EUROVOLC

ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

APPLY TO ACCESS THE
VOLCANO DYNAMICS COMPUTATIONAL CENTRE
AT INGV PISA

When: the next call will open in **July 2019**

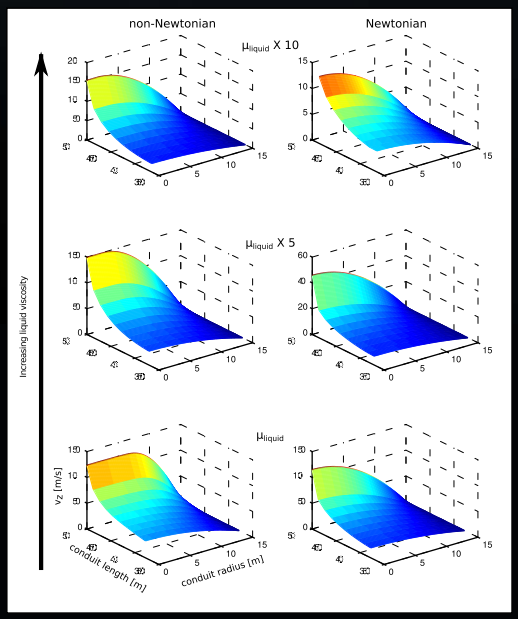
How: submit your work plan through the EUROVOLC website: **https://eurovolc.eu**

Who: everybody from anywhere

What: if successfully evaluated, your travel and subsistence costs will be supported (see the call for detailed information) to develop your work plan with the code developers and expert code users.

Within the framework of the H2020 project EUROVOLC,
INGV Pisa provides the computational offer described below.
Please contact ***chiara.montagna@ingv.it*** for further information.

EUROVOLC (European Network of Observatories and Research Infrastructures for Volcanology) is a EU/H2020 project aimed at promoting an integrated and harmonized European volcanological community able to fully support, exploit and build-upon existing and emerging national and pan-European research infrastructures.



CONDUIT4 for conduit flow dynamics; FORTRAN

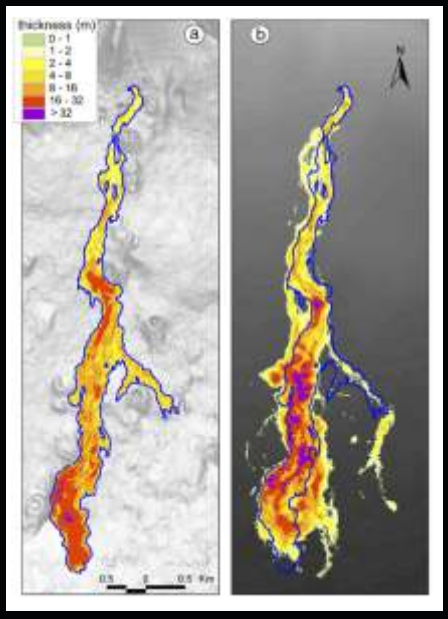
- 1.5D steady, compressible flow
- non-equilibrium multiphase dynamics
- non-ideal multi-component H2O+CO2 saturation (using SOLWCAD)
- non-Newtonian rheology
- dynamic model for magma fragmentation

→ *Papale, P., "Dynamics of magma flow in volcanic conduits with variable fragmentation efficiency and non-equilibrium pumice degassing." Journal of Geophysical Research 106 (2001): 11043.*
→ *Colucci, S., Papale, P., Montagna, C.P., "Non-Newtonian flow of bubbly magma in volcanic conduits." Journal of Geophysical Research 122 (2017): 1789.*

MrLavaLoba for lava flow dynamics; Python

- stochastic lava flow model
- probabilistic creation of new lava parcels from existing ones depending on topography slope
- area and thickness of final lava deposit as outputs
- tunable input parameters: topography, erupted volumes

→ *de' Michieli Vitturi, M., Tarquini, S., "MrLavaLoba: A new probabilistic model for the simulation of lava flows as a settling process." Journal of Volcanology and Geothermal Research 349 (2018): 323.*
→ *Tarquini, S., de' Michieli Vitturi, M., Jensen, E., Pedersen, G., Barsotti, S., Coppola, D., Pfeffer, M.A., "Modeling lava flow propagation over a flat landscape by using MrLavaLoba: the case of the 2014–2015 eruption at Holuhraun, Iceland." Annals of Geophysics 61 (2018): 28.*

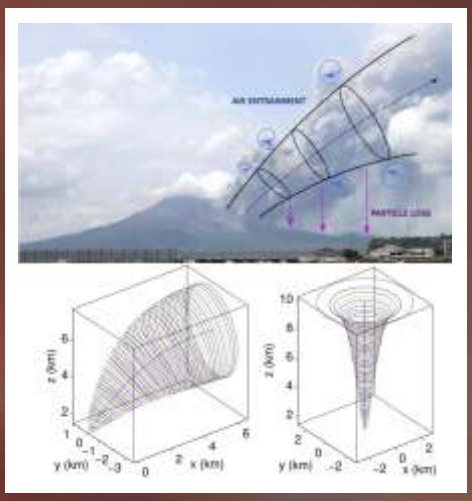


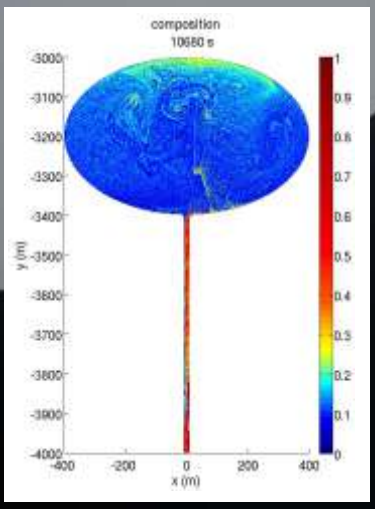
PLUME_MoM for volcanic plume dynamics; FORTRAN90

