

An Indian-Australian research partnership

**Project Title:**

A system approach model for Citrus crop growth prediction using ground and remote sensing based information and data assimilation techniques

**Project Number**

IMURA0603

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Centre of Studies in Resources Engineering

## Research Academy 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](http://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

## The research problem

Define the problem

Indian semi-arid agro-ecosystems are continuously facing problems pertaining to biotic and abiotic pressures and it is essential to understand the nexus between the said sub-systems. Thus, a systems-approach is a felt-need to understand the contributing water-plant-soil-weather-environment continuum that affects both quality and quantity of the crops.

With increase in Earth Observation (EO) satellites and proximal sensing systems, it is possible to monitor agro-meteorological conditions at highest precision levels. Although

there is an increase in rate of earth resources data collection through these multiple platforms, short of data processing and information generation tools / algorithms are needed for processing this voluminous data.

In this study, emphasis will be made to estimate/predict rainfall, soil moisture & other soil related parameters and surface/groundwater for water balance studies, which will be used to underpin a crop growth prediction model. Multi-mode systems will be used for observing/generating the necessary data. The data will be used in conjunction with data assimilation techniques for optimal parameterization of the crop growth prediction model.

The test bed will be Citrus-dominated Vidharbha region of Maharashtra (India) as it is a heavily instrumented site with quality data that represents the issues identified above.

## **Project aims**

*Define the aims of the project*

Main emphasis will be to develop a systems approach based Citrus crop growth prediction model with water and related optimal parameters from ground/remote sensors and data assimilation techniques.

Specific aims are to:

1. Use surveillance data from sensing platforms (Satellite, Ground-based sensors, possibly UAVs) and ground truth to constrain a range of related Citrus variables
2. Understand the nexus between water-soil-plant-weather-disease and optimization of parameters with assimilation techniques
3. Solve the water budgeting and its impact on crop health issues for Citrus growth/production with a focus on rainfall, soil moisture and groundwater assessment
4. Develop a new integrated Citrus crop growth prediction methodology

## **Expected outcomes**

*Highlight the expected outcomes of the project*

1. A system which elucidates the significance of the link concerning water, soil, plant, disease and weather sub-systems
2. A Citrus crop growth prediction model with input from multiple platforms with optimal parameters
3. Water balance of the study area for Citrus with estimates of soil moisture, groundwater and rainfall
4. Precision database for future use/scop

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

*Describe how the project will address the goals of one or more of the 6 Themes listed above.*

The proposal will become a part of Information Technology Research Academy (ITRA) Water, a Government of India initiative with curriculum, research and social/outreach impact related goals. The said project has a user agency, Maharashtra Orange Growers Association, and is ready to adopt new technologies to improve both quality fruits and productivity. The project is expected to generate multi-source voluminous water and related data. The data could be used for water related issues, including precision

agriculture (irrigation and protection), by understanding the links between water-plant-soil-weather continuum in the groundwater agro-ecosystem that lead to sustainable development of the fragile semi-arid tropics.

### 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.*

Masters in Engineering/Technology with specialization in any of the following areas:  
Geo-informatics/ Hydrology/ Water Resources Engg./ Agriculture Engineering

### Potential Collaborators

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

Maharashtra Orange Growers Association, Warud, Amravati District, Maharashtra

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

agro-meteorology, citrus crop, crop growth prediction, data assimilation,  
ground/environmental sensors, remote sensing, systems-approach, water