University of BRISTOL

CABOT INSTITUTE

Living with global uncertainty

MODELLING VOLCANIC RISK

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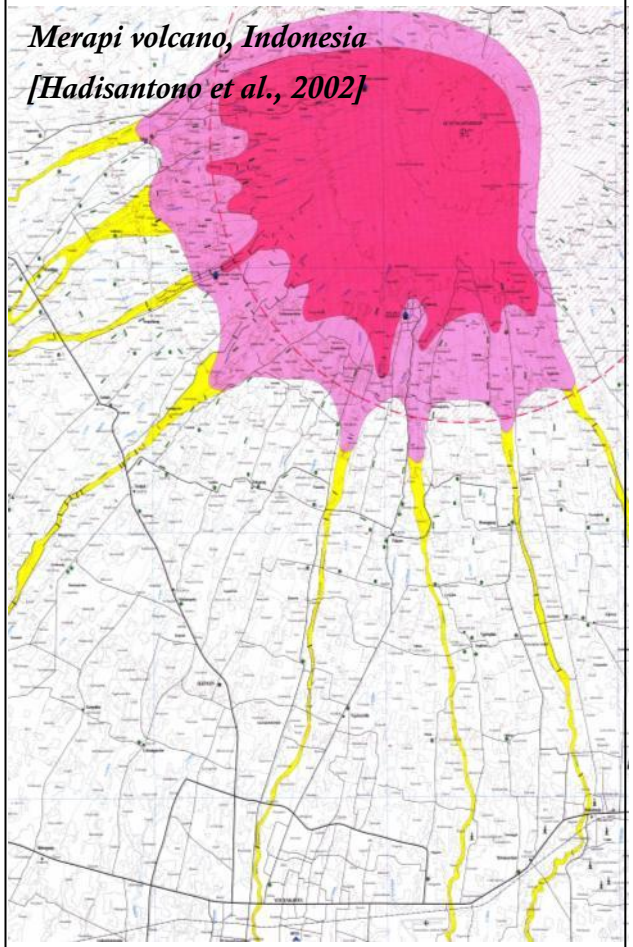
Damage to the village of Balerante, 5km from Merapi volcano during the October-November 2010 eruption
Photo: courtesy of the village chief of Balerante

VOLCANIC RISK ASSESSMENT

Precautionary approach:

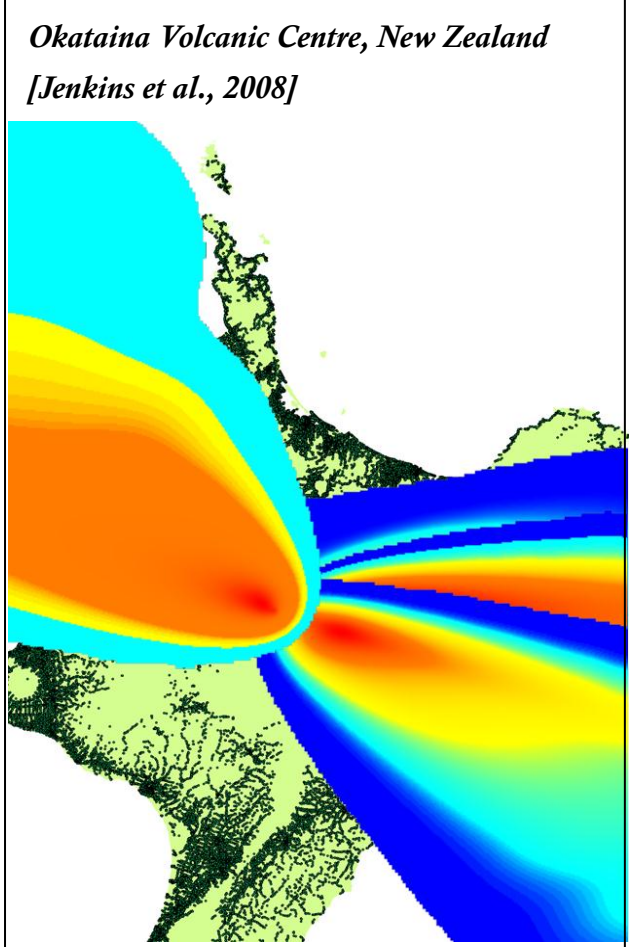
Not appropriate for densely populated areas, islands or long-duration crises

Scenario-based assessment:



Does not capture the full range of potential future eruptions; Easy to communicate/plan for

Probabilistic assessment:



Resource and time-intensive; analogous volcano data can be used to supplement data gaps

SCENARIO-BASED ASSESSMENT

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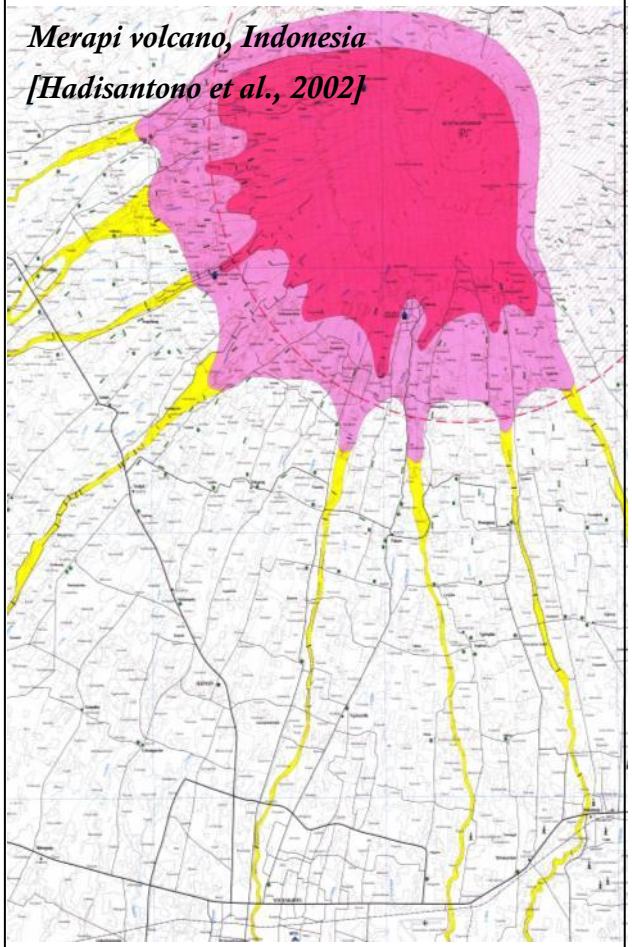

