Australian Government
Geoscience Australia

Open Source Volcanic Ash Modelling

Volcanic ash is the most widespread of volcanic hazards and has the potential to affect hundreds of thousands, or even millions, of people living in the vicinity of active volcanoes. Geoscience Australia is working with geoscience agencies in South East Asia to measure the potential impacts associated with ash from volcanic eruptions.

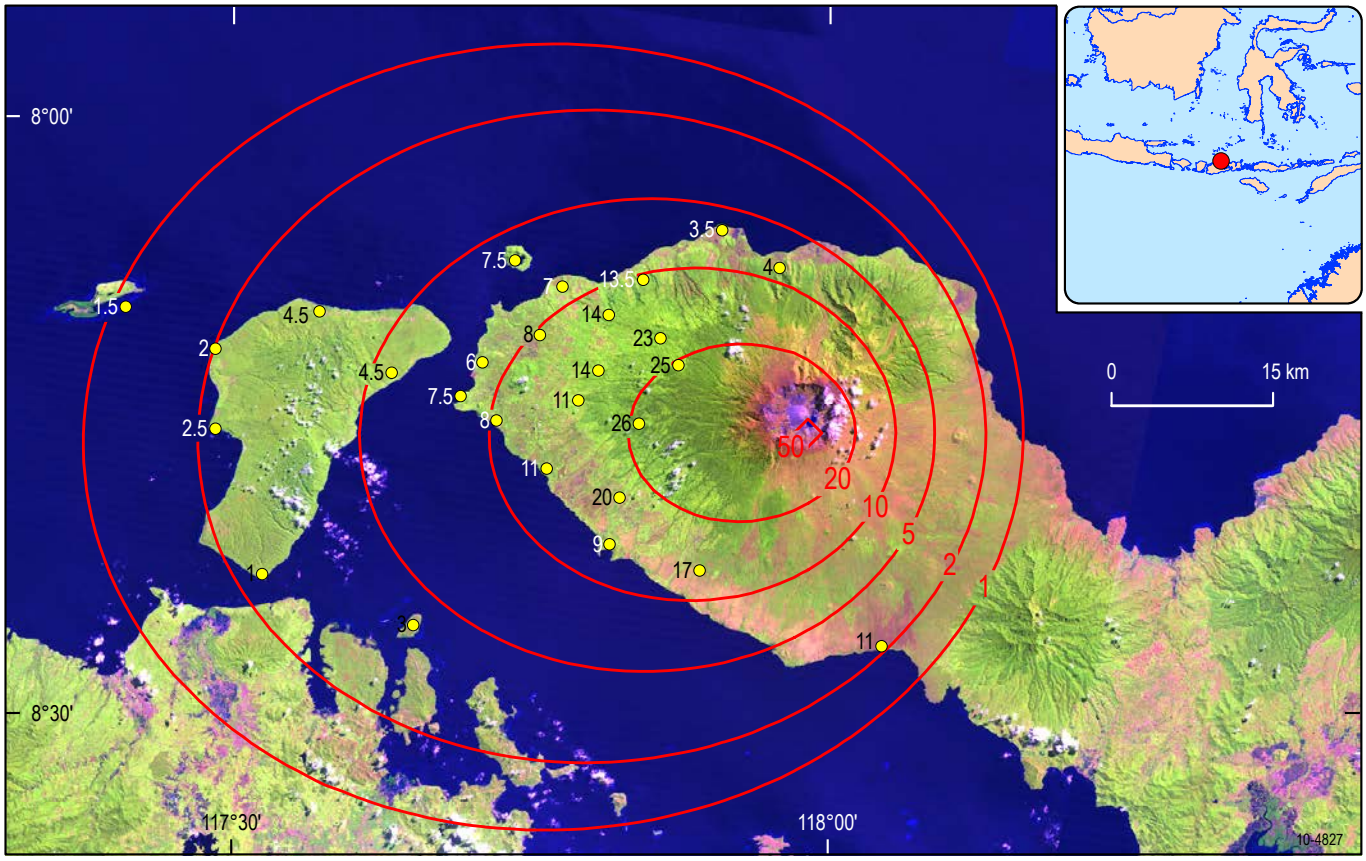
As well as holding the potential to cause significant loss of life, fallout of ash associated with volcanic eruptions can collapse structures, damage or destroy agriculture, contaminate water supplies and cause disruption to lifelines and transport services (eg. aircraft).

Current volcanic ash hazard maps feature a hazard zone around a volcano that reflects where ash may have accumulated in the past. This style of hazard map is typically insufficient for prepardness and planning. It cannot account for changes in the style or magnitude of known volcanic eruptions, changes in wind direction and speed, or volcanoes that haven't erupted during historical times.

To reduce the impact of volcanic ash, reliable estimates of where the ash will be distributed, how thick and how heavy (load) it will be at a given location are needed. Computational modelling is one tool that can be used. To maximise the effectiveness of such models they should be freely and readily accessible (i.e. open source), easy to use, well tested and validated.

Pompeii—Eruption of Vesuvius AD79.

Volcanic ash fallout—Tavurvur Volcano—Papua New Guinea.



Volcanic ash hazard map for the 1815 eruption of Tambora Volcano in Indonesia: the lines represent ash thickness as predicted by the volcanic ash hazard model and the points represent known ash thickness collected by volcanologists which have been used to validate the model result.

A number of techniques are employed for modelling volcanic ash hazards:

Historical eruption investigation:

Increasing our understanding of past eruptions for a region can help us determine which communities are living at risk. We use historical records and volcanic ash deposits to increase our understanding of how a particular volcano has erupted in the past and how it may behave in the future.

Scenario-specific volcanic ash hazard modelling:

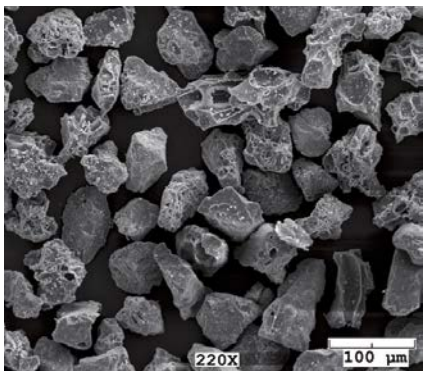
An eruption column laden with volcanic ash is simulated which considers the interaction between vent location, meteorological factors and surface topography. The wind field accounts for changes in wind speed, direction and temperature with altitude, all of which can greatly influence the transport and deposition of volcanic ash particles. The model is used to estimate the volcanic ash distribution across the landscape.

Model validation:

The volcanic ash hazard model must be validated before it can be used by emergency managers. Validation can tell us how accurately the model reproduces observed volcanic ash deposits associated with historical eruptions. Modelled results are compared with known volcanic ash deposits. This gives emergency managers confidence in the model as a predictive tool.

Further information:

Email: naturalhazards@ga.gov.au | Tel: 1800 800 173
Web: www.ga.gov.au/hazards



Scanning Electron Microscope (SEM) images of volcanic ash particles featuring rough abrasive edges.

Volcanic ash cloud— Tavurvur Volcano— Papua New Guinea.

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