VESUVIUS

Escaping from or cohabiting with the volcano?

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ESCAPING

VESUVIUS EVACUATION PLAN

Beneficiaries:
- Politicized regulatory group of geologists and geophysicists;
- Organizations using the territory surrounding the volcano for illicit purposes.

poor evacuation infrastructure
1,000,000 people within 10 km radius of crater

Dispersion of 1,000,000 people, territory abandoned to speculators, culture destroyed, massive refugee problem for EU.

1. Deportation of 1,000,000 people from 24 communities surrounding the volcano;
2. Prediction of eruption 3 weeks in advance based on unspecified precursors;
3. Unreliable evacuation infrastructure;
4. Resettlement of evacuees all over Italy with no resettlement plans;
5. Abandonment of the evacuated territory without a return strategy;
6. Destruction of Vesuvian culture;
7. Opening of abandoned territory to speculators;
8. Encouraging decision makers to postpone indefinitely territorial interventions for making it resilient to future eruptions;
9. High risk of draining the national treasury with false alarms;
10. Involving European Union to deal with refugees;
11. This risk management strategy is neither resilient nor sustainable.

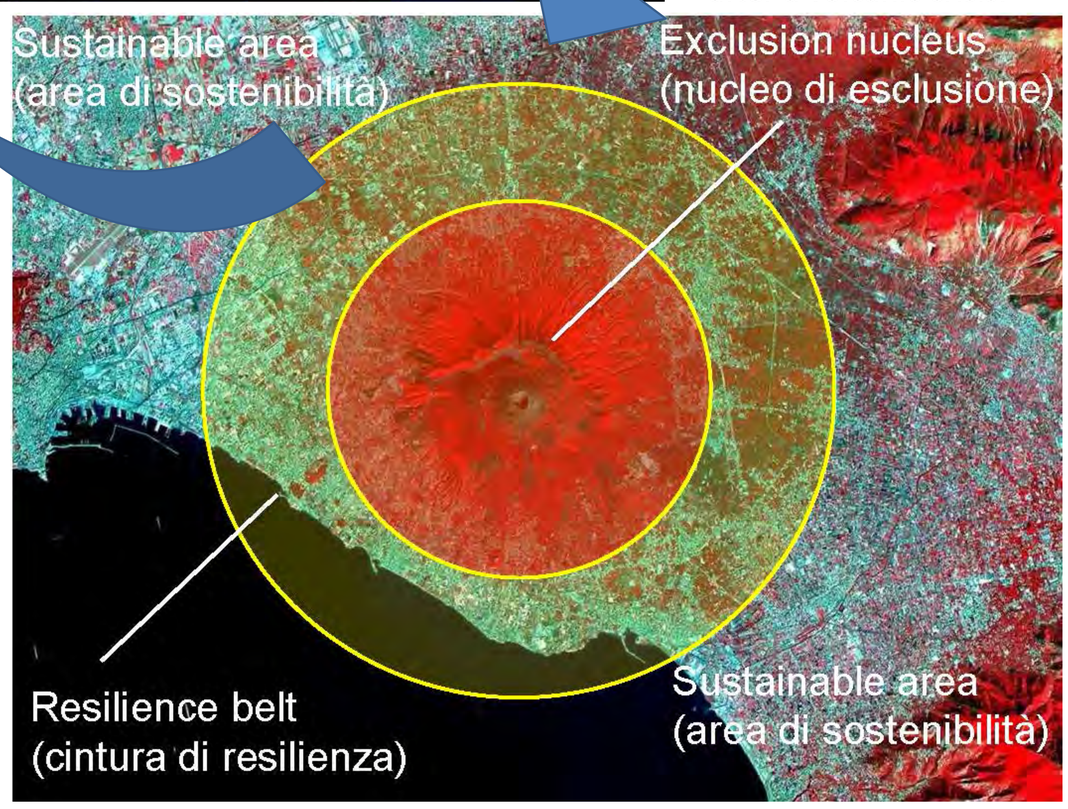
COHABITING

VESUVIUS PENTALOGUE (VESUVIUS 2000)

Beneficiaries:
- Vesuvius area residents wanting security and prosperity;
- Advocates of resilience and sustainability.

Temporary resettlement of population into sustainable areas until the volcanic crisis subsides.

Territory and culture recuperated after a volcanic crisis.



1. Vesuvius evacuation plan is problematic and unacceptable. Require: (a) "temporary settlements" for inhabitants close to their native homeland, until the volcanic crisis subsides; (b) minimization of the effects of the eruptions on the built environment;
2. A continuing close habitation of the population with the volcano requires redefinition of the *danger zone* around Summa-Vesuvius:
   - ❑ **EXCLUSION NUCLEUS** should be established that prohibits all future human settlements and discourage the existing ones;
   - ❑ **RESILIENCE BELT** housing most of the current population should be established, where: (a) All structures (new and existing) conform to specifically drafted construction codes based on *maximum plausible seismic and volcanic actions scenarios*; (b) Comprehensive "scenario evacuation plans" for the population within this belt to be implemented as backup strategies;
   - ❑ **SUSTAINABLE AREA** should be established beyond the resilience belt, allowing for both *sustainable practices* and *temporary resettlements* of the "resilience belt" citizens.
3. Built environment construction codes for the danger zone based on: Plinian eruption scenarios; scenario-based seismic hazard assessment and zonation, dynamic structural analyses, global volcanic simulations modeling of eruption processes;
4. Volcanic risk information and education should involve: (a) An effective volcanic risk information campaign and active public preparedness strategy; (b) Volcanic Risk Education Safety Program in all schools surrounding the volcano;
5. Effective collaboration between political authorities, scientific community, and population.

ELEMENTS OF VESUVIUS PENTALOGUE

Probabilistic Risk analysis

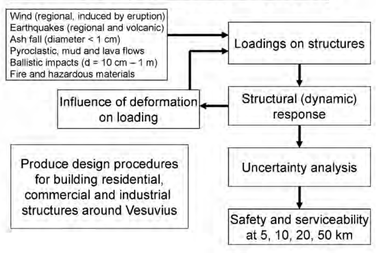
- Risk analysis tries to answer the questions:
  - What can happen?
  - How likely is it to happen?
  - If it happens, what are the consequences?
- Risk analysis includes
  - All possible scenarios S_i
  - Likelihood of each scenario L_i
  - Consequences of ith scenario X_i

$$R = (S_i, L_i, X_i)_{complete}$$

Seismic Zonation

- Scenario-based deterministic approach
  (Klügel Mualchin & Panza, 2006; Panza, Romanelli & Vaccari, 2001)
  - determine scenario earthquakes for considered locations
    - identify seismogenic zones, faults
    - identify largest earthquakes from each source
    - identify gelological, geotechnical, geophysical site conditions
    - establish attenuation relations for propagation of seismic signals
    - determine likelihoods of scenarios
    - establish uncertainty of modeling parameters
  - determine design parameters for structural analysis
    - ground displacement spectrum at location(s) of interest
    - ground velocity spectrum at location(s) of interest
    - ground acceleration spectrum at location(s) of interest

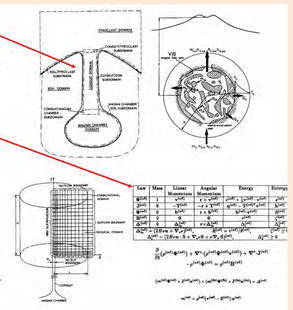
Vulnerability of structures



Global Volcanic Simulator

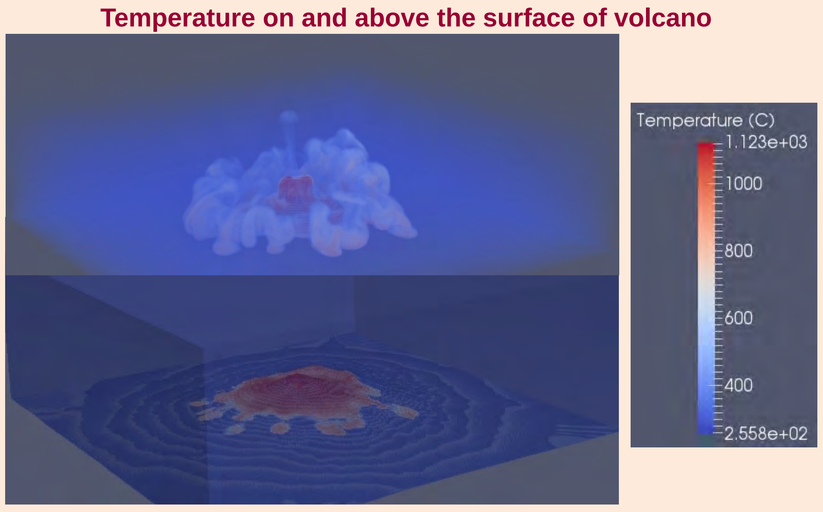
Dobran (1993, 1994, 2001, 2006)

- Physico-mathematical-computer model of volcanic system
- Determine scenarios and their likelihoods
  - Magma chamber dynamics
  - Opening of volcanic conduits
  - Conduit flow dynamics
  - Dispersion of pyroclasts in the atmosphere
  - Ash fall from eruption column
  - Propagation of pyroclastic, lava and mud flows
  - Dispersion of ballistic blocks
- Domain decomposition
  - magma chamber
  - conduit
  - soil and rock
  - atmosphere
- 3-dimensional
  - transient
  - multiphase
  - nonequlibrium
  - eulerian
  - lagrangean (ballistics)
- Numerical implementation
  - implicit
  - parallel computer architectures



PYROCLASTIC FLOWS OF A.D. 79 VESUVIUS ERUPTION

Temperature on and above the surface of volcano



Education