Ground mobile observation system for measuring multisurface microwave emissivity

He Wenying[1,2] Chen Hongbin[1,2] Xuan Yuejian[1] Lijun[1]
Nan Weidong[1, 3] Duan Minzheng[1,2]

1.Key Laboratory of Middle Atmosphere and Global Environment Observation, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
2.University of Chinese Academy of Sciences, Beijing 100049, China
3 Xianghe Observatory of Whole Atmosphere, Institute of Atmospheric Physics, Chinese Academy of Sciences, Xianghe 065400, China

Abstract

Large microwave surface emissivities with a highly heterogeneous distribution and the relatively small hydrometeor signal over land make it challenging to use satellite microwave data to retrieve precipitation and to be assimilated into numerical models. To better understand the microwave emissivity over land surfaces, we designed and established a ground observation system for the in situ observation of microwave emissivities over several typical surfaces. The major components of the system include a dual-frequency polarized ground microwave radiometer, a mobile observation platform, and auxiliary sensors to measure the surface temperature and soil temperature and moisture; moreover, observation fields are designed comprising five different land surfaces.

Based on the observed data from the mobile system, we preliminarily investigated the variations in the surface microwave emissivity over different land surfaces. The results show that the horizontally polarized emissivity is more sensitive to land surface variability than is the vertically polarized emissivity: the former decreases to 0.75 over cement and increases to 0.90 over sand and bare soil and up to 0.97 over grass. The corresponding emissivity polarization difference is obvious over water (>0.3) and

cement (approximately 0.25) but reduces to 0.1 over sand and 0.05 over bare soil and almost 0.01 or close to zero over grass; this trend is similar to that of the Tb polarization difference. At different elevation angles, the horizontally/vertically polarized emissivities over land surfaces obviously increase/slightly decrease with increasing elevation angles but exhibit the opposite trend over water.

Key words: Ground mobile observation system, microwave radiometer, microwave surface emissivity, surface temperature, land surface