IITB-Monash Research Academy

An Indian-Australian research partnership

Indian Institute of Technology Bombay | MONASH University

Project Title:	**Estimation and partitioning of evapotranspiration using soil moisture and vegetation parameters retrieved from passive microwave remote sensing**	
Project Number	**IMURA0975**	
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IITB Department:	Civil Engineering	

Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST **one.** For more information, see www.iitbmonash.org)*	
1	*Material Science/Engineering (including Nano, Metallurgy)*
2	*Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*
3	*Math, CFD, Modelling, Manufacturing*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*
8	*HSS, Design, Management*

Research Themes:

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*
7	*Humanities and social sciences*
8	Design

The research problem

Modelling evapotranspiration (ET) and its components from remote sensing (RS) datasets has received tremendous attention in the last two decades. The methods to estimate evapotranspiration can be broadly classified into surface temperature based methods and conductance based methods. The surface temperature based methods are mostly suitable for bare- to moderately- vegetated surfaces with some degree of water stress. Whereas, the conductance based models are expected to work better in sparsely- to well-vegetated regions without water stress. One of the important factor that control ET is the availability of moisture at the surface (in soil and in vegetation). Passive microwave (PMW) RS has the ability to retrieve near-surface soil moisture (SM) and vegetation properties (especially Vegetation Optical Depth, VOD) and these variables can be potentially used to constrain the ET retrieval models. However, the use of the variables retrieved from PMW RS for ET modelling is still at a nascent stage and also suffers from a coarse spatial resolution. This project aims to develop methodologies for the use of SM and VOD in RS models for the estimation of ET and its components viz. soil evaporation, interception evaporation and transpiration.

Project aims

The aims of this project are:

1) To develop suitable methodology for constraining the remote sensing based evapotranspiration models using soil moisture and Vegetation Optical Depth retrieved from passive microwave remote sensing.

2) To develop downscaling methods to improve the spatial resolution of SM and VOD datasets for improving the resolution of the estimated ET.

3) To estimate ET, its components and carbon assimilation by vegetation (especially Gross Primary Productivity) using the developed models at moderate to high spatial resolution (sub kilometre scales)

Expected outcomes

1. Methodology for downscaling of soil moisture and VOD from passive microwave remote sensing
2. Remote sensing based model for retrieval of ET and its components using downscaled SM and VOD

Two-three high impact publications.

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

The project fits into the themes of “Water”. Evapotranspiration is the second largest flux of the global water cycle and in addition connects the energy, water and carbon cycles. Further, soil moisture is a most important state variable and knowledge about this is required in several applications. This project deals with the retrieval of two important components of the water cycle and hence fits into the theme of water quite well.

Potential RPC members from IITB and Monash

At IITB
Prof. Karthikeyan Lanka; Prof. Subimal Ghosh

At Monash
Prof. Chris Rudiger

Capabilities and Degrees Required

The candidate should have an exceptional academic background and a strong interest in research. Candidates with BTech/MSc. /MTech degrees related to the fields of water resources/ Remote Sensing are encouraged to apply. Knowledge in remote sensing is mandatory. Experience in computer programming (Matlab, Python etc.) and mathematical knowledge including numerical techniques and probability and statistics are required. Student should have good attitude towards mathematical concepts and modelling. In addition, the candidate should have excellent oral and written communication skills in English and should be able to undertake field visits for data collection.

Necessary Courses

1. Remote Sensing
2. Remote sensing for Hydrology and Water Resources Management.
3. Ecohydroclimatology

Potential Collaborators

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.

Water, Modelling and simulation