



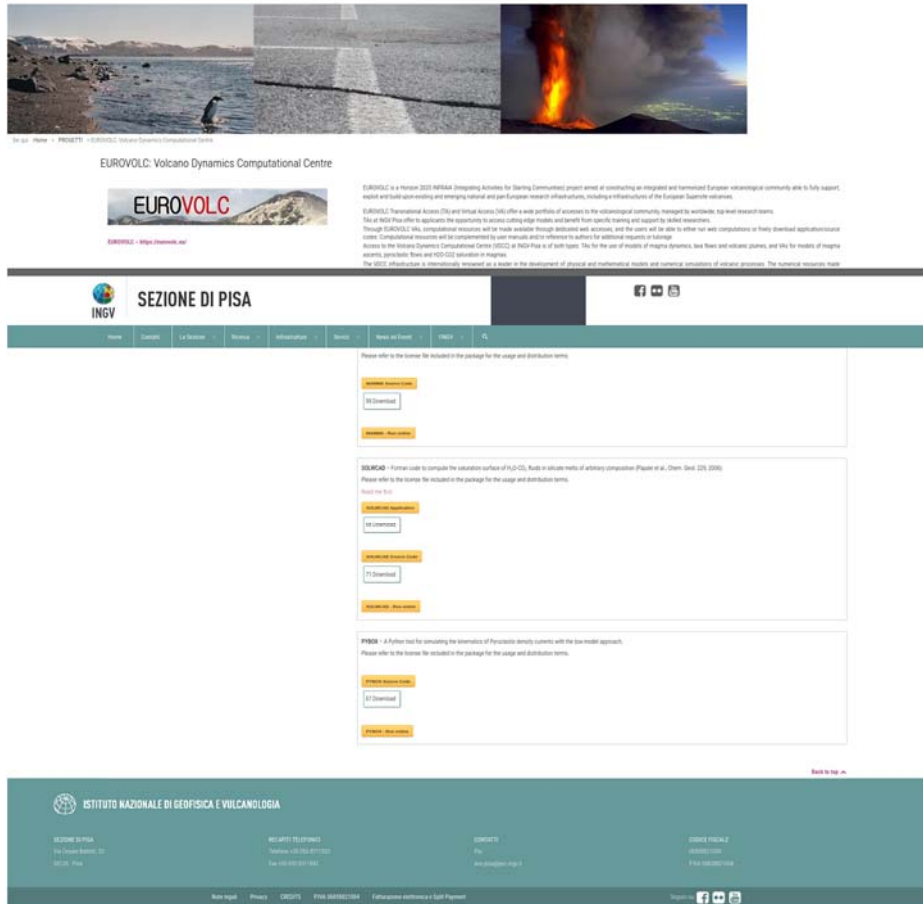
WP18

Access to the *Volcano Dynamics Computational Centre*
at INGV Pisa

VIRTUAL ACCESS

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Virtual Access active since March 2019



EUROVOLC: Volcano Dynamics Computational Centre

EUROVOLC is a Horizon 2020 INFRAIA (Impulsing Activities for Starting Communities) project aimed at constructing an integrated and harmonized European volcanological community able to fully support, exploit and build upon existing and emerging national and pan-European research infrastructures, including a Infrastructure of the European South-West volcanoes.

EUROVOLC Transnational Access (TA) and Virtual Access (VA) offers a wide portfolio of resources to the volcanological community, ranging from academic, top-level theoretical teams. TA or VA Plus offer to applicants the opportunity to access cutting-edge models and datasets from specific training and support by skilled researchers.

Through EUROVOLC VA, computational resources will be made available through dedicated web interfaces, and the users will be able to either run web-computations or freely download application-specific codes. Computational resources and the corresponding to user manuals are in reference to submit the additional requests or change Access to the Volcano Dynamics Computational Centre (VDC) at PISA-Plus in all types. This for the use of models of magma dynamics, lava flows and volcanic plumes, and also for models of magma ascent, permeability flow and H2O-CO2 exsolution in magmas.

