



CAMPI FLEGREI CALDERA UNREST SCIENTIFIC SIMULATION 9th - 13th FEBRUARY 2014

SIMULATION PLAN



*Volcanic Unrest in Europe
and Latin America:
phenomenology, eruption
precursors, hazard
forecast, and risk
mitigation*

WP 9: Decision-making and
unrest management

Task 9.6: Simulation of unrest
and decision making



VUELCO
CAMPI FLEGREI CALDERA UNREST SCIENTIFIC SIMULATION
9th - 13th FEBRUARY 2014

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Premise

The simulation is carried out as part of the European project "VUELCO - Volcanic Unrest in Europe and Latin America: Phenomenology, Eruption Precursors, Hazard Forecast, and Risk Mitigation" (www.vuelco.net), funded by the European Union under the 7th Framework Program.

The simulation is designed to test the response of the scientific component of the National System of Civil Protection during a hypothetical, though plausible volcanic crisis at Campi Flegrei.

The simulation will place particular focus on communication procedures between the National Institute of Geophysics and Volcanology (INGV) and the Department of Civil Protection (DPC), on methods and procedures for the interpretation of scientific data and on crisis assessment and their possible scenarios, to support decisions of the Department of Civil Protection.

Not provided for in this simulation is the involvement of the Operational component of the National System of Civil Protection, nor of the local authorities, nor of the population.

Instead, in ways that are defined in the following, the simulation provides for the participation of scientists from other Latin American and European institutions involved in the VUELCO project, as well as for the participation of representatives of other civil protection structures of the countries involved in the project itself.

1. Introduction and purpose

The simulation is designed primarily to test the functionality and effectiveness of the entire supply chain that leads to predictive assessments (unrest or eruption), in support of operational decisions of civil protection in the event of a volcanic crisis.

In an ideal development of a crisis, it seems reasonable to expect a phase of "magmatic unrest", meaning a phase in which there occur relevant phenomena (earthquakes, deformations and increases in the release of fluids), produced by processes of magma migration, which may possibly be accelerated up to the event of an eruption.



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The transition from the stage of "magmatic unrest," produced by the processes of magma recharge of the superficial system, to the final magma ascent culminating in a possible eruption, could happen quickly, although the exact rate of transition is not known.

Likewise unknown with exactness a priori are the place where the eruption might occur and its scale. The simulation will help to better define how this general framework can be refined and/or corrected.

In this sense, the chain of acquisition, validation and processing of monitoring data (seismic, geodetic and geochemical), the process of analysis and comparative evaluation of the data, any possible modeling of the pre-eruptive and eruptive processes and the final assessment for operational purposes, will be test subjects.

The test will follow the current procedures that regulate the activity of volcanic monitoring and of communication between INGV and DPC, the assessment of the time table for the execution of certain procedures, the implementation of further monitoring actions.

The results expected from the simulation are the identification of potentially critical flaws, impacting the scientific chain, with particular reference to the robustness of the system of acquisition/transmission of data, on the speed of the system of analysis and evaluation of data to, on the compliance of the existing protocols to guarantee the effectiveness and speed of assessments.

The simulation will provide, in particular to the DPC, the opportunity to reflect on its current procedures, and enable the scientific participants involved (mainly INGV) to test their own internal procedures, making them more suited to the needs posed by a real volcanic crisis.

The participation of international representatives in the exercise will add further value to the event. The national component will in fact benefit from a neutral and competent participation, able to express opinions on the functionality, robustness and effectiveness of the system currently in use.

The test of the system currently operating at Campi Flegrei will prompt foreign representatives to confront a concrete case, characterized by high levels of risk, for which the possibility cannot be excluded that - in the future - a real crisis could actually occur.

According to the agreements between the DPC and the INGV, the latter shall describe "the event taking place or, when possible, formulate a prediction, even shortly after the occurrence of an event, its characteristics and its evolution."

The INGV, by means of bulletins and written reports, is expected to formulate:

- 1) Hazard evaluations related to the phenomena in progress;
- 2) Synthesis of the state of the volcano's activity and, where possible, information about its possible evolution in the short, medium term;



- 3) Overall synthetic assessment of phenomena, of the state of the volcano and of its possible evolution.

