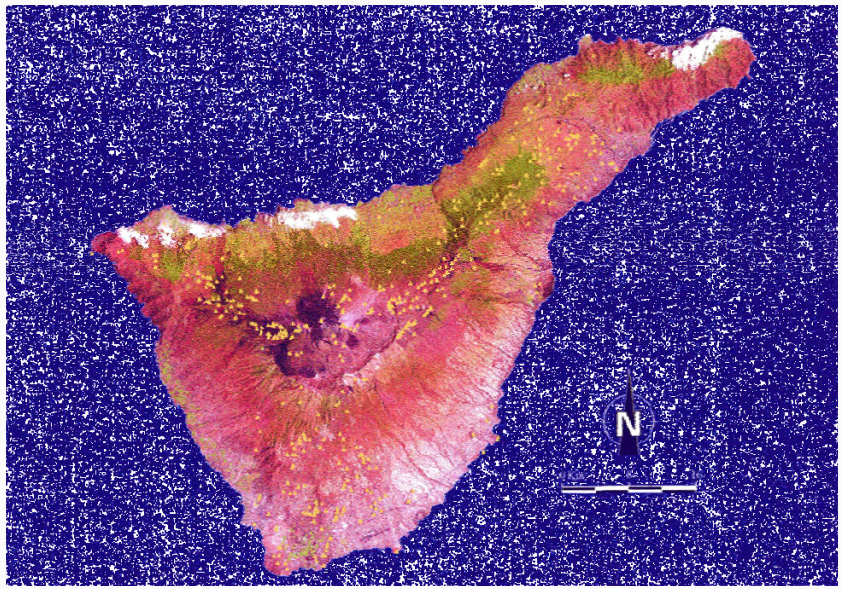
MINISTERIO DE EDUCACIÓN Y CIENCIA

Instituto Geológico y Minero de España

A GIS-based volcanic hazard map for Tenerife at a 1:25,000 scale



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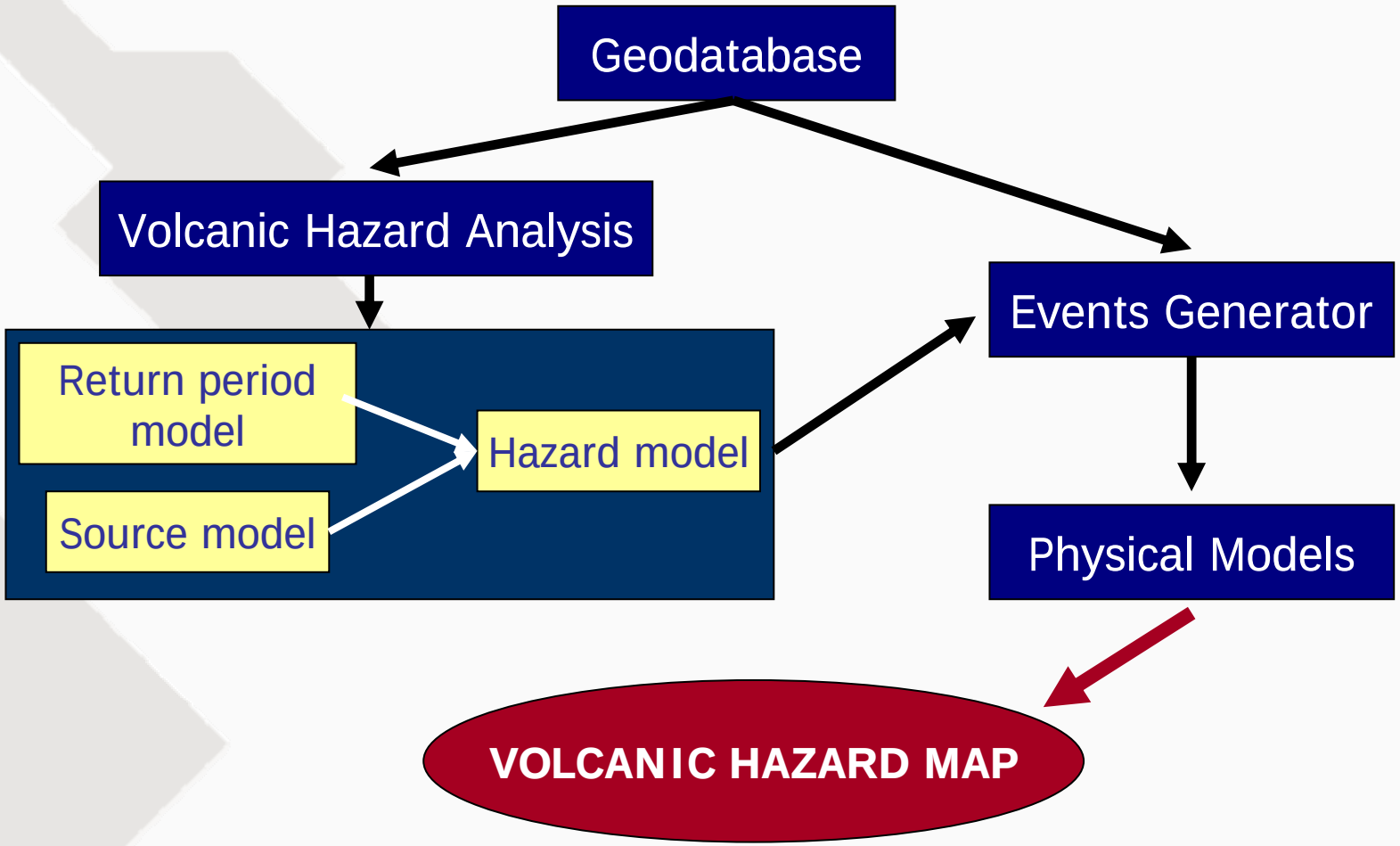
M. J. Mancebo, M. Llorente, F. Gómez, F. Real

IGME

Objective

The development of a methodology to map volcanic hazards in Tenerife at a 1:25,000 scale

Methodology



Geodatabase

Designed of a georreferenced database using ArcView® 9.2 by ESRI®

Advantages:

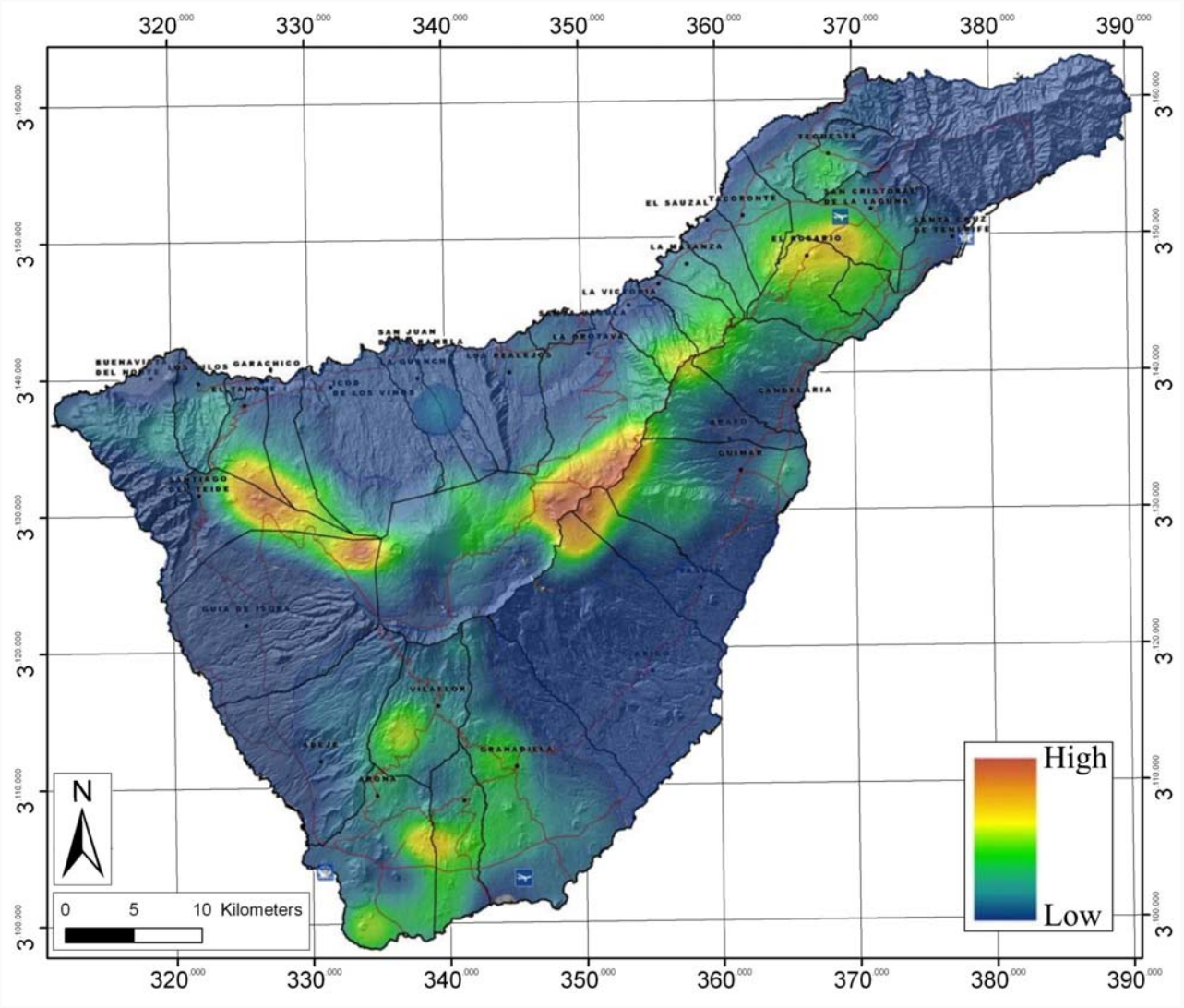
- Widely used
- Allows users to access, update and modify the information easily
- Allows users to integrate numerical models
- Automated generation of volcanic hazard maps

Source Model

Spatial probability of having an eruption

- Based on the analysis of volcanic vents distribution
- 764 vents
- Vents are grouped and their distribution pattern is spatial dependent
- 7 vents per eruption

Source Model



Return Period Model

Probability that an eruption might occur

- 71 published geochronological data
- Main eruptive style → Effusive fissure eruptions
- Magnitude (Lava flows) → VEI = 2-3
- An eruption per 400 years
- Number of simulations for a period of 100 ka:
  - 101 for the central area
  - 151 for the rift area

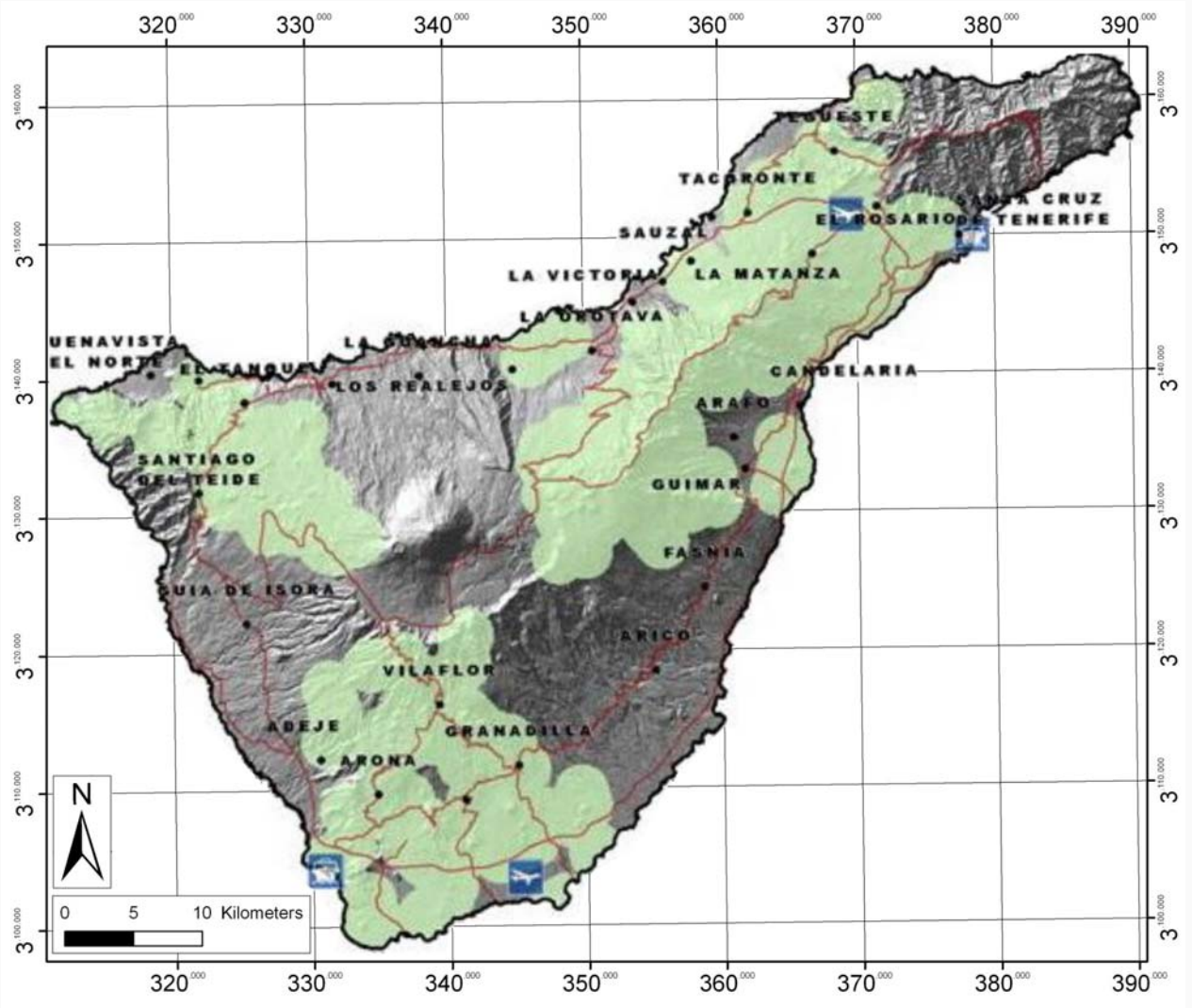
Hazard Model

Spatial probability of having an eruption of a given type and magnitude

- Several scenarios considered based on:
  - Magma composition
    - Basic to intermediate or salic
  - Eruptive evolution and history
    - Monogenetic or polygenetic
    - Related to Teide or not
  - Potential explosivity
    - Magma viscosity

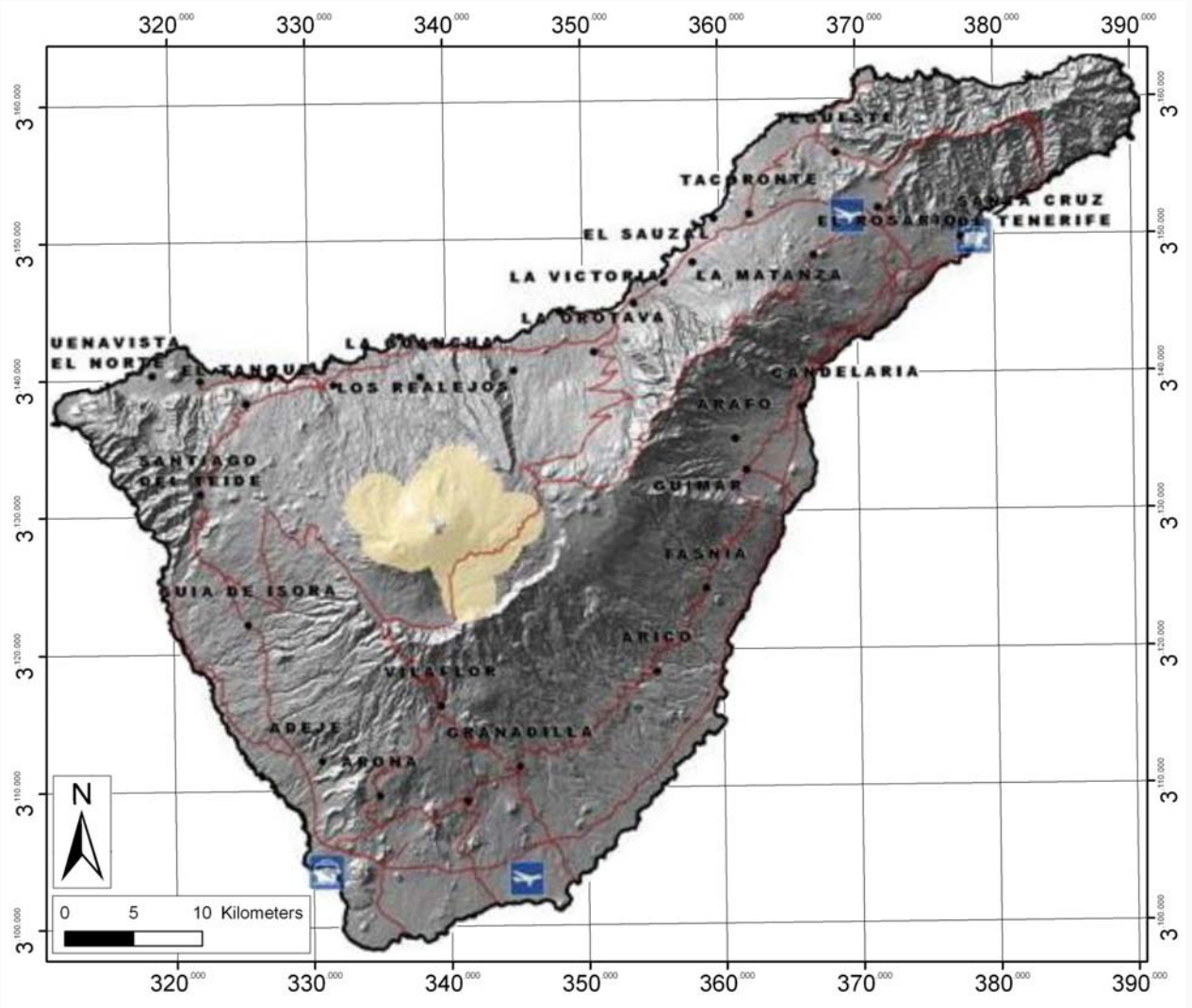
Hazard Model

Basic to intermediate shield volcanism



Hazard Model

Salic central volcanism



The Events Generator

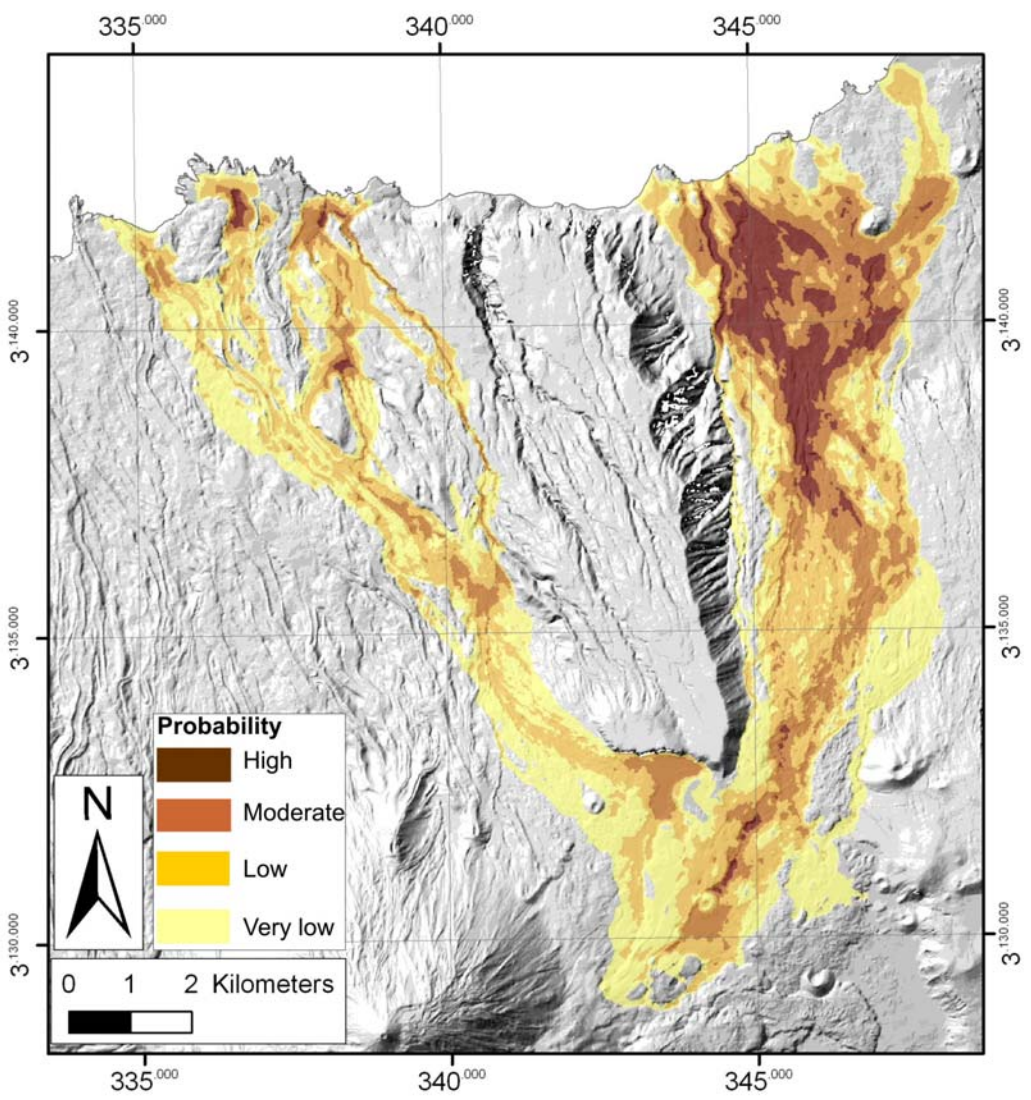
- Provides the number and type of scenarios that represent the eruptive behaviour in Tenerife
- Based on the alleatory sampling of variables (Monte Carlo method)
- Provides the data needed for the physical modelling

Lava flows model

Deterministic model based on cellular automata tech. *(Miyamoto and Sasaki, 1997)*

- Viscosity
- Density
- Emissivity
- Specific heat
- P and T

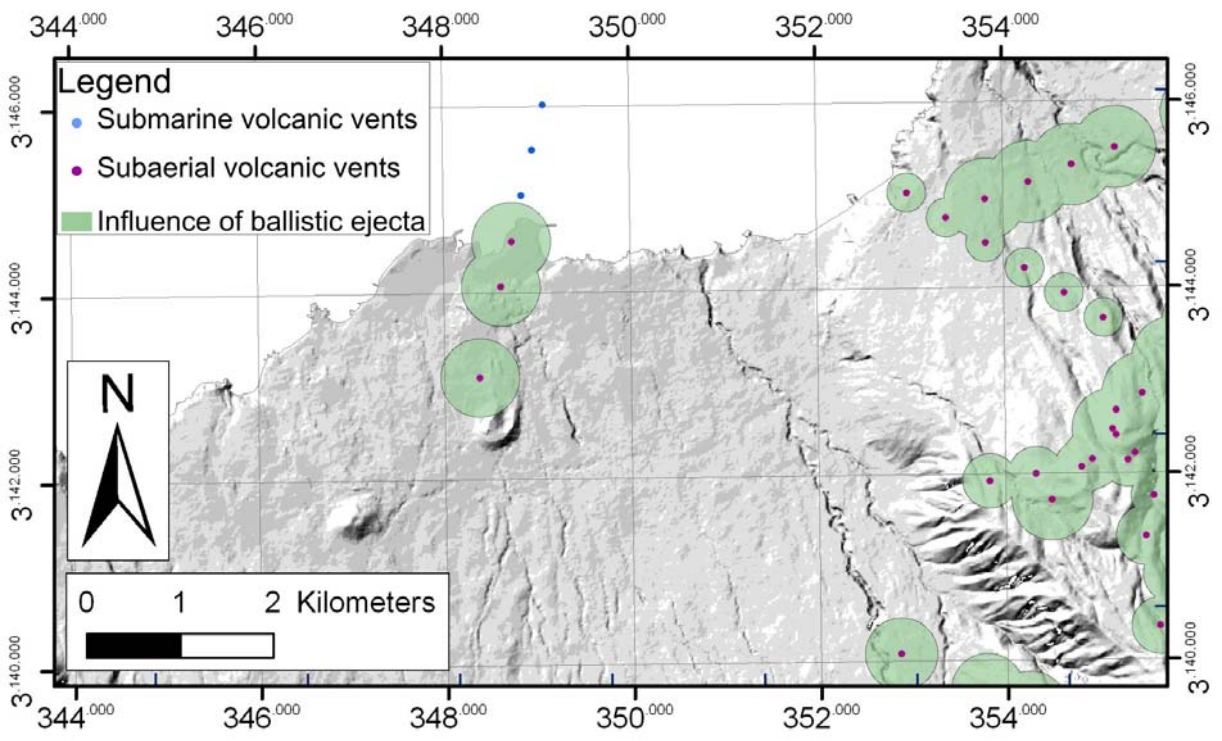
- Lava spatial distribution
- Thickness of the lava flow for each pixel



Ballistic ejecta model

Ballistic trajectories

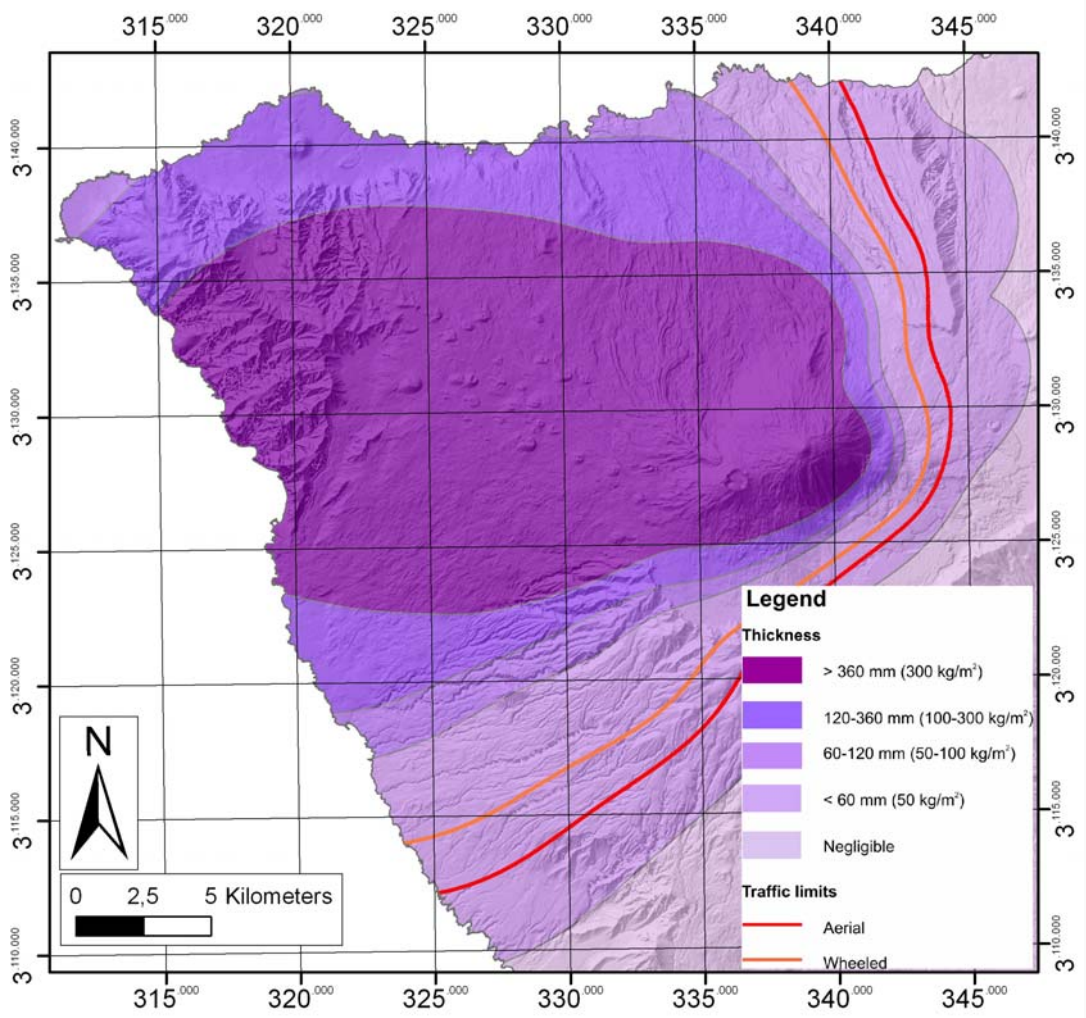
- *Earth's gravity*
- *Initial angle*
- *Initial fragment velocity*

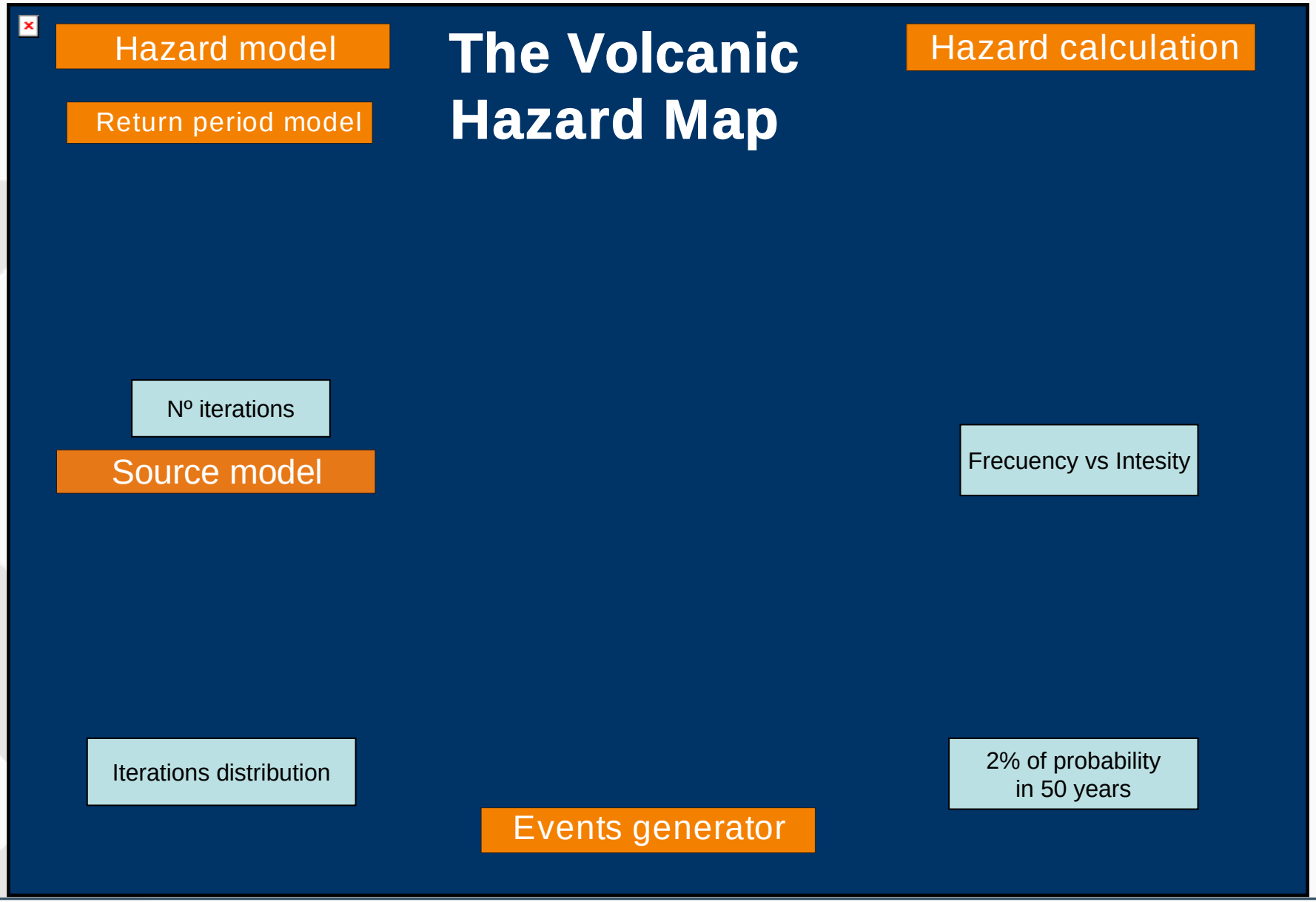


Ash fallout model

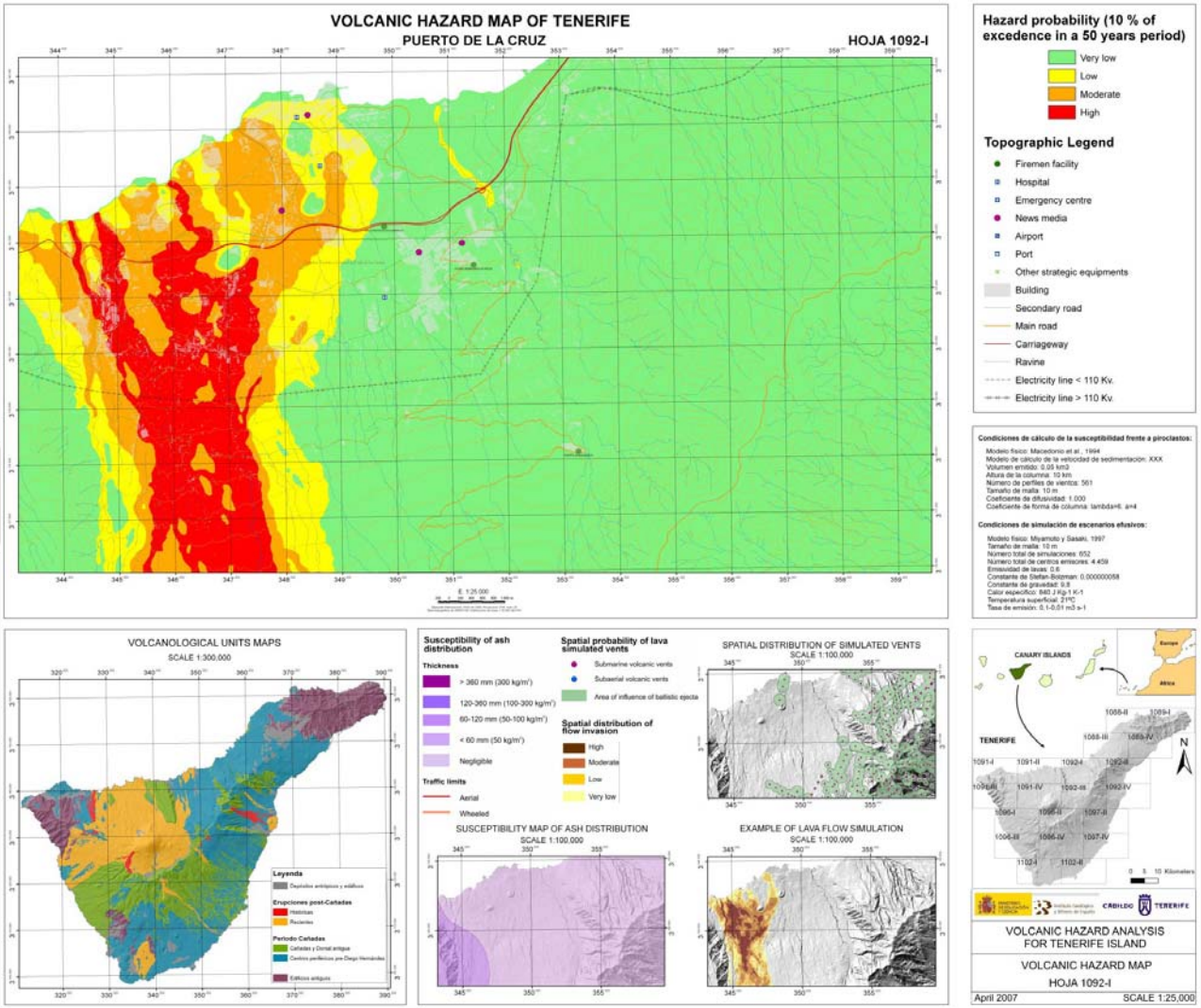
2.5D advection-diffusion model HAZMAP
(Pfeifer et al, 2003; Costa et al., 2003)

- *Wind distribution*
- *Magma volume*
- *Eruption magnitude*




Hazard model
Return period model
The Volcanic Hazard Map
Hazard calculation
Nº iterations
Source model
Frecuency vs Intesity
Iterations distribution
2% of probability in 50 years
Events generator

Printed version



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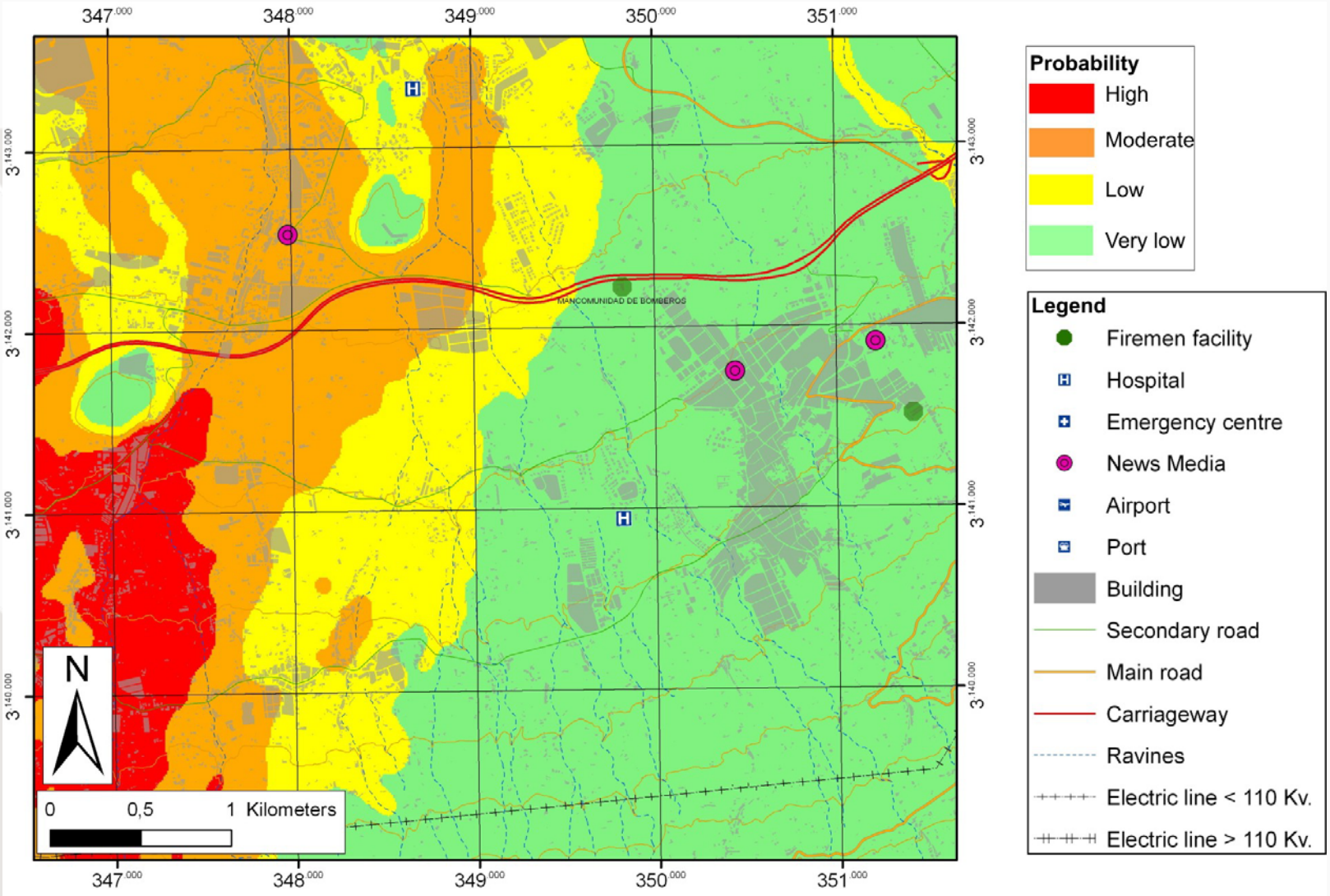
The Volcanic Hazard Map



Conclusions

- The methodology employed allows users to update and modify the data, and obtain different maps easily
- The preliminary volcanic hazard map of Tenerife is the current base for risk assessment and spatial planning regarding the future volcanic crisis in Tenerife

Projected Research Activities

- Generate new information and include it in the geodatabase
- The integration of a program for modelling piroclastic flows
- Improve the methodology including monitoring data
- Apply this method to other Canary Islands

Recommendations

- Creation of a cartographic infrastructure for geologic hazards
- Design and develop an information system for geologic hazards and promote its use
- Improve and develop new monitoring systems for geologic hazards

- Improve the understanding of monitoring data through basic studies and modelling
- Train specialists in Crisis Management
- Increase the transfer of knowledge about geologic hazards to citizens

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