

An Indian-Australian research partnership

Project Title: **Towards Assimilation of SMAP and SMOS soil moisture and brightness temperature into a land surface model**

Project Number **IMURA0777**

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Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see www.iitbmonash.org)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks,	7	Humanities and social sciences
8	Telecomm, Power Eng HSS, Design, Management		

		8	Design
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The research problem

Define the problem

The low frequency microwave brightness temperature (Tb) observations from the SMAP and SMOS missions have immense potential to improve the prediction skill of land surface models through data assimilation. For direct assimilation of Tb, the LSM needs to be coupled to a forward radiative transfer model (RTM) which acts as an observation operator to simulate Tb from LSM simulated soil moisture and temperature states. For this present project, both SMOS and SMAP Tb shall be utilized over the Murrumbidgee Catchment of Australia. The results of assimilation shall be evaluated using independent airborne brightness temperature data, intensive field sampling and continuous in-situ measurements of near-surface and root-zone soil moisture from the OzNet networks and SMAPEX data sets (see www.oznet.org and www.smapex.monash.edu). The near-surface soil moisture information is known to preserve a “memory” which impacts weather anomalies such as heat waves and rainfall.

Project aims

The research hypotheses that this project aims to address are the following:

- Effect of data assimilation approaches to assimilate SMOS and SMAP for soil moisture estimation.*
- Impact of direct assimilation of microwave brightness temperature (Tb) as compared to derived soil moisture assimilation to yield better SM simulation within an LSM framework.*
- Utilizing the soil moisture memory for studying the effects of extreme weather events.*

Expected outcomes

The expected outcomes shall be the following:

- To propose improved techniques for assimilation of soil moisture within a land surface model framework*
- To check the potential of Tb assimilation so as to get better soil moisture simulations*
- To check the soil moisture memory and study its potential applicability in examining extreme weather.*

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

The project falls under the cluster of earth sciences and civil engineering under the research theme of water.

This project address the key variable of soil moisture which is a tiny component of the water cycle but has a huge impact on weather due to its crucial interface between the land and the atmosphere. This tiny amount plays a very important role in agriculture, weather and climate studies. This project will address the behaviour of soil moisture using land surface modelling and data assimilation.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

M.Tech/MS/MSc in Engineering (Civil, Remote sensing, Environmental Engineering, Geoinformatics, Water resources engineering)

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.

Select up to **(4)** keywords from the Academy's approved keyword list (**available at <http://www.iitbmonash.org/becoming-a-research-supervisor/>**) relating to this project to make it easier for the students to apply.

SMAP

Soil moisture

Tb

Oznet