This simulation is intended to test the scientific evaluational activities that INGV and DPC will put in place, each according to their prerogatives and their roles and responsibilities in case of a volcanic crisis at Campi Flegrei.

In particular we aim to:

- a) verify the procedures and operating methods of survey, monitoring and evaluation of phenomena in progress;
- b) test the effectiveness of communications between INGV and DPC;
- c) test the use of probabilistic forecasts models, likewise developed under the project, during the evaluation phases of a volcanic crisis;
- d) test the methods of analysis and interpretation of data, of assessment of the crises, of the definition of possible scenarios, from the scientific component of the National System of Civil Protection to support decisions of the Department of Civil Protection;
- e) verify the procedures and modalities of interaction and communication between the Scientific Advisory Committee of the Department of Civil Protection and the Department itself;
- f) identify the strengths and weaknesses of the entire system to determine possible improvements;
- g) identify the needs of the decision-makers at every single stage, in order to improve the response of the scientific component;
- h) observe and assess the transition of alert levels to identify possible improvements.



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2. Agenda

The event will run from February 9 to 13, 2014. The actual simulation portion will take place over three days from the afternoon of the 10th (for the "Volcano Team," INGV, ASI, – IREA-CNR and DPC-CFC) / the morning of the 11th (for the rest of the participants: Italian experts invited by the DPC members VUELCO, etc.), until the morning of the 13th.

For more details about the schedule, please refer to the following section nr.5 "Simulation rules".

The general plan is as follows:

February 9th: A day long field trip to Campi Flegrei, including visit to Osservatorio Vesuviano and briefing about:

- Eruptive history of Campi Flegrei;
- Bradiseismic crises of the last decades;
- Current status of the volcano;
- Monitoring system;

February 10th: Visit to the Department of Civil Protection and briefing about:

- Campi Flegrei scenario and civil protection aspects;
- Procedures and timing to collect data, validating, processing and valuating of ground-based monitoring parameters;
- Procedures and timing to collect data, validating, processing and valuating of satellite interferometry monitoring parameters;
- Models to elaborate damage scenarios;
- Probabilistic models for eruption forecasting, their uses and results of their use applied to the actual situation;
- Introduction of simulation: actors, roles and simulation rules.

Beginning in the afternoon, concurrently with briefing going on at DPC headquarter, first phase of the simulation will start, with the arrival of first signals sent by the 'Volcano Team' and releasing in the evening of first bulletin by INGV (whose members will work mainly at their offices located in the Osservatorio Vesuviano).



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February 11th: Simulation: the first phase of simulation will start in the early morning, for the rest of participants (Italian experts invited by DPC, VUELCO members, etc.)

February 12th: Simulation

February 13th: Debriefing on simulation.

3. Organizations involved

Italian organizations

- Department of Civil Protection (DPC)
- National Institute of Geophysics and Volcanology (INGV)
- Study Center PLINIUS– University of Naples “Federico II” (PLINIUS)
- Istituto per il Rilevamento Elettromagnetico dell’Ambiente - Consiglio Nazionale delle Ricerche (IREA-CNR)
- Italian Space Agency (ASI)
- Centro di Analisi e Monitoraggio del Rischio Ambientale - University of Salerno (AMRA)

International VUELCO project partners

- University of Bristol, United Kingdom (UNIVBRIS)
- University of Leeds, United Kingdom (UNIVLEEDS)
- Agencia Estatal Consejo Superior de Investigaciones Científicas, Spain (CSIC)
- Ludwig-Maximilian University of Munich, Germany (LMU)
- Centre National de la Recherche Scientifique, France (CNRS)
- Seismic Research Centre-University of West Indies, Trinidad and Tobago (SRC-UWI)
- Instituto Geofísico de Escuela Politécnica Nacional, Ecuador (IGEPN)

Foreign Civil Protection Agencies

- Servicio de Protección Civil y Atención de Emergencias - Canary Islands - Spain
- Civil Protection Agency of Dominica – West Indