

**Imantha Gunasekera<sup>1</sup>, Susanna Jenkins<sup>1</sup>, In collaboration with: Peter J. Baxter<sup>2</sup>**

# Jean-Christophe Komorowski<sup>3</sup>

1: Earth Observatory of Singapore, Nanyang Technological University, 2: Institute of Public Health, University of Cambridge, 3: Equipe de Géologie des Systèmes Volcaniques, Institut de Physique du Globe de Paris

## I. Background

The speed at which emergency services respond following a volcanic eruption plays a vital role in determining the survivability of casualties. Residents in impacted zones exposed to a pyroclastic density current will suffer severe burns and will require intensive treatment and care. However most hospitals have very limited capacity to treat burn victims and therefore the management of casualties can have a large impact on their survivability. Mitigation plans need to be enforced to enable swift access to vital equipment such as ventilators.

This poster will explore how to quantify the impact of casualty rescue and treatment on casualty survivability. The selected study area is the island of Guadeloupe, where the populated area of Basse Terre and Saint Claude are in close proximity to the La Soufrière volcano.



Rescuers carrying casualties burned by dilute pyroclastic density currents from Merapi volcano on 5 November 2010. Photo source: Boston.com, 2010.

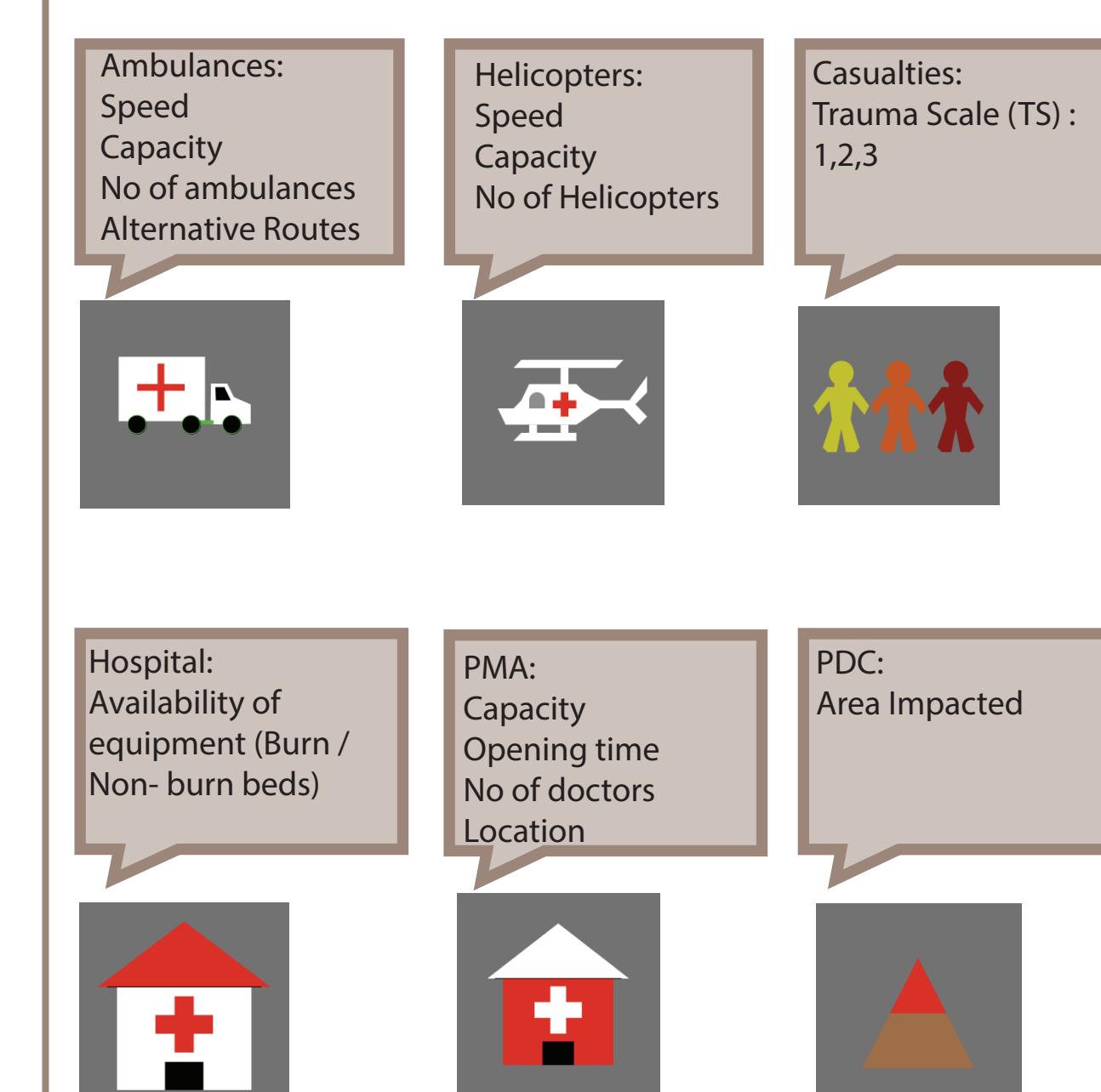


Pyroclastic Density Current from Soufrière Hill  
Volcano as seen from Fort Ghaut, Montserrat  
on 04 August 1997. Photo source:  
[theatlantic.com](http://theatlantic.com), 2013

## **II.What affects casualty survivability?**

- Severity of injuries
  - Age and health conditions
  - Time to receive medical treatment
    - Overloading at hospitals
    - Modes of rescue (helicopter / ambulance)
    - Location of treatment facilities
    - Damage to transportation systems
  - Availability of medical equipment
  - Area of Impact : Number of casualties affected

## **IV. What parameters are considered in the model**



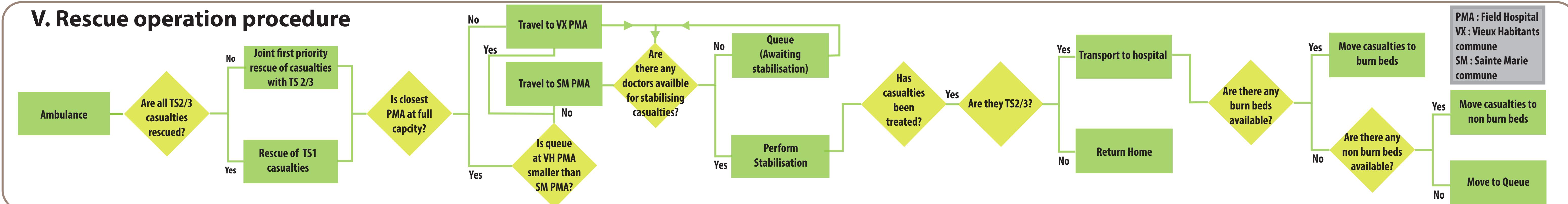
### III. Modelling Approach

- Wide Variety of parameters affecting rescue operations
  - Identify which parameters are critical and how changes influence survivability
  - Use of an Agent Based Modelling approach to simulate post disaster casualty rescue , transport and treatment

