Operational 500 m surface soil moisture product using EOS-04 C-band SAR over Indian agricultural croplands

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Surface soil moisture (SSM) at high spatial resolution is an essential land parameter for agricultural applications like irrigation mapping, scheduling, crop water stress assessment, etc. However, available satellite derived soil moisture products are inadequate for meeting the requirements of agricultural applications due to coarse scale soil moisture (~10–40 km). In this article, we developed an operational framework for first of its kind sub-km (~500 m) operational soil moisture product over India by utilizing ISRO's EOS-04 C-band synthetic aperture radar (SAR) data based on active-passive approach. The potential of EOS-04 SAR for sub-km scale is demonstrated and tested over major cropland sites covering highly heterogeneous and dynamic crop conditions in different agro-climatic regions over India which shows a good agreement with *in situ* datasets with mean ubRMSE, ranging from 0.051 to 0.078 m^3/m^3.

Keywords: Active-passive, agricultural applications, EOS-04 SAR, soil moisture active and passive, surface soil moisture.

Introduction

are used for large-scale drought assessment and other applications. However, available satellite soil moisture products from spaceborne microwave radiometers are not adequate for finer soil moisture (sub-km scale) monitoring due to coarse spatial resolution which is a prime requirement of agricultural and other fine scale applications.

Currently, there are two microwave radiometer-based satellite missions in orbit dedicated to measuring the Earth's surface soil moisture (SSM) with a spatial resolution of about 30–40 km such as (i) Soil moisture and ocean salinity (SMOS) launched by the European Space Agency in November 2009 and (ii) Soil moisture active and passive (SMAP) launched by NASA (National Aeronautics and Space Administration, USA) in January 2015. In order to further improve spatial resolution at 1–3 km scale, SMAP mission was originally designed to get complementary benefits of higher resolution from synthetic aperture radar (SAR) and higher sensitivity towards soil moisture from radiometer by combining collocated radar and radiometer observations based on active–passive approach. Unfortunately, L-band radar of SMAP became non-functional after two and a half months due to certain radar anomaly. Further, to meet the requirement of agricultural and other fine