

An Indian-Australian research partnership

<b>Project Title:</b>	<b>Influence of large-scale atmosphere and ocean variability on past and future East Antarctic Ice Sheet mass balance</b>	
<b>Project Number</b>	IMURA0895	
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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 <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</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 <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</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, Telecomm, Power Eng	7	Humanities and social sciences
8	HSS, Design, Management	8	Design

## The research problem

*Define the problem*

The Antarctic ice sheet (AIS) is the largest body of ice on Earth, with an ice volume equivalent to 58.3 m global mean sea level rise. It is usually divided into three ice sheets: The Antarctic Peninsula Ice Sheet, the West Antarctic Ice Sheet, and the East Antarctic Ice Sheet. Despite its remote location, being surrounded by the Southern Ocean, the AIS is nevertheless sensitive to recent climate change. The Antarctic Peninsula and West Antarctica are among the fastest warming regions on Earth. Ocean warming has primarily been responsible in forcing ice loss in these regions, particularly in the Amundsen Sea region of West Antarctica where the rate of ice loss has recently accelerated. The East Antarctic Ice Sheet has experienced both mass gain and mass loss. For example, Totten and Denman Glaciers in East Antarctica have recently lost mass, also likely due to an influx of warm ocean waters. In contrast, some other parts of East Antarctica have been characterised by unusually frequent passages of strong short-termed precipitation events which have led to mass gain. It is unclear whether this is due to natural climate variability or a manifestation of warming. Our understanding of the influence of various driver such as large-scale atmosphere and ocean variability in ice sheet mass balance is still not clear. A better understanding of these processes is thus critical for predicting the future behaviour of ice sheets and their effect on sea level.

## Project aims

*Define the aims of the project*

The project aims to understand the influence of large-scale atmosphere and ocean variability on past and future East Antarctic Ice Sheet mass balance through assimilation of remotely sensed ice sheet surface velocity and available surface mass balance records within an ice sheet modelling framework. The ice sheet model will be used to identify sectors of the ice sheet that are particularly vulnerable to climate warming. Climate modelling, will also be used to better understand the natural and anthropogenic drivers of ice sheet changes in Antarctica.

## Expected outcomes

*Highlight the expected outcomes of the project including likelihood of patents*

1. This project will provide the successful PhD candidate with highly valued and sought-after skills in numerical modelling and remote observation of ice and a deep understanding of ice sheet processes. This will equip the student with the necessary expertise to develop leadership amongst the next generation of glaciologists, ready to carry out their own programme of innovative scientific research.
2. Two/ three high impact publications.

## 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 project very well fits into the two following themes viz. (i) advanced computational simulations and (ii) water. It involves advanced simulations using complex computation models to help us understand why and how ice sheets/glaciers move and behave under different climate scenarios. Its about water and sea level rise and global climate. About 98% of Antarctica is covered by the Antarctic ice sheet, a dome of ice averaging at least 1.6 km (1.0 mi) thick. The continent has about 90% of the world's ice (and thus about 70% of the world's fresh water). If all of this ice were melted, sea levels would rise about 58.3 m.

## Capabilities and Degrees Required

*List the ideal set of capabilities that a student should have for this project. 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.*

Academic Qualification:

M.E./ M. Tech/MS/M.Sc. (Post graduate) in Geoscience/Geophysics/Geoinformatics/Remote

Sensing/Earth Sciences with strong background in mathematics and atmospheric physics are preferred.

Skills required:

Applicants will need to have experience in the use of complex numerical models. Experience of computer programming (eg. Fortran, Matlab, Python, R) on Linux-based systems is of advantage. Expertise in SAR data processing for glacier velocity/ice sheet velocity estimations is preferred. Experience in climate modelling and/or climate reanalysis datasets would be an advantage.

Apart from this, the candidate should have very good English skills for oral as well as written communications.

## 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.

At IITB: Prof. Subimal Ghosh; Prof. Sridhar Balasubramanian

At Monash: Monash co-hosts the Australian Research Council Centre of Excellence in Climate Extremes, and within this there are many potential collaborators including A/P Julie Arblaster, A/P Dietmar Dommenget, Dr Ben Henley, Dr Ailie Gallant and Dr Shayne McGregor.

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.

Modelling and Simulations; Geoscience; Water and Climate change