha-Tropiques in focus. The land emissivity is retrieved using satellite microwave radiometer data from Special Sensor Microwave/Imager (SSM/I) and TRMM Microwave Imager (TMI) at 10, 19, 22, 37 and 85 GHz. After identifying the clear sky daily data, the microwave radiative transfer computation, is applied to the respective daily atmospheric profile for deducing the upwelling and downwelling atmospheric radiations. This, along with the skin temperature data, is used to retrieve land emission from satellites data. The emissivity maps of India for three months representing winter (January) and post-monsoon (September-October) seasons of 2008 at V and H polarizations of all the channels (except for 22 GHz) are generated. Though the land emissivity values in V-polarization vary between 0.5 and ~1, some land surface classes such as the desert region, marshy land, fresh snow covered region and evergreen forest region, *etc*, show distinct emissivity characteristics. On this basis few typical classes having uniform physical properties over sufficient area are identified. Usually the Indian desert region is dry and shows low emissivity (~0.88 in Hpolarisation) and high polarization difference, V-H (~0.1). Densely vegetated zones of tropical rain forests exhibit high emissivity values (~0.95) and low polarization difference (<0.01). The mangrove forest region and marshy areas exhibit very low emissivities (~0.8) with very high polarization difference (~0.2). Thus the effectiveness of multi-frequency and dual polarization emissivity in delineating distinct land surface classes is demonstrated especially extending the utility of the microwave satellite payloads dedicated for measuring atmospheric parameters over the land.

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