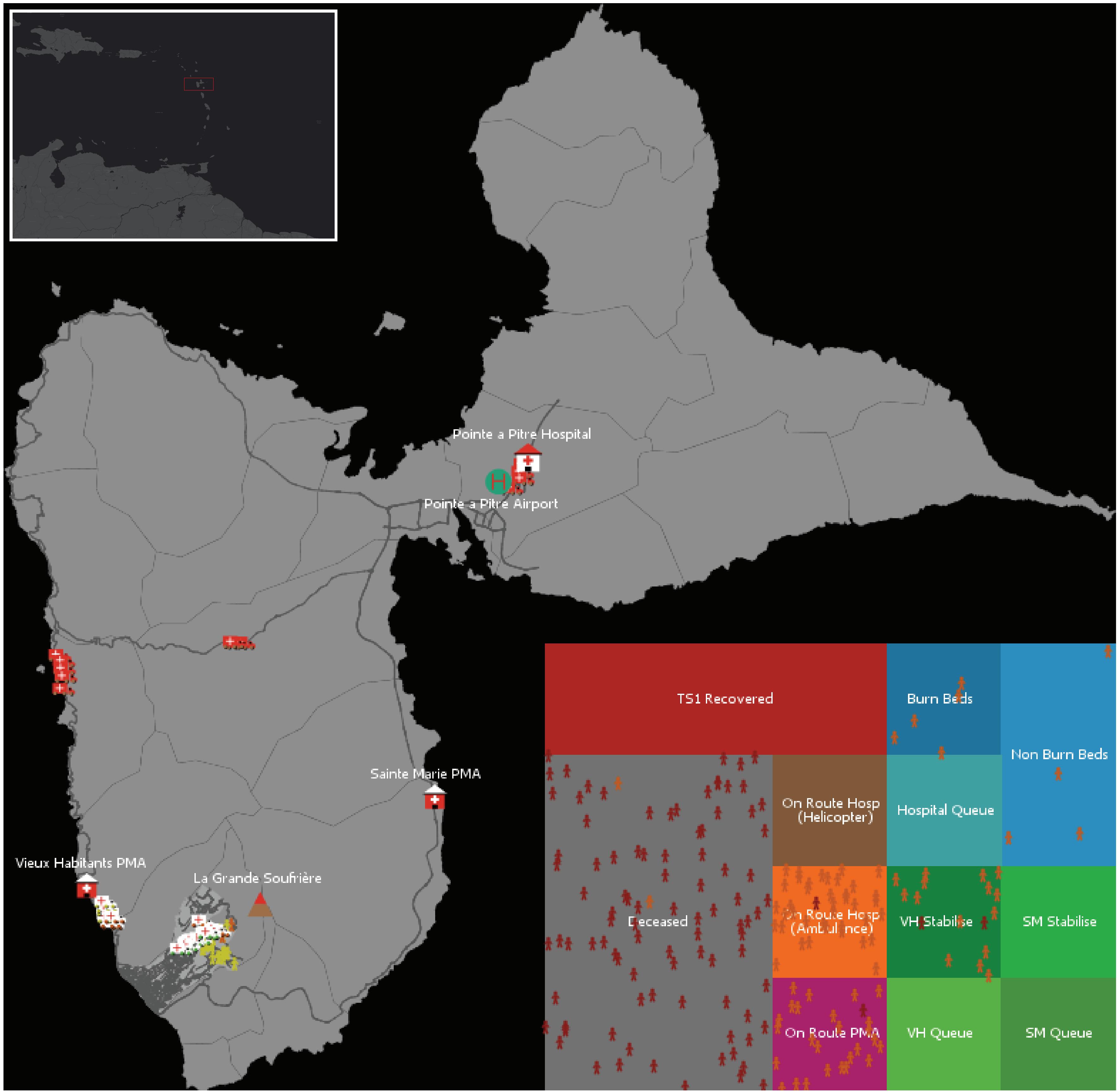
# A visual interpretation of post-disaster rescue **NetLogo** Agent Based Modelling environment

**NetLogo + GIS** Agent-based modelling environment  
Locations of infrastructure (medical facilities, roads etc) and casualties

