

Volcano and Seismic source Modelling VSM

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Abstract—The VSM (Volcano and Seismic source Modelling) tool is a Fortran code used to model ground deformation detected by the most common geodetic techniques (interferometric SAR, GPS, leveling and EDM - Electro-optical Distance Measuring). VSM performs geophysical inversion modeling of ground deformation to retrieve the parameters of the causative magmatic source, or to retrieve the seismic source parameters. A magmatic source can be approximated (modeled) by a confined part of crust with a certain shape (e.g., a sphere, a sill, a dyke, a spheroid), which is inflating/deflating because of a change in the internal magma/gas pressure. Each shape generates a specific surface deformation pattern, and comparing the modeled deformation with that actually observed at the surface, it is possible to estimate the best-fit source parameters. The same applies to the seismic source, that is commonly described as a rectangular plane with dip and strike angles. The VSM tool carries out this task by minimizing the difference between the observed and the computed displacement field, through a global optimization process. The VSM tool allows the user to choose among several geometrical sources: sphere (Mogi, 1958), spheroid (Yang et al., 1988), ellipsoid (Davis, 1986), fault (Okada, 1992), sill-like source (Fialko et al., 2001) and retrieves the best-fit source parameters. More sources can be combined. The VSM software tool is developed by INGV, in Fortran 90. The non-linear inversion core is by M. Sambridge (1999). This Research Object contains the OSX and Linux executables, documentation and input/output if a real example applied to Campi Flegrei (Italy) with InSAR and GPS data. Please refer to documentation for further information. Contact: Elisa Trasatti elisa.trasatti@ingv.it.

Index Terms— geodetic data; volcano deformation; source model; magmatic source

I. INTRODUCTION

This document provides a paper-style view of the Research Object (RO) “Volcano and Seismic source Modelling VSM”¹, which is a release generated on 18 October 2019 from the live RO “Volcano and Seismic source Modelling VSM”². The ROs have been created, managed and preserved via ROHub platform [1]. Please refer to [2] for a general introduction to the RO concept, to [3] for a detailed description of the RO model, and to [4] for more information about ROHub platform.

The RO is of type “Workflow-centric”, which represents an aggregation of related resources where scientific workflows play the central role.³

An overview of this RO is depicted in Figure 1. In summary, the results obtained include

¹http://sandbox.rohub.org/rodl/ROs/volcano_source_modelling_vsm-release/

²http://sandbox.rohub.org/rodl/ROs/volcano_source_modelling_vsm/

³See RO types definitions at <http://w3id.org/ro/earth-science#>

VSM_results_example.zip⁴; Additionally, this RO has been enriched automatically with the following annotations:

- concepts (most frequently mentioned in the RO): *sources, DEFORMATION, Error, field, FAULTS, max, min, DATA, SPACE, Coo, displacements*
- domains (fields of knowledge in which the main concepts are commonly used): *physics, mathematics*
- frequent expressions (most frequently mentioned noun phrases): *expressions of Mansinha, analytical expression, shear fault, GPS data, VSM software tool*
- named entities (most frequently mentioned):
 - Places: *VSM c c Volcano*

Note that the RO can be cited through its DOI [10.24424/ro-id.HRFPNERWFQ](https://doi.org/10.24424/ro-id.HRFPNERWFQ).

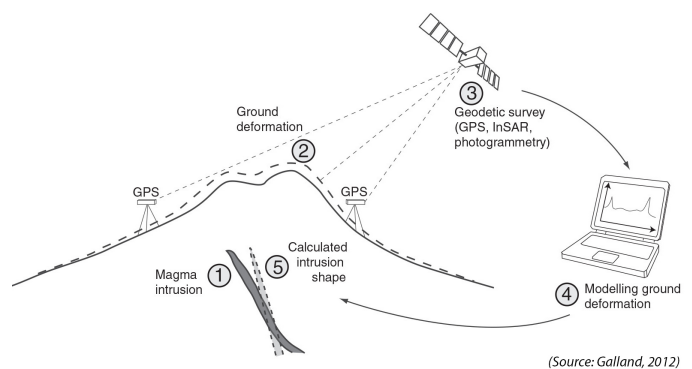


Fig. 1. Research Object Sketch

II. RESOURCES

The resources encapsulated by the RO are summarized in table I

ACKNOWLEDGMENT

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REFERENCES

- [1] The Research Object Management Platform - ROHub <http://www.rohub.org/>.
- [2] K. Belhajjame, O. Corcho, D. Garijo, J. Zhao, P. Missier, D. Newman, R. Palma, S. Bechhofer, E. García Cuesta, J. M. Gómez-Pérez, S. Soiland-Reyes, L. Verdes-Montenegro, D. De Roure, and C. Goble “Workflow-Centric Research Objects: First Class Citizens in Scholarly Discourse”, Proceedings of Workshop on the Semantic Publishing, SePublica Crete, Greece 28 May 2012.

⁴http://sandbox.rohub.org/rodl/ROs/volcano_source_modelling_vsm-release/VSM_results_example.zip

TABLE I
RESEARCH OBJECT RESOURCES

name	size	type
VSM_results_example.zip	1.1 MB	Result
description.rtf	2.4 KB	Document
VSM_RedHat_6.7	206.1 KB	Workflow
galland-eps1-2012-figura-2.jpg	272.6 KB	Sketch
VSM_example.zip	1.1 MB	WorkflowRun
HOW_TO_USE_VSM.pdf	249.3 KB	Document
VSM_input_example.zip	3.2 KB	Dataset
VSM_MacOS_10.14	219.0 KB	File
VSM_data_example.zip	46.4 KB	Dataset
VSM_ubuntu20.04	228.9 KB	File
VSM_ubuntu12.04	213.6 KB	File

- [3] Belhajjame K., Zhao J., Garijo D., Gamble M., Hettne K., Palma R., Mina E., Corcho O., Gómez-Pérez J. M., Bechhofer S., Klyne G., Goble C. "Using a suite of ontologies for preserving workflow-centric research objects", Journal of Web Semantics: Science, Services and Agents on the World Wide Web Available online 11 February 2015 ISSN 1570-8268.
- [4] Palma R., Corcho O., Gómez-Pérez J. M., Mazurek, C. "ROHub - A Digital Library of Research Objects Supporting Scientists Towards Reproducible Science". In Semantic Publishing Challenge of Proc. Extended Semantic Web Conference (ESWC) Crete, Greece 25-29 May 2014