**Introduction - PTYA Model**

The Papathoma Tsunami Vulnerability Assessment (PTVA) Model calculates the tsunami vulnerability of buildings in a given tsunami flood area. It was first developed and applied in 2003, tested on the effects of the 2004 Indian Ocean tsunami, and then improved and applied again in 2009 for calculating the tsunami vulnerability of two coastal areas in Sydney Australia. It is a deterministic model that uses the characteristics of buildings and their surroundings to determine their vulnerability due to their exposure and prolonged contact with water by a tsunami.

**PTYA Model & Relative Vulnerability**

The Relative Vulnerability Index (RVI) Score is a weighted sum of two components:

1. The vulnerability of the carrying capacity of the building structure hit by the horizontal hydrodynamic force
2. The vulnerability of different building components due to their prolonged contact with water (plaster, fixtures, tiles, appliances, etc)

Therefore,

\[
\text{Relative Vulnerability Index (RVI)} = \frac{2}{3} \times \text{SV} + \frac{1}{3} \times \text{WV}
\]

Where SV is Structural Vulnerability and WV is vulnerability due to water intrusion.

**PTYA Model & Structural Vulnerability**

The Structural Vulnerability is calculated as:

\[
\text{SV} = Bv \times Ex \times Prot
\]

Where:
- **Bv**: The vulnerability of the building itself. It depends on the physical characteristics of the building itself (Number of floors, building material, orientation, condition, movable objects, etc).
- **Ex**: The water exposure or the water depth where the building is located.
- **Prot**: The level of protection of the building by its environment (building row, natural barriers, vegetation, walls, etc).

**PTYA Model & Water Intrusion Vulnerability**

The vulnerability of a building due to its contact with water depends on the number of floors that are inundated, including the basement:

\[
\text{WV} = \frac{\text{number of inundated levels}}{\text{total number of levels}}
\]

**PTYA Model - Required Data**

- Inundation Scenario
- Geo-referenced and ortho-rectified aerial images
- Digital Elevation Model with good horizontal resolution and vertical accuracy, used to calculate water depths for the building footprints
- A polygon shapefile for the building footprints
- Attribute data for every building
PTVA Model - Outputs

- RVI Score
- Prolonged contact with water vulnerability score (WV)
- Structural vulnerability score (SV)
- Building vulnerability score (BV)
- Protection score (Prot)
- Exposure score (Ex)
- Other statistics

Thank you for your attention