ANALYSIS OF 7 YEARS AQUA AMSR-E DERIVED SOIL MOISTURE DATA OVER INDIA

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Abstract

Aqua AMSR-E L3-daily soil moisture data of 7 years (2002-2008) were analysed for monitoring soil moisture pattern over entire India and also some specific areas with limited groundtruth.

Test sites selected for this study are: 1) Jodhpur and Jaisalmer in Rajasthan, 2) Pune in Maharastra, 3) Gurdaspur district in Punjab 4) Bankura district in West Bengal 5) Ahmedabad, Surendranagar, Bhavnagar districts in Gujarat State. Aqua AMSR-E Soil Moisture Level 3 daily data product (25 km x 25 km pixel spacing, but at spatial resolution of 56 km) for the period 2002-2007 were obtained from National Snow and Ice Data Centre (NSIDC). Daily Precipitation data from the Indian Meteorological Department (IMD), Pune and Meteorological Centre, Ahmedabad were acquired for the analysis of the data. TRMM data were also downloaded for the analysis of soil moisture. Soil Classification Data were taken from National Bureau of Soil Survey & Land Use Planning (Indian Council of Agricultural Research), Nagpur. Field work was carried out in Rajasthan and Gujarat in Dec. 2005 and 2006 to collect soil temperature and soil moisture for comparison with AMSR-E retrieval data.

NSIDC website interface allows users to select required area for obtaining soil moisture product. We selected the lower and upper latitudes as 5^0-40^0N and longitude 55^0-100^0E to cover India and its surrounding. The selected area gives a rectangular matrix with 163 rows x 173 columns. The downloaded file is in Hierarchical Data Format (HDF) with many channels containing soil moisture in ascending and descending passes, brightness temperature at all channels, etc. Using the NSIDC supplied software, soil moisture data were extracted for ascending and descending passes. The corresponding latitude and longitude files were also extracted. Using instructions given by NSIDC through website, the soil moisture product was georeferenced using ENVI software with latitude and longitude as a projection and WGS84 as a reference system. For daily, weekly and monthly average of soil moisture, we have averaged NSIDC daily soil moisture products using a computer programme developed for averaging. To get daily average soil moisture, we averaged ascending and descending soil moisture data.

Monthly average soil moisture maps were generated for the period 2002-2008 using L3-soil moisture products. It was observed from these maps that the western side of India with desert (Rajasthan state) shows low soil moisture (<6%) during summer season and maximum of 8 to 10% during rainy season. Due to sandy soil and less rainfall (<100 mm), drought like conditions prevail in this area. Gujarat area (western part of India) shows highest soil moisture during the rainy season (Aug.) of 2004. Out of all years, 2005 shows highest soil moisture at many parts of India. As per the records of India, 2002 was considered as a drought year and the soil moisture pattern shows similar condition.

Average monthly soil moisture values of AMSR-E at five test sites were plotted for 7 years. Jaisalmer and Jodhpur show lowest and Gurdaspur shows the highest soil moisture (17%). Variation in estimated soil moisture in Jaisalmer and Jodhpur are observed in winter and summer. This variation can be attributed to estimation error in soil moisture retrieval through the model. In 2005, Pune test area showed highest soil moisture during rainy season due to heavy rainfall.

By comparing groundtruth and Aqua estimated soil moisture, we found that the difference of 4% (over estimation) for Jaisalmer area and 2% under estimation for Gujarat area. We also made a comparison between estimated soil moisture and rainfall data and found that the estimated soil moisture varies well with rainfall for uniform bare fields.

Monthly average soil moisture over five test areas
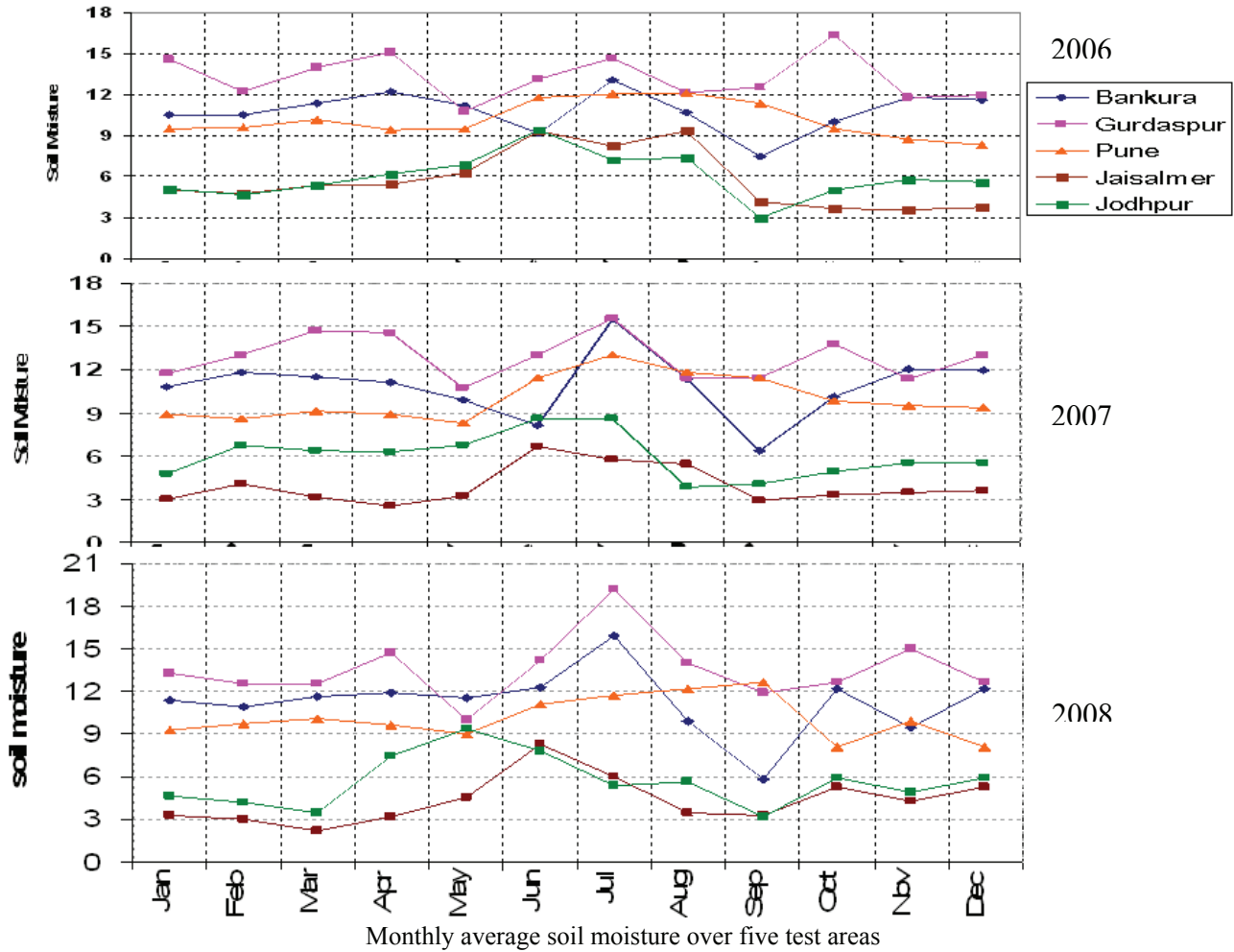
Groundtruth versus Estimated SM

$y = 0.6507x + 4.0932$

$R^2 = 0.7929$