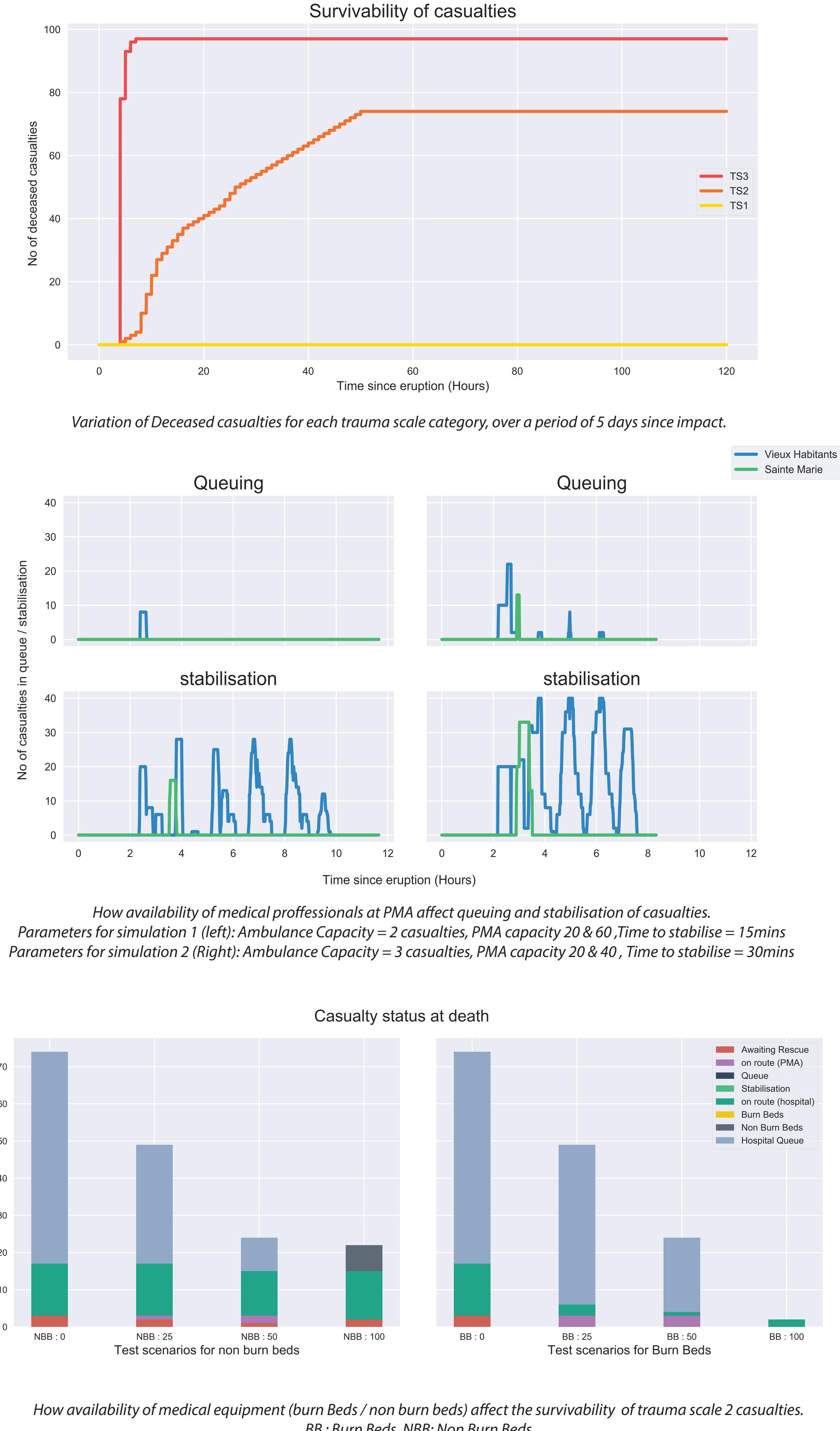
- **Python** + Offers a wide variety of packages that can be implemented to improve model accuracy



## **VI. Casualty Rescue, Transport and Treatment Model**



## VII. Results



## **VIII. Next Step : Sensitivity testing**

The key next step will be to further test the effect of different impact and rescue, transport or treatment scenarios on casualty survivability over time. This will help to identify the optimum response for different impact scenarios. Parameters to test include:

- Impact: Different pyroclastic density current runout extent and areas, durations and temperatures;
  - Rescue: Different modes of rescue, e.g. helicopter, self-evacuation, higher capacity ambulances;
  - Transport: The effect of ashy roads, or bridge or building collapse on transport speed and route;
  - Treatment: Evacuation to mainland US or France; increased equipment and capacity at PMAs and hospitals, as well as the addition or change in location of PMAs

References cited: Boston.com, 2010. Images available from the authors and at [http://www.boston.com/bigpicture/2010/11/mount\\_merapis\\_eruptions.html](http://www.boston.com/bigpicture/2010/11/mount_merapis_eruptions.html) (Last accessed 05/12/12), Atlantic.com, 2013, Images available from the authors and at <https://www.theatlantic.com/photo/2013/05/soufriere-hills-volcano/100509/>