IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Geodynamics of Burmese arc and adjoining regions: Geophysical and numerical modeling**	
Project Number	**IMURA0905**	
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IITB Department:	Earth Science	

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

The southeast Asian convergent plate margin is located where the Indian oceanic tectonic plate come together with the Asian plate to form a subduction zone. These are areas of tectonic stress coupling, which is released, over the short timescales, through destructive earthquakes. The nature and distribution of earthquakes and deformation in the region of Burma indicate rather highly spatially variable compression and relative movement of different segments along this margin. The mechanical coupling in this area must ultimately reconcile with the geodynamics of the convergent margins, although how these processes operate in this area has remained unsolved. Insights into such fundamental problem will be obtained from integrating spatio-temporal data, structural geological data, geophysical observation and three-dimensional geodynamic models and will shed light on the tectonic nature of coupling and its control on current seismicity of the area.

Project aims

The aim of this project is to couple computational modelling of subduction processes with geophysical observation to elucidate the nature of the coupling along the Burmese arc and adjoining regions. This novel coupling focuses on the forward modelling of the physical properties of this area, including that of the subsurface, in particular the slab and the mantle beneath the two converging plates. The approach focuses on this area provides two ways to validate the models: the dynamic solution provides stress and strain rates that are comparable to earthquakes' centroid moment tensors and seismic strain rates integrated over the catalogue, and distribution of mass allowing synthetic gravity to be computed and compared to the observable. Constraining these two at the same time yield a self-consistent model of the current tectonic stress coupling in this area.

The project will answer these questions:

What is the control of deep structure on surface deformation?

What is the control of subduction on the stresses and seismicity?

Can we predict synthetic geophysical observables that independently constrain the modelling?

Expected outcomes

The outcomes expected are insights on the seismicity of the southeast Asian convergent zone. Understanding the interactions between plate structures and subduction dynamics allows to a better assessment of the state of stress of plate margins. These outcomes will further the way we understand the physics behind earthquakes and tsunami, and seismic hazard assessment.

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

The application of advanced computational methods to the Earth Sciences squarely falls under the theme "Advanced computational engineering, simulation and manufacture". Capitanio has an international reputation in the field of Computational Geodynamics. The application of numerical modelling to Earth Sciences represents an advance in the simulation of relevant problems such as the deformation and seismicity at the surface of the Earth.

Additionally, the outcome proposed here will have an impact on the understanding of formation of earthquakes, which remains to date an unsolved, yet critical for the hazard these pose to our community.

Capabilities and Degrees Required

Candidates having first class Masters degree in Geophysics /Applied Geophysics /Marine Geophysics or M.Tech. computational seismology or Computer Science with strong interest & motivation to undertake geodynamics related research problems.

Experience or knowledge in strong skills of algorithm development and data manipulation with sound computational background is most desirable.

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.

Potential collaborations at Monash are with Dr P Chowdhury, computational geodynamicist, Dr S. Quenette, deputy director of the eResearch, and Dr R. Armit, expert in geophysics and modelling.

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.

Geo Science, geotechnical, geomechanics
Computational Fluid Dynamics and Mechanics
Modelling and Simulation
Computer Simulation
Data Science, optimisation, algorithms