

An Indian-Australian research partnership

Project Title: **Using GIS and other methods to understand and quantify the vulnerability of a megacity like Mumbai to floods**

Project Number **IMURA0256**

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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

The research problem

Define the problem

An exhaustive knowledge of flood risk in different spatial locations is essential for developing an effective flood mitigation strategy for a watershed. A common approach to assess "flood risk" as the product of "probability or likelihood of hazard", i.e. the physical and statistical aspects of the actual flooding (e.g. return period of the flood, extent and depth of inundation), and the "vulnerability", i.e. the exposure of people and assets to floods and the susceptibility of the elements at risk to suffer from flood damage. The proposed Ph.D. topic aims to produce a comprehensive analysis of risk and vulnerability to flood in order to address a number of practical issues which has not been considered before. Two components of vulnerability to flood: (a) infrastructure and (b) socio-economic; will be evaluated individually using a Geographic Information System (GIS) environment and the components will be aggregated to determine an overall vulnerability to flood. The proposed methodology will estimate the impact of infrastructure vulnerability due to inundation of critical facilities (e.g., nursing homes, public buildings or emergency shelters, schools, hospitals, etc.) and emergency service stations (e.g., fire and rescue stations, police stations, etc.). To model the impact of inundation of a cell (which may contain one or more critical facilities) on its surrounding cells the concept of areal data (lattice data) modelling of spatial statistics will be applied. The exposures of land use / land cover and soil type will also be considered to include their effects on severity of flood. The values of probability of occurrence, vulnerability to flood, and exposures of land use and soil type to flood will be considered to finally compute flood risk at different locations in a watershed.

Project aims

Define the aims of the project

To map the flood risk at watershed level and to develop a flood risk information system, which will be demonstrated on Mumbai city, India (a region prone to flash flooding).

Expected outcomes

Highlight the expected outcomes of the project

The flood risk information system will be designed to provide support to the general public, decision-makers and water management professionals.

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 proposed topic aims to assess and map risk and vulnerability to floods, and dissemination of the appropriate information to different stakeholders, which is an essential step of the flood management process. Water management professionals can utilize the flood risk information in planning, design, construction, and operation and maintenance of flood protection infrastructure (e.g. reservoirs, dikes, drainage pipes, etc). Knowledge of flood risk can aid decision-makers in: constructing land development plans and land use zoning; planning emergency response strategies; waste disposal site selections; preparing infrastructure budgetary decisions; developing guidelines for operation of existing water retaining structure; and general policy development at all levels. The general public may also use the information in purchasing a house, or in selecting a site to start a business.

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.

- Must have a sound knowledge and experience of working with Geographic Information System (GIS) software.
- Must have studied Mathematics / Statistics as a course at undergraduate (bachelor's degree) level.