Meteorological sub-divisional scale rainfall monitoring using Kalpana-1 VHRR measurements

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Abstract

Geostationary satellites provide measurements over a wider geographical area with high temporal sampling, while microwave measurements are more accurate but sparse. For continuous monitoring of the Indian monsoon, geostationary platform would be ideal. In this study, INSAT (Indian National Satellite) Multi-spectral Rainfall Algorithm (IMSRA) has been used for the estimation of rainfall from Kalpana-1 very high resolution radiometer (VHRR) measurements. IMSRA benefits from the relative advantages of infrared and microwave sensors and is operational at the India Meteorological Department (IMD). In this paper, rainfall is estimated over India at meteorological sub-divisional scale during the south-west monsoon season of 2009 using Kalpana-1 satellite measurements. This is the first experimental attempt to generate meteorological sub-divisional scale rainfall maps using Kalpana-1 satellite measurements. The rainfall maps for the south-west monsoon season over the Indian land region are successfully utilised as a space input for the drought monitoring of the year 2009. The results have been compared with the IMD gauge-based accumulated rainfall maps at monthly and seasonal time scales. The qualitative comparison suggests that rainfall maps generated using the present methodology is in good agreement with the IMD rainfall maps. The quantitative comparison of the sub-divisional monthly accumulated rainfall shows a correlation of 0.77 and standard error of 71 mm over the non -orographic regions, whereas a correlation of 0.60 and standard error of 117 mm is observed over the orographic regions. The present study shows that Kalpana-1 satellite-based rainfall estimates (IMSRA technique) can act as a complementary tool for the monsoon monitoring over the Indian meteorological sub-divisions and can be used for various meteorological and hydrological applications.