- steady-state integral plume model
- particle aggregation
- multiple gas species
- phase change of water: condensation and ice formation
- Pyhton scripts for coupling with volcanic ash transport and dispersion (VATD) models

→ *de' Michieli Vitturi, M., Neri, A., Barsotti, S., "PLUME-MoM 1.0: A new integral model of volcanic plumes based on the method of moments." Geoscientific Model Development 8 (2015): 2447.*

→ *de' Michieli Vitturi, S.L. Engwell, M., Neri, A., Barsotti, S., "Uncertainty quantification and sensitivity analysis of volcanic columns models: Results from the integral model PLUME-MoM." Journal of Volcanology and Geothermal Research 326 (2016): 77.*





GALES for magma feeding systems; C++, parallel computing (HPC)

- 2D/3D multi-component magma flow dynamics in geometrically complex systems (reservoirs, dikes, conduits)
- space-time-composition dependent magma properties, non-Newtonian rheology, and H2O+CO2 saturation (using SOLWCAD)
- finite element solution method
- suited to simulate magma convection and mixing dynamics in volcanic plumbing systems

→ *Longo, A., et al, "Magma convection and mixing dynamics as a source of Ultra-Long-Period oscillations." Bulletin of Volcanology 74 (2012): 873.*

→ *Papale, P., Montagna, C.P., Longo, A., "Pressure evolution in shallow magma chambers upon buoyancy-driven replenishment." Geochemistry, Geophysics, Geosystems 18 (2017): 1214.*

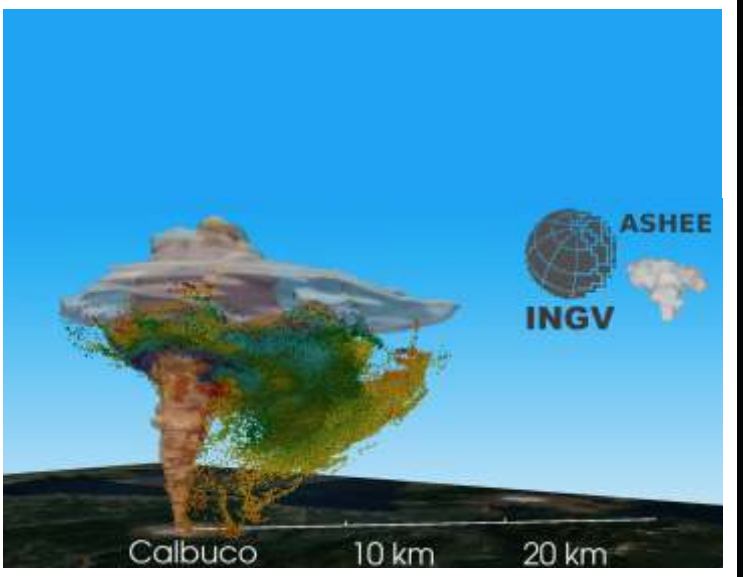
→ *Garg, D., Papale, P., Colucci, S., Longo, A., "Long-lived compositional heterogeneities in magma chambers, and implications for volcanic hazard." Scientific Reports 9 (2019): 3321.*

ASHEE for volcanic plume and dilute pyroclastic density current dynamics; C++/OpenFOAM, parallel computing (HPC)

- 3D Eulerian-Lagrangian plume model for gas-particle two-way coupled turbulent, compressible mixtures
- efficient up to ca. 15 gas/ash Eulerian species, Lagrangian approach for lapilli and bombs
- particle settling and clustering, phase changes of water
- wind and topography in unstructured mesh, user-friendly pre/post-processing tools
- dynamic LES Turbulence model: no empirical parameters for entrainment and mixing

→ *Cerminara, M., Esposti Ongaro, T., Berselli, L. C. "ASHEE-1.0: a compressible, equilibrium–Eulerian model for volcanic ash plumes," Geoscientific Model Development 9 (2016): 697.*

→ *Cerminara, M., Esposti Ongaro, T., Neri, A. "Large Eddy Simulation of gas–particle kinematic decoupling and turbulent entrainment in volcanic plumes," Journal of Volcanology and Geothermal Research 326 (2016): 143.*



PDAC (Pyroclastic Dispersal Analysis Code) for volcanic columns and pyroclastic flow dynamics; FORTRAN90, parallel computing (HPC)

- 2D/3D non-equilibrium, compressible multiphase flow model for a mixture of gas and N Eulerian particulate phases
- Finite-volume solution method on a Cartesian rectilinear mesh
- Suited for simulating explosive eruption scenarios (e.g., Vulcanian and (sub)-Plinian eruption dynamics, volcanic blasts, pyroclastic flow propagation)
- Topography can be imported from ASCII DEM files and resolved with an immersed-boundaries method

→ *T. Esposti Ongaro, C. Widiwijayanti, A.B. Clarke, B. Voight, and A Neri. Multiphase-flow numerical modeling of the 18 may 1980 lateral blast at mount st. helens, usa. Geology, 39(6):535–538, 2011*

→ *T. Esposti Ongaro, C. Cavazzoni, G. Erbacci, A. Neri, and M.V. Salvetti. A parallel multiphase flow code for the 3d simulation of explosive volcanic eruptions. Parallel Computing, 33(7-8):541–560, 2007*

Graphics: P. Pantani