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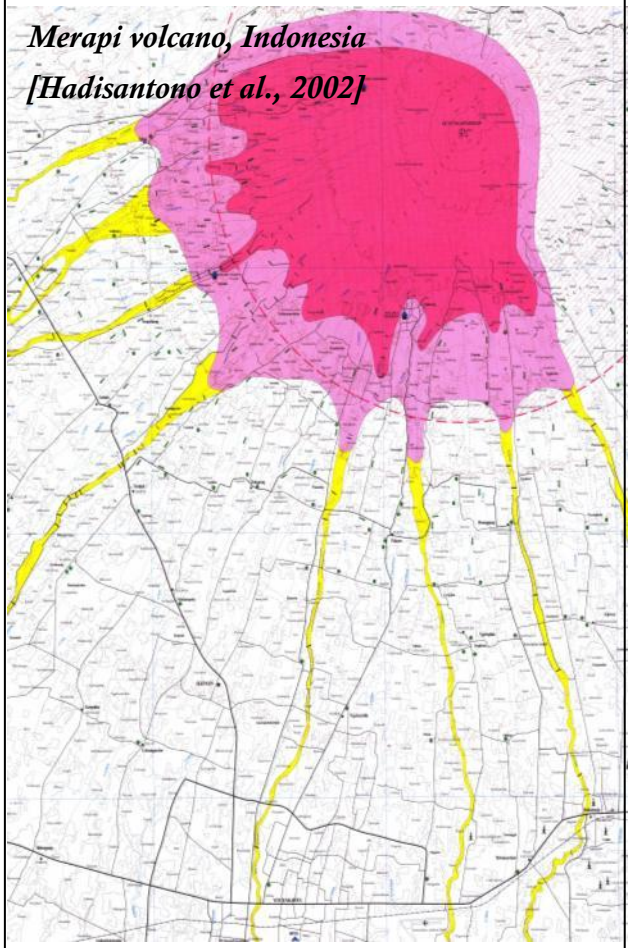

Merapi volcano, Indonesia
[Hadisantono et al., 2002]

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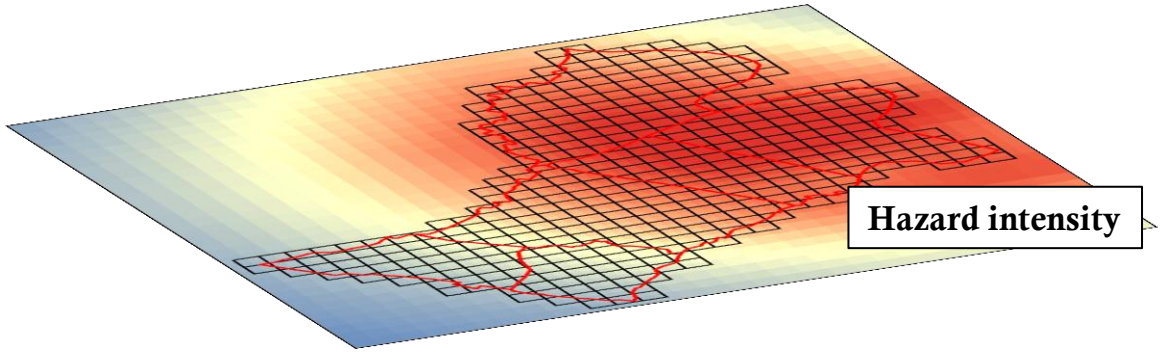

Impact modelling for a future eruption of La Soufrière volcano, Guadeloupe.
CASAVA project, with Cambridge Architectural Research and University of Cambridge

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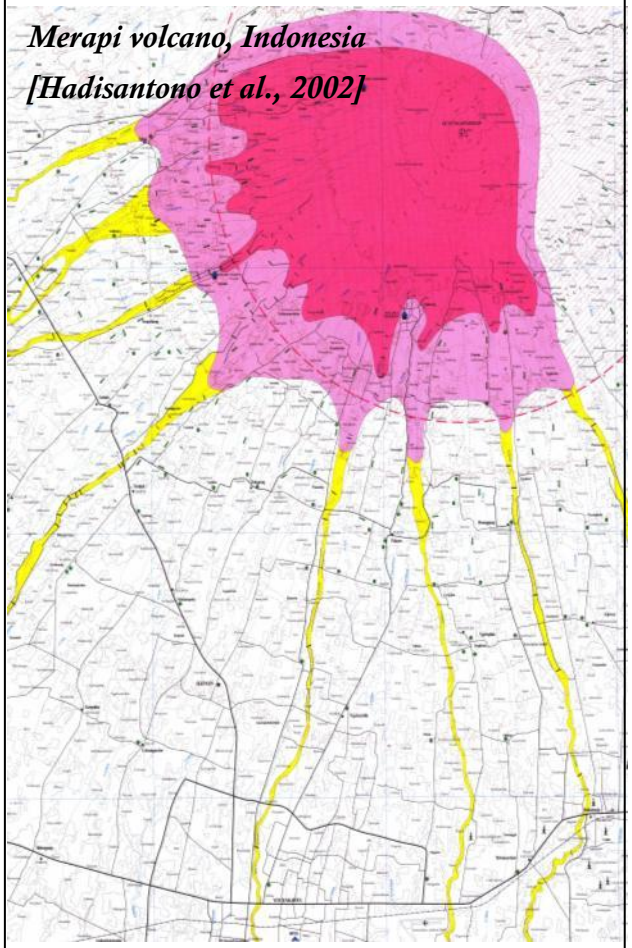

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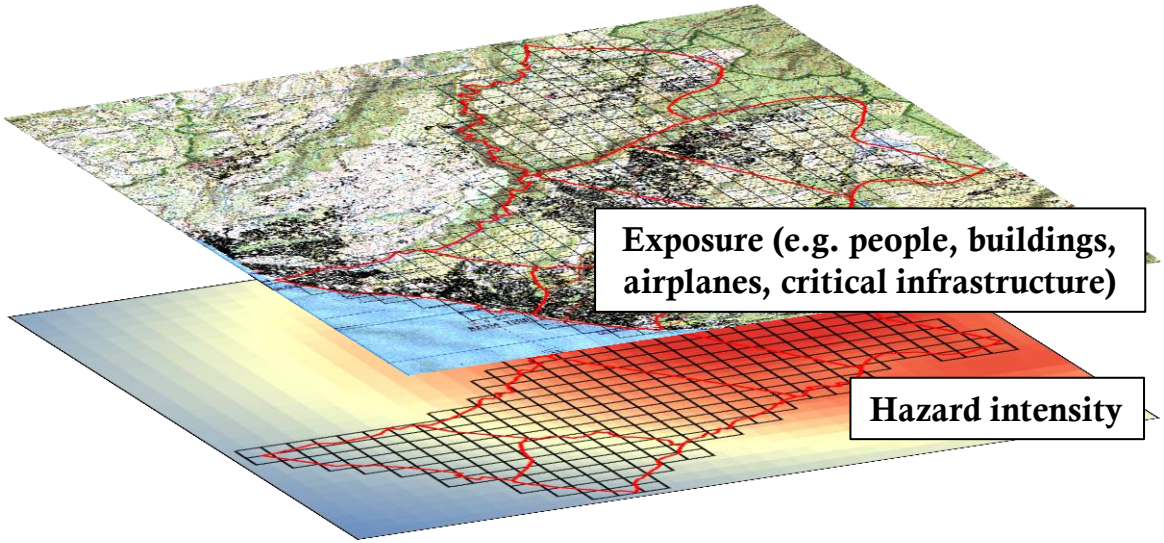

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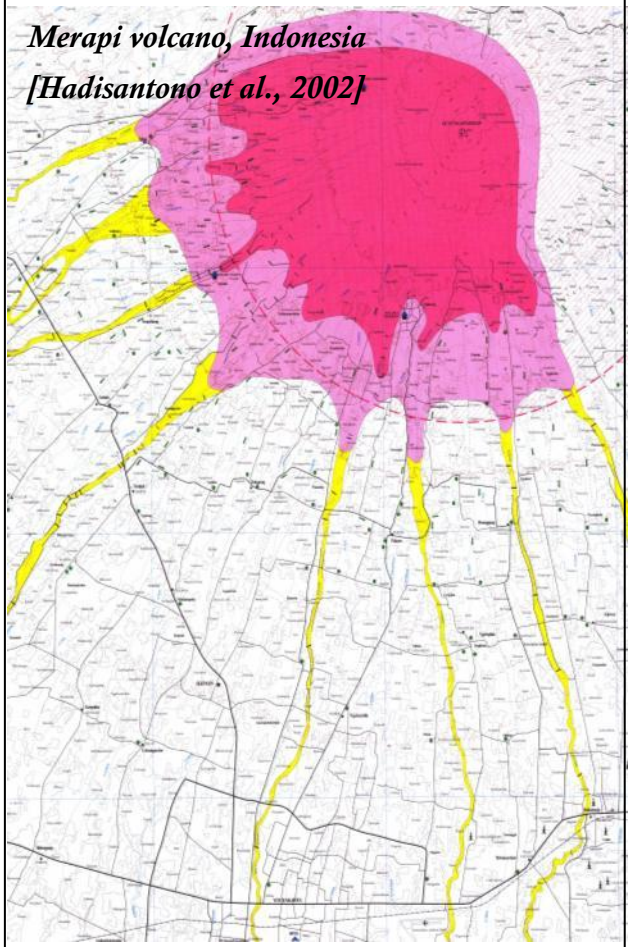

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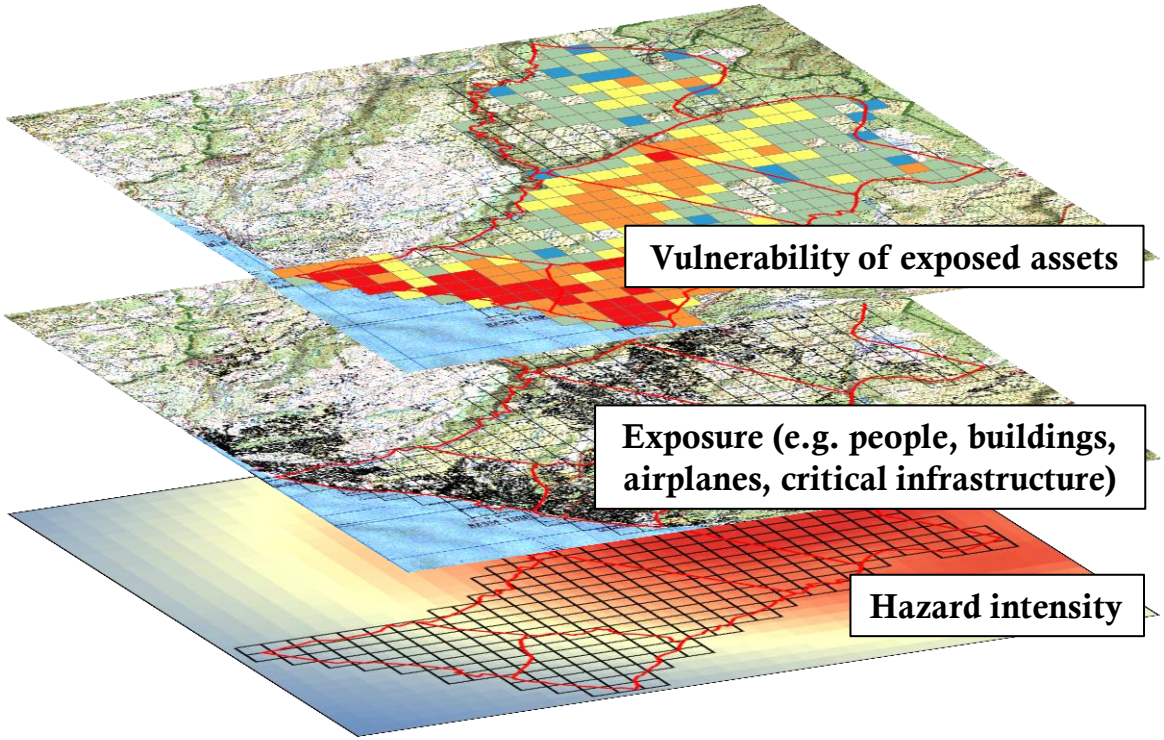

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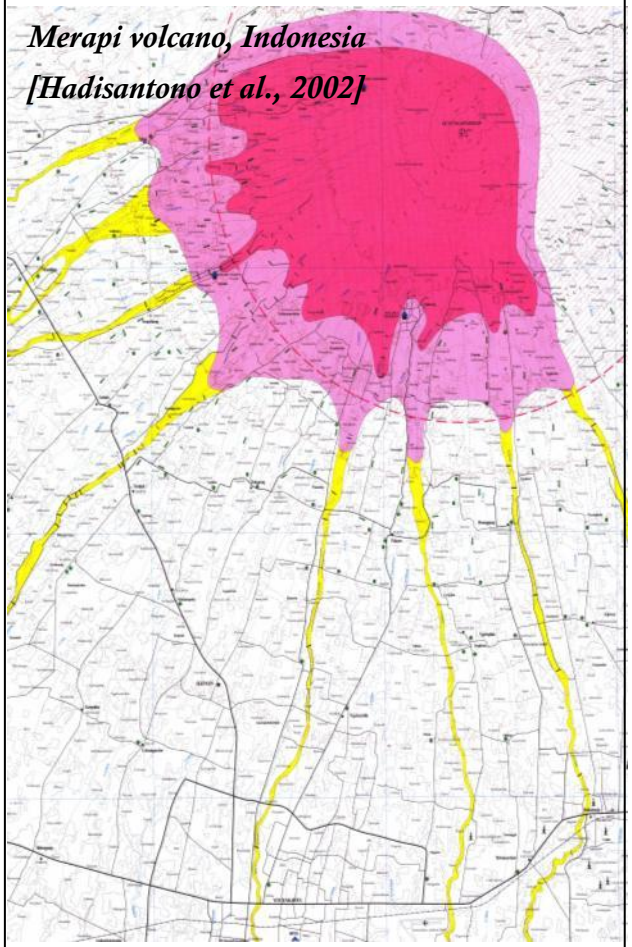

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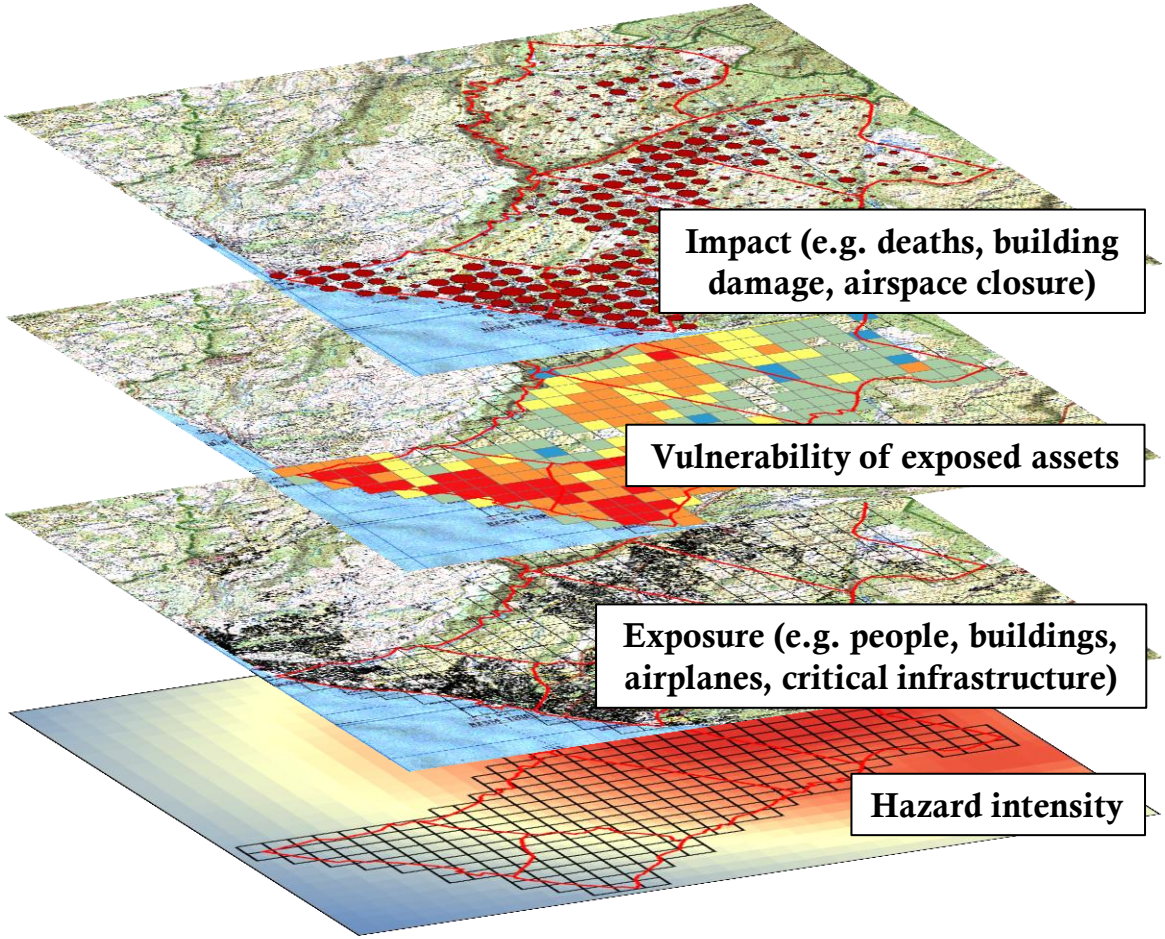

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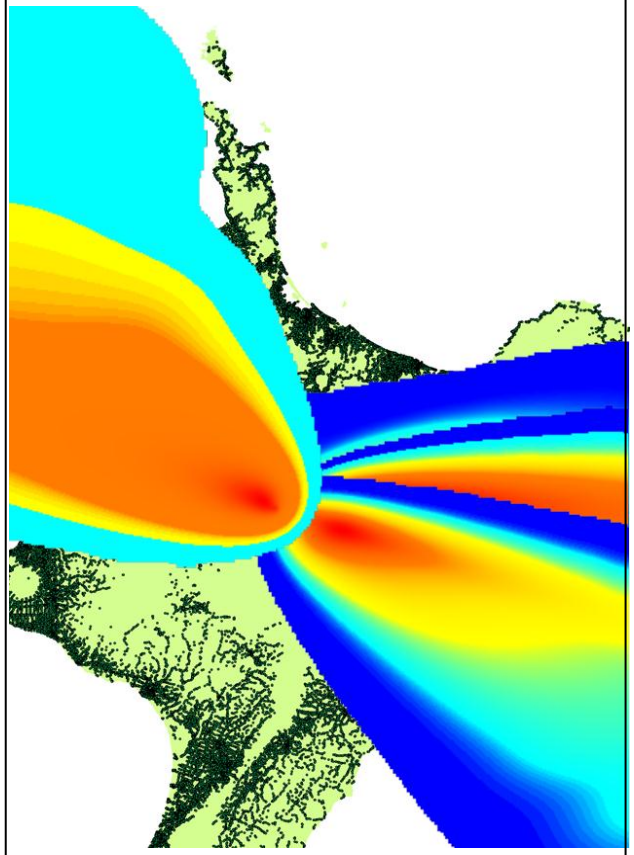
PROBABILISTIC ASSESSMENT

Probabilistic assessment:

Okataina Volcanic Centre, New Zealand

[Jenkins et al., 2008]



Resource and time-intensive; analogous volcano data can be used to supplement data gaps

- Probabilistic framework to assess long-term hazard and risk across large regions; applied to the Asia-Pacific region

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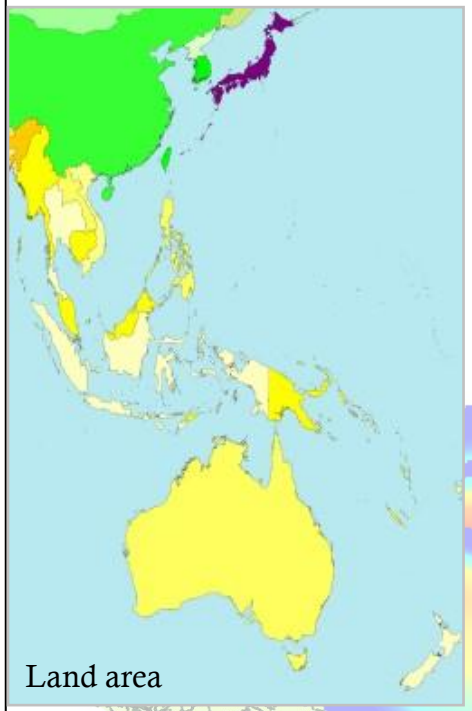

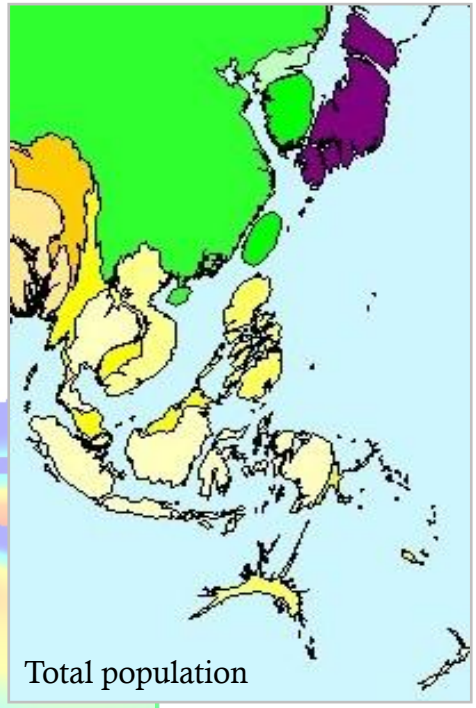

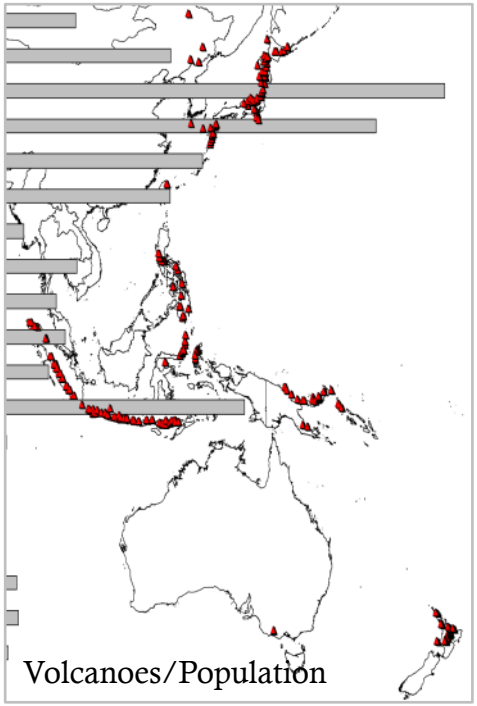

www.worldmapper.org; www.pdc.org

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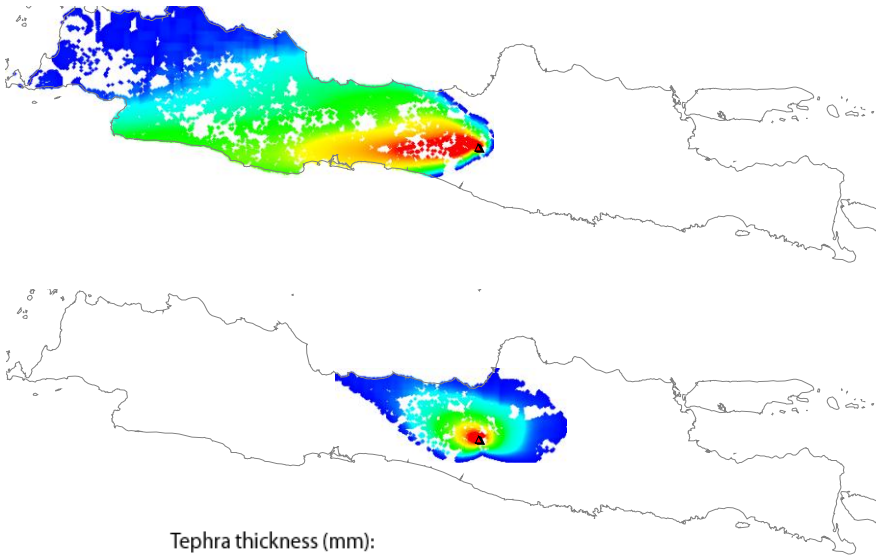

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- Probabilistic framework to assess long-term hazard and risk across large regions; applied to the Asia-Pacific region
- Statistical analysis of eruption magnitude and frequency for 190 volcanoes
- Stochastic ash dispersal modelling with local wind conditions

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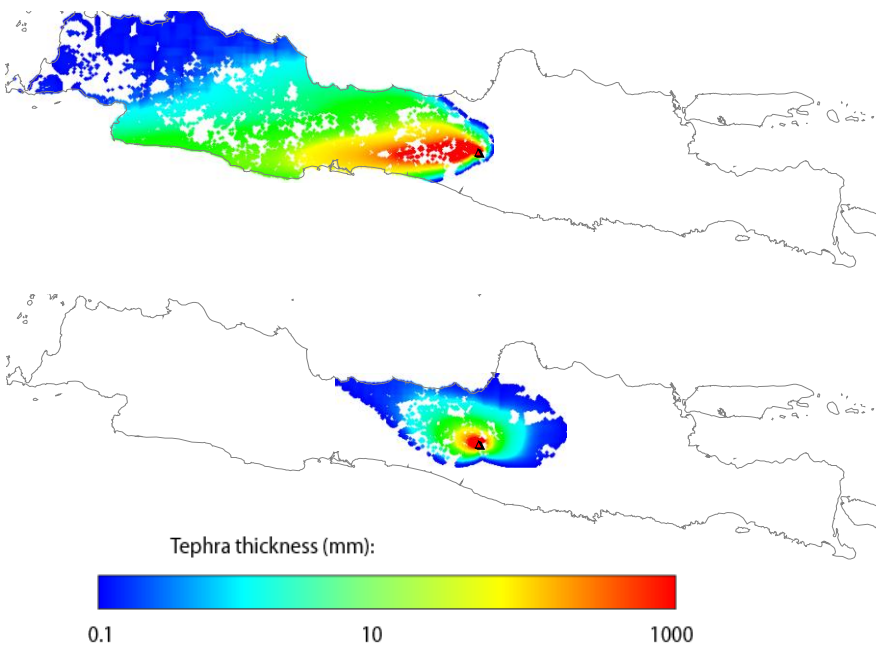
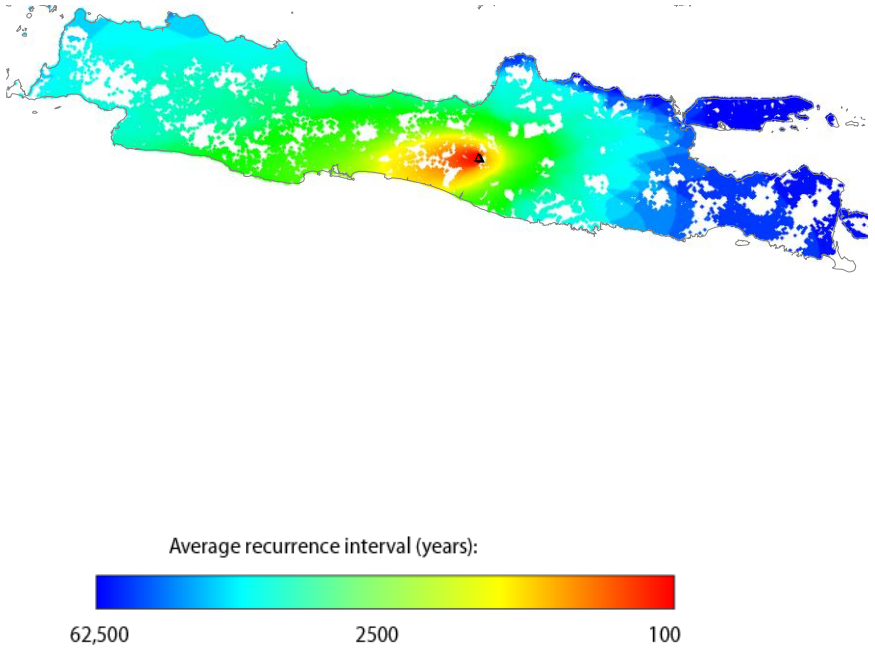
Single simulations

1000 simulations; Merapi volcano (>10 mm)





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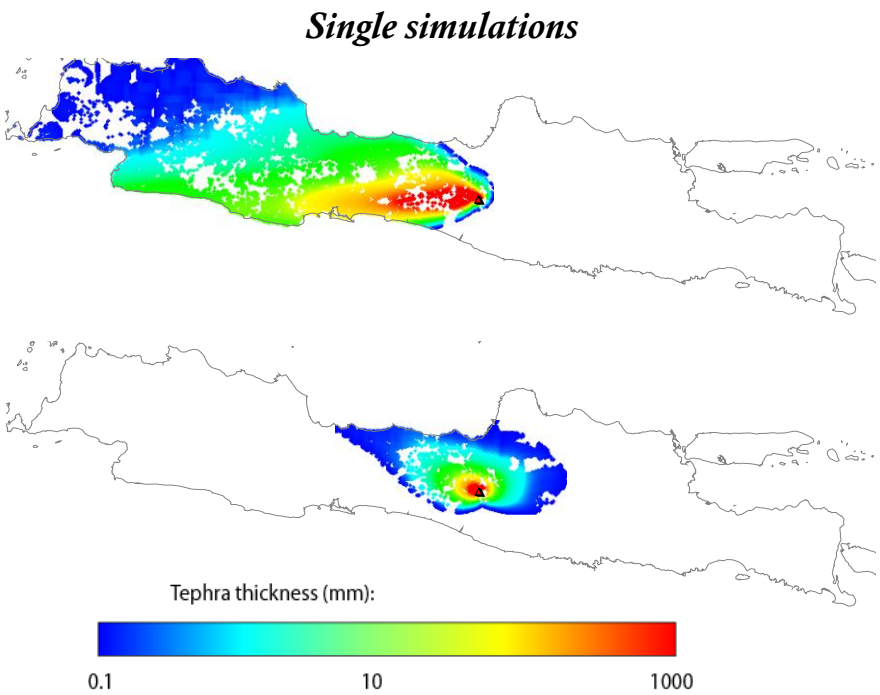

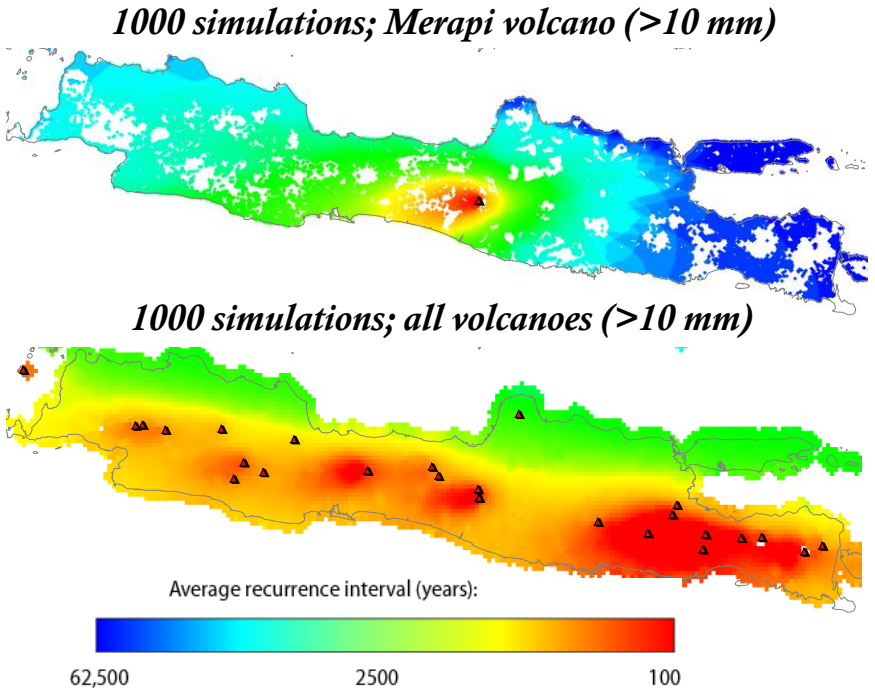

- Statistical analysis of eruption magnitude and frequency for 190 volcanoes
- Stochastic ash dispersal modelling with local wind conditions
- Assesses the cumulative peril from multiple volcanic sources

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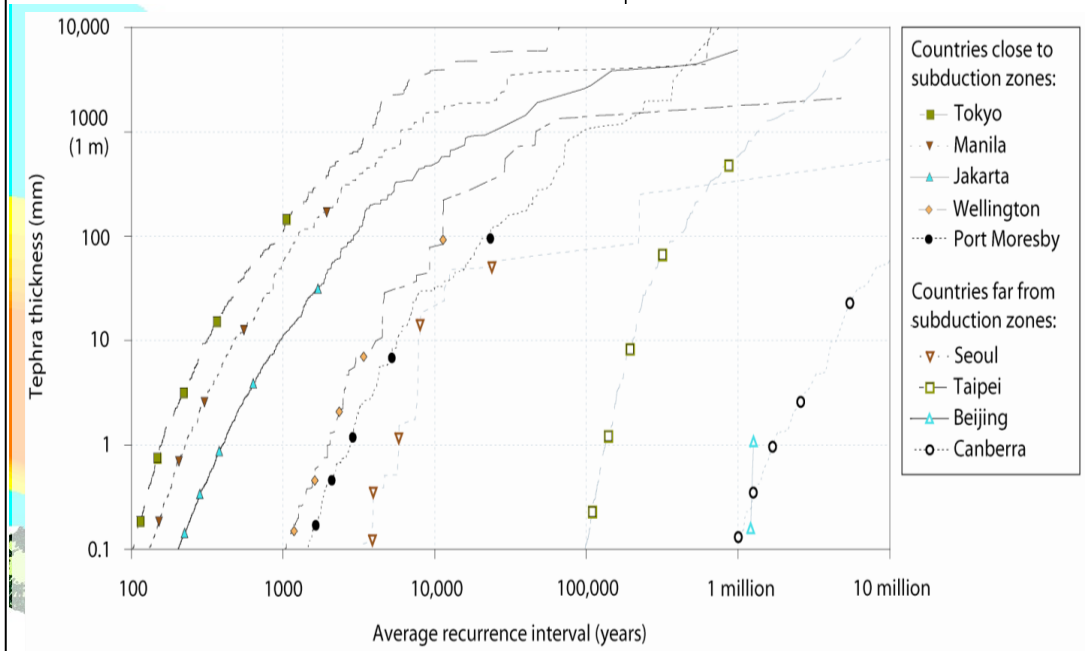

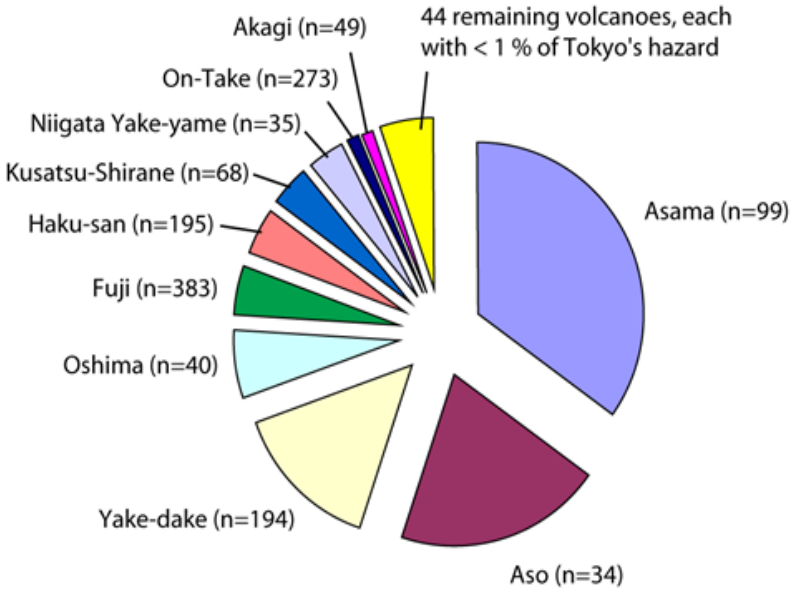

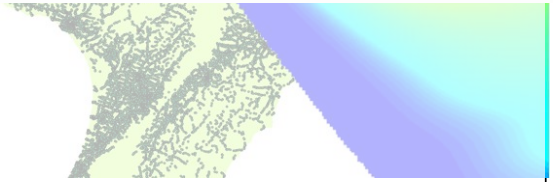

- Assesses the cumulative peril from multiple volcanic sources
- Can disaggregate hazard at specific locations or for a volcano
- Combined with population density and vulnerability (UN's Human Development Index) to provide high- and low-'risk' areas

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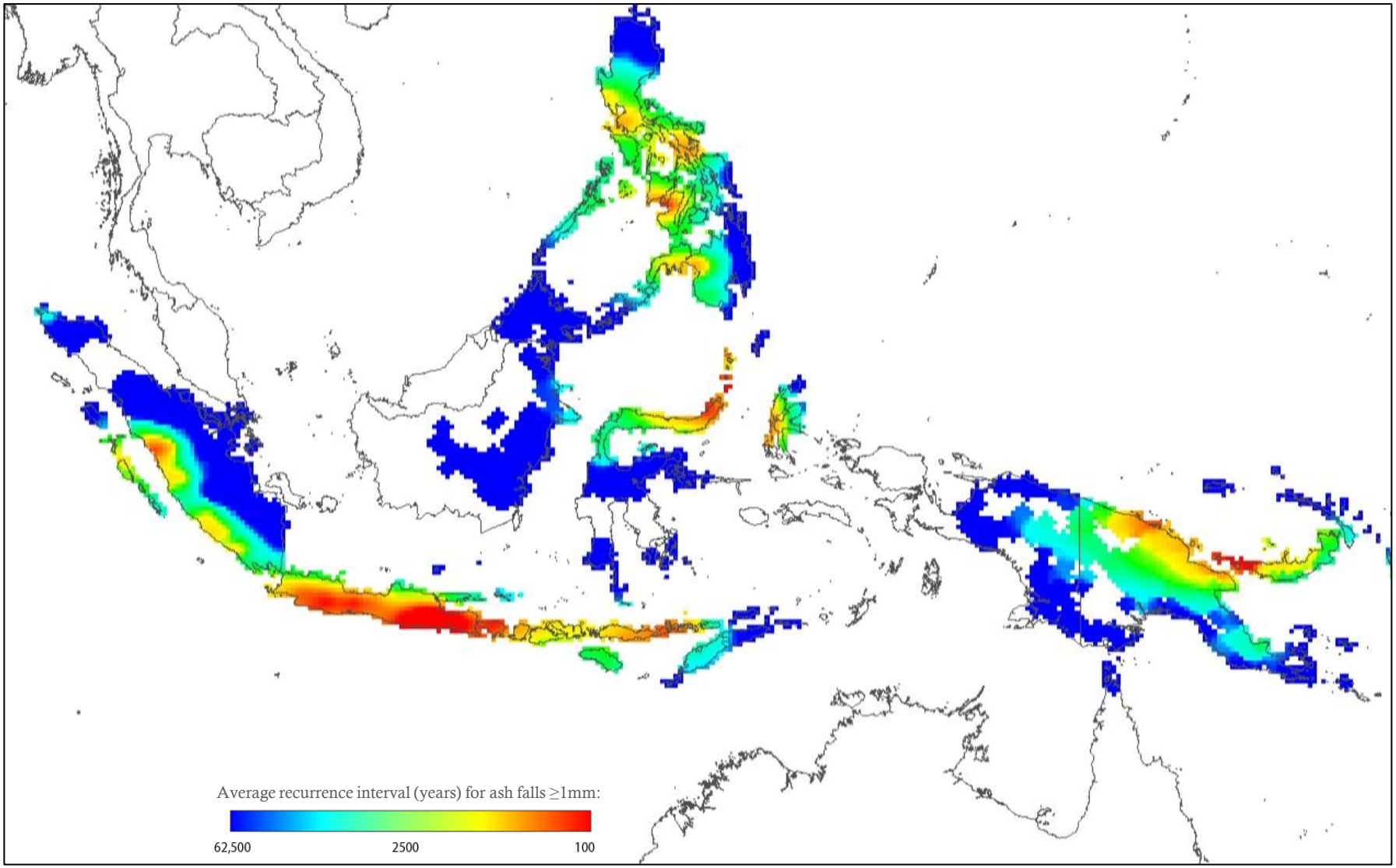

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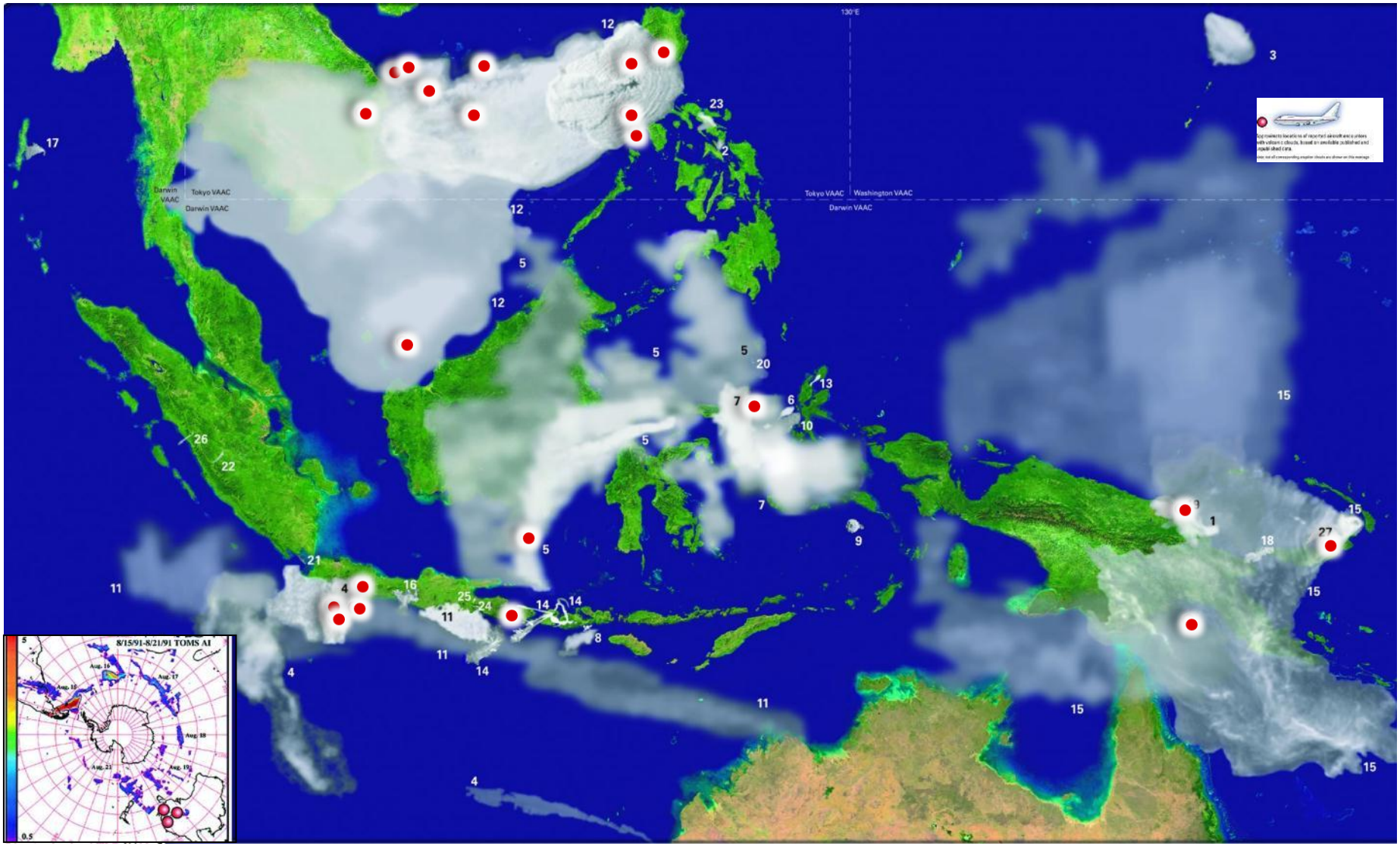
27 ash encounters in Darwin VAAC 1979-2001:



http://www.bom.gov.au/info/vaac/publications/vapostermedium.jpg

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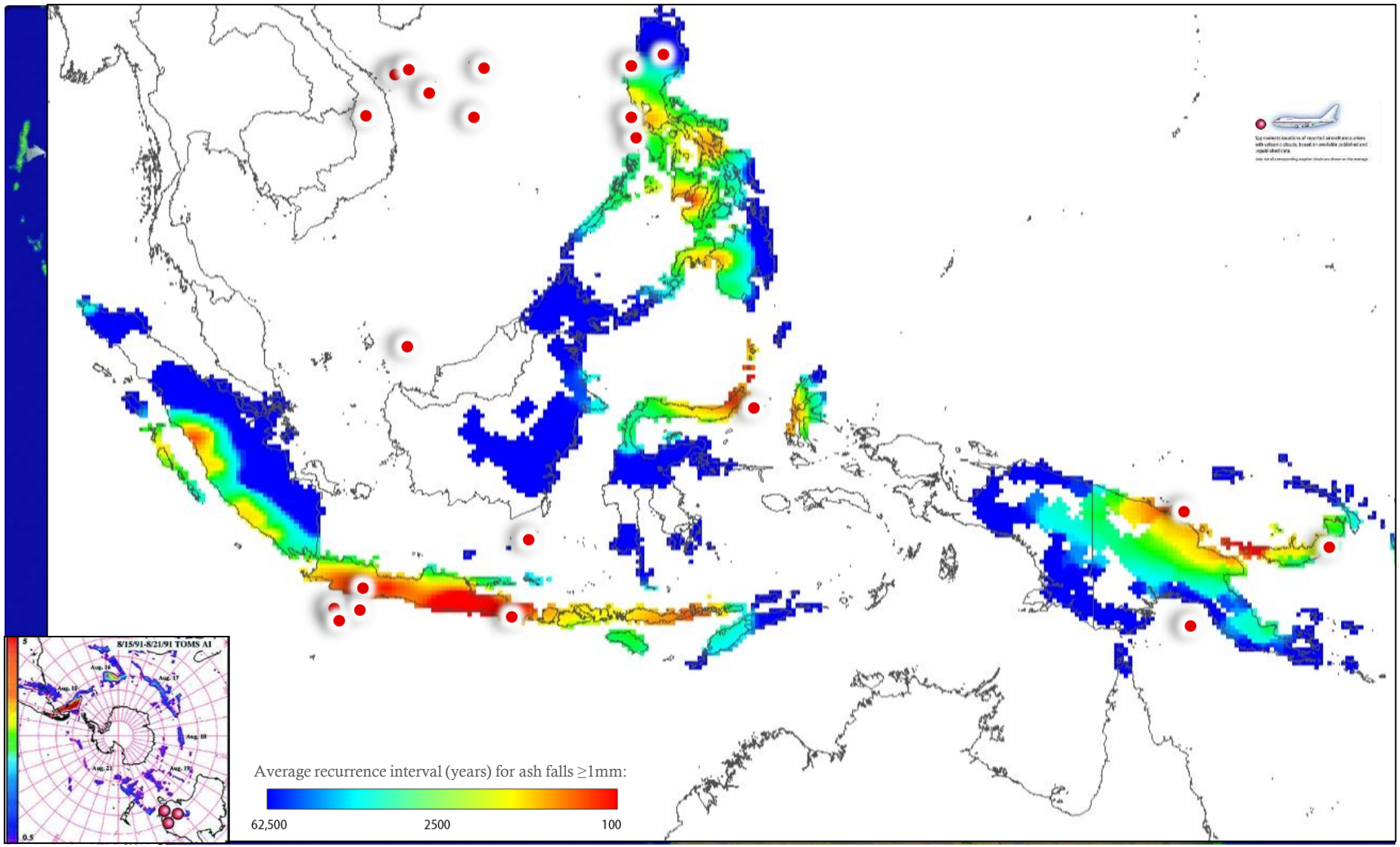

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CONCLUDING REMARKS

- **Probabilistic volcanic risk modelling is complicated by:**
  1. Production of multiple hazards that can occur contemporaneously and have different spatial extents, intensities, durations and consequences
  2. Relatively sparse dataset of previous eruptions, globally or at any one volcano, and few data regarding eruption impacts on populations and their activities
- **Recent advancements in volcanology include the use of event trees and expert elicitation to identify scenarios and their associated probabilities**
- **Challenges in volcanic probabilistic risk modelling include:**
  - The holistic probabilistic modelling of complex interconnected, varying hazards
  - Effect of simplifying complex numerical models for probabilistic modelling
  - The communication of probabilistic volcanic risk to public and authorities
  - Utilising probabilistic modelling in informing mitigation actions and decision-making such as evacuations and land-use planning

Thank-you!
Arigatou gozaimasu!

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Damage to the village of Balerante, 5km from Merapi volcano during the October-November 2010 eruption
Photo: courtesy of the village chief of Balerante