The VDC infrastructure is intentionally wrapped as a suite in the development of physical and mathematical models and numerical simulations of volcanic processes. The numerical resources made

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- EUROVOLC** - Python code to compute the subsurface surface of H₂O-CO₂ fluids in a static model of arbitrary composition (Paganò et al., Chem. Geol. 225, 2006).
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- SEISIM** - Python code to compute the subsurface surface of H₂O-CO₂ fluids in a static model of arbitrary composition (Paganò et al., Chem. Geol. 225, 2006).
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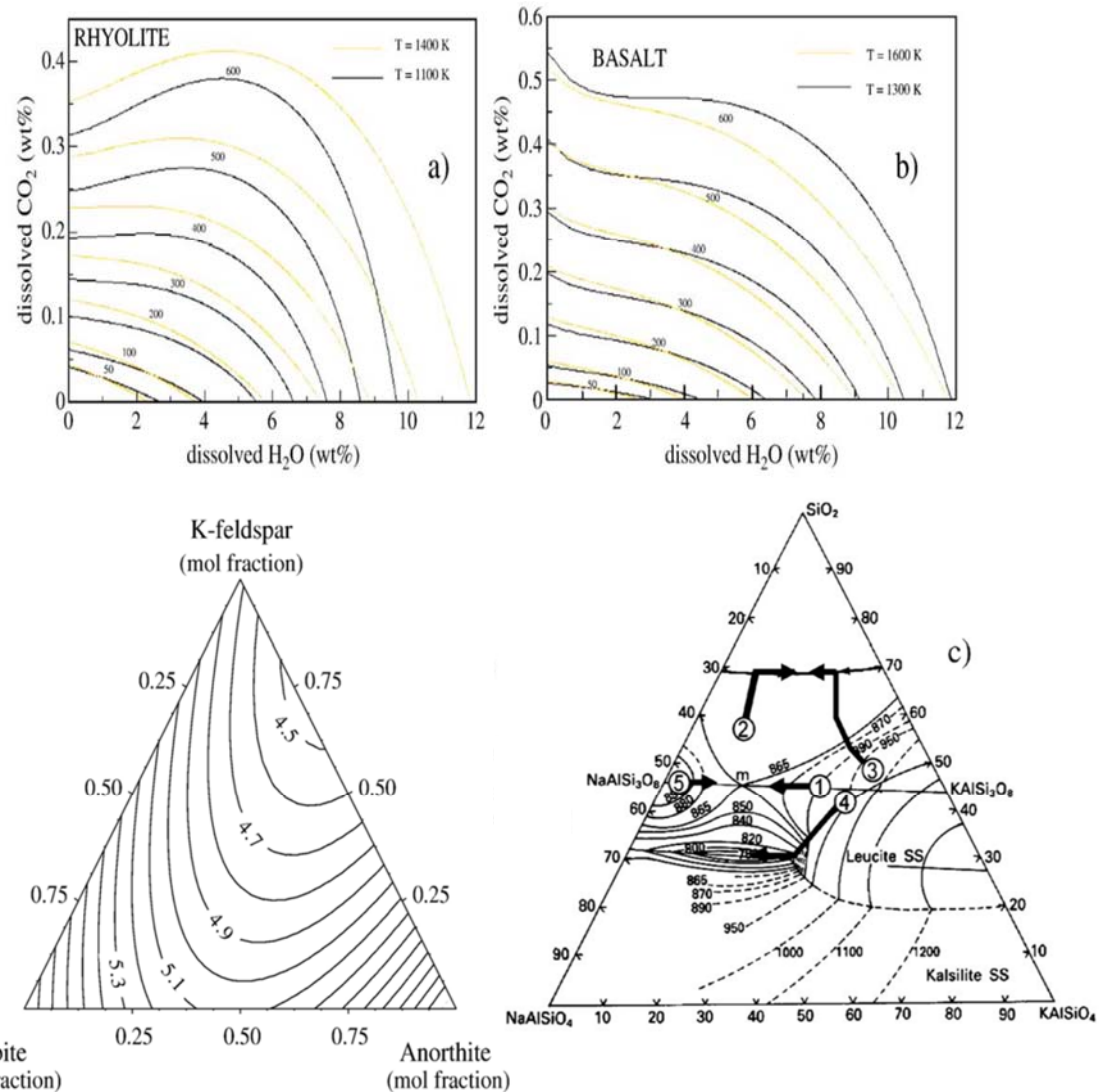
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SOLWCAD

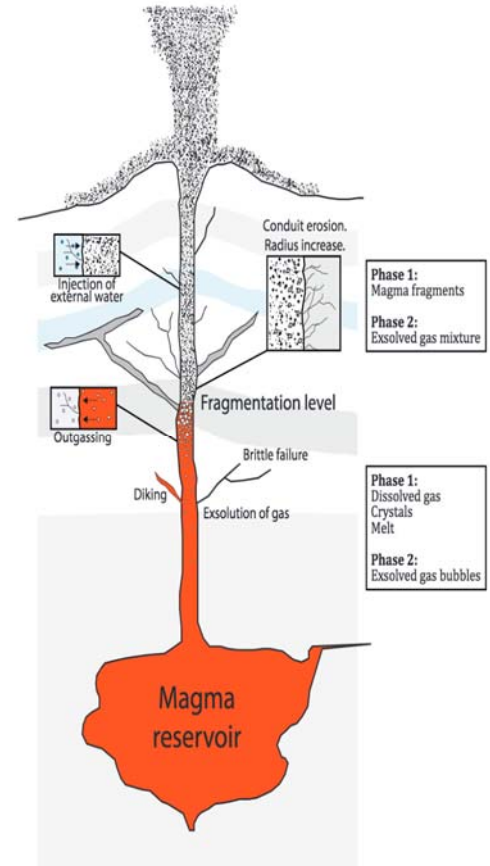
SOLWCAD is a Fortran code that computes the **fully non-ideal**, multi-component, compositional-dependent saturation surface of H_2O+CO_2 in silicate melts over P-T-composition conditions relevant to magmatism and volcanism. Calculations allow to either **1)** determine the partition of H_2O and CO_2 between the melt and gas phase, or **2)** determine the entrapment pressure and corresponding gas phase composition from dissolved amounts.



Papale, P., Moretti, R., Barbato, D., The compositional dependence of the saturation surface of $H_2O + CO_2$ fluids in silicate melts. *Chem. Geol.* 229, 78-95 (2006).

MAMMA (Magma Ascent Mathematical Modeling and Analysis)

MAMMA is a FORTRAN90 code designed to solve a conservative model for magma ascent in a volcanic conduit, described as a compressible multicomponent two-phase flow. The system of conservation equations considers the effects of the main processes that magmas experience during ascent, such as crystallization, rheological changes, fragmentation, physical interaction with conduit walls, outgassing and degassing. The model is capable of describing conduits with elliptical cross sections and depth-dependent dimensions.



Aravena, A, M. de' Michieli Vitturi, R. Cioni, and A. Neri. "Physical constraints for effective magma-water interaction along volcanic conduits during silicic explosive eruptions." *Geology* 46, no. 10 (2018): 867-870.

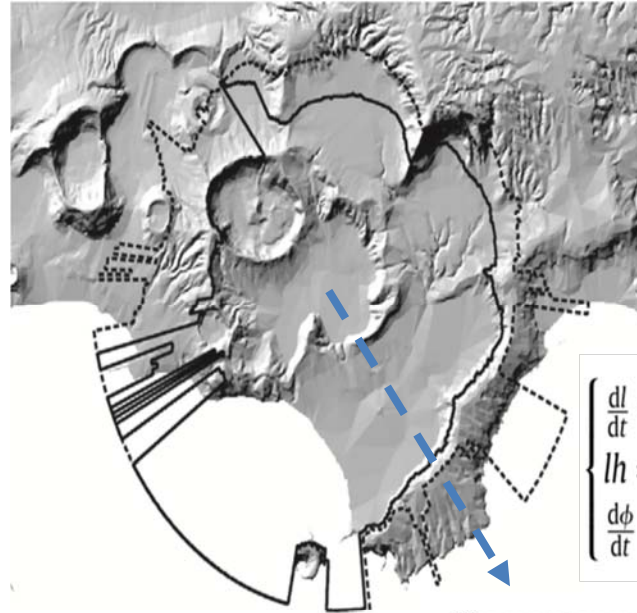
La Spina, G, M. Burton, M. de' Michieli Vitturi, and F. Arzilli. "Role of syn-eruptive plagioclase disequilibrium crystallization in basaltic magma ascent dynamics." *Nature communications* 7 (2016): 13402.

PyBOX

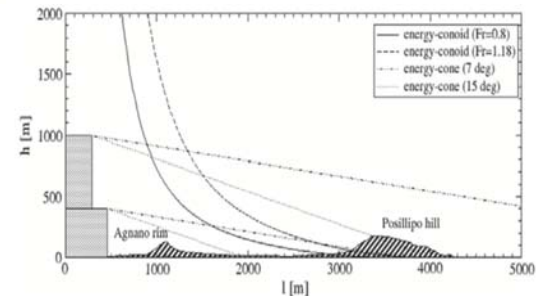
PyBOX is a Python/Fortran90 code that solves the so-called «box model» equations describing the kinematics of a pyroclastic density current over a flat surface and in a steady atmosphere.

The model integrates a procedure to account for blockage of PDCs by a rugged topography imported as a ASCII file, by adopting the so-called «energy-conoid» approach.

Virtual Access will include an interface to import the DEM file and input parameters and to visualize georeferenced maps of invasion and plots of decaying dynamic pressure.



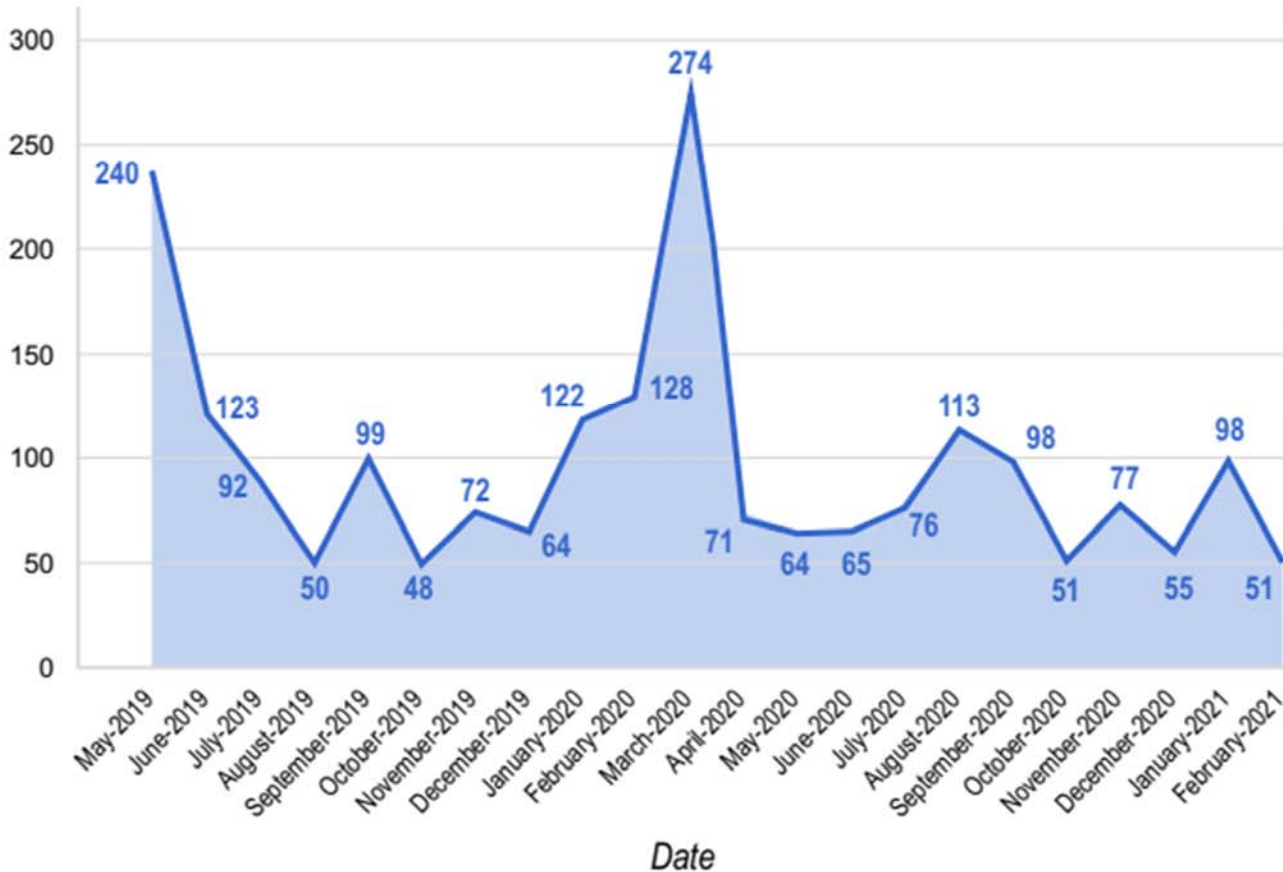
$$\begin{cases} \frac{dl}{dt} = Fr(g'h)^{1/2} = Fr(g'_p \phi h)^{1/2} \\ lh = l_0 h_0 = A \\ \frac{d\phi}{dt} = -\frac{w_s \phi}{h} \end{cases}$$



Esposti Ongaro, T. , Orsucci, S., & Cornolti, F. (2016). A fast, calibrated model for pyroclastic density currents kinematics and hazard. *Journal of Volcanology and Geothermal Research*, 327, 257-272.

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The future

- Add entries to EUROVOLC wiki
- Add another package to calculate synthetic geophysical signals
- After EUROVOLC the infrastructure will most probably be maintained within
EPOS ERIC