

An Indian-Australian research partnership

Project Title:	Hybrid Downscaling of Orographic Precipitation	
Project Number	IMURA0488	
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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)

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

Orography commonly enhances the local precipitation rate through a variety of dynamical means. Many regional operational forecasting models, even run at a high resolution like 1.5 km, need to be evaluated for different characteristics such as spatio-temporal variability, extremes etc. These simulations necessarily smooth the peaks of the mountain and thus alter the amount and location of the local precipitation. Hence we propose to run regional weather forecast model at medium resolution (say at 10 km) and then further perform statistical downscaling at station level.

The science questions, we propose to address are the followings:

1. To what extent does increased resolution improve the skill of simulations of precipitation in orographic regions? Does there exist an optimum resolution beyond which the performance does not improve?
2. How effective are common "nudging" techniques in improving simulations in orographic regions?
3. How effective are statistical downscaling techniques in improving the simulations of precipitation

- the performance of medium scale dynamics downscaling model in hilly region?
4. How effective are these various techniques in improving simulations of extreme precipitation events?

Project aims

Define the aims of the project

The aim of this project is to develop a robust hybrid (numerical and statistical) downscaling approach to improve precipitation forecasts in orographic regions. This research will examine a variety of dynamical mechanisms that are leading to the orographic enhancement to refine the downscaling algorithm.

Expected outcomes

Highlight the expected outcomes of the project

We will develop a methodology for improving the simulation of orographic precipitation.

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.

This research will directly address research theme 4: water. The outcome/ product of the proposed work may directly be used in a hydrologic model for hydrological forecast.

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.

Expertise in meteorology is strongly desired. This research will require skills in managing large data sets, numerical modelling and statistics. Computer programming skills will be necessary.

Potential Collaborators

Prof. Chandra Venkataraman, Prof. Subhankar Karmakar,

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

Orographic Precipitation
Numerical Downscaling
Statistical Downscaling