IITB-Monash Research Academy

An Indian-Australian research partnership

Indian Institute of Technology Bombay | MONASH University

Project Title:	**Soil moisture mapping and validation using EOS data**
Project Number	**IMURA0466**

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IITB Department:	Centre of Studies in Resources Engineering	

Research Academy Themes: 4

Highlight which of the Academy's Theme(s) this project will address?
(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Surface soil moisture information through remote sensing is very important in the field of agriculture, hydrology and meteorology. AMSR-E onboard Aqua satellite provided daily surface soil moisture maps of entire earth at spatial resolution of 60 km during the period 2002-2011. SMOS and AMSR-2 are now providing soil moisture information at higher spatial resolution and better accuracy. Recently, SMAP satellite was successfully launched and will provide data very soon at high spatial resolution. AMSR-E's 9 years of soil moisture data analysis over India provided useful information about drought and heavy rainfall events. It is also observed that the soil moisture is very dynamic during the monsoon period of India. In view of the availability of SMAP data, it is important to study the soil moisture retrieval algorithms and validation with groundtruth observations over specific test areas of India that we used for AMSR-E data validation. As the spatial resolution of SMAP products are 3 km, 36 km and 9 km (combined active and passive), it is possible to compare estimated soil moisture from ALOS-2 L-band fully polarmetric SAR and Indian RISAT-1 C-band hybrid polarimetric SAR data. Effect of vegetation and soil roughness will also be studied as they are different for passive and active sensors. If vegetation and roughness correction are applied, the improvement in soil moisture estimation is possible using SMAP active data. It is also planned to interact with National Centre for Medium Range

Weather Forecasting (NCMRWF), India, for utilizing soil moisture products for weather forecasting.

Project aims

1) Application of various soil moisture retrieval models for SMOS, AMSR-2 and SMAP satellite data.
2) Collection of groundtruth data over bare, rough and vegetation covered fields for the validation of various soil moisture retrieval techniques and SMAP products.
3) To study the drought and heavy rainfall events using several years of soil moisture maps.

Expected outcomes

The study will be useful for the validation and retrieval accuracy of SMOS, AMSR-2 and SMAP soil moisture products over Indian test areas at different agro-climatic conditions. The study may also lead to the development of new retrieval algorithms using active and passive data from SMAP. India is experiencing severe drought and floods every year. The distribution of these affected areas can be identified and the soil moisture pattern over long time period can be studied. Improvements in weather and hydrological forecasts are also possible through soil moisture maps.

How will the project address the Goals of the above Themes?

Soil moisture is very useful in agriculture, hydrology and meteorology. In agriculture, it is useful for irrigation scheduling, seed germination and crop yield forecasting. In hydrology, partitioning of rainfall into its runoff and infiltration components depends on soil moisture. By incorporating soil moisture in weather forecasting models, improvement in the prediction of rain is possible.

Capabilities and Degrees Required

M.Tech. in Remote Sensing and GIS/Geomatics/Geoinformatics. Experience in using image processing and GIS software. Understanding of various microwave emission and scattering models for the retrieval of soil moisture and able to code. Ability to collect groundtruth data in terms of soil moisture, soil roughness and vegetation in different seasons and crop growth cycle.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Prof. Subimal Ghosh, Dept. of Civil Engg., Indian Institute of Technology Bombay

Prof. M. Sekhar Associate Professor, Dept. of Civil Engg., Indian Institute of Science, Bangalore (India)

Dr. M.V.R. Sesha Sai, National Remote Sensing Centre, ISRO, Hyderabad.

Please provide a few key words relating to this project to make it easier for the students to apply.

Soil moisture, retrieval techniques, microwave remote sensing, drought, microwave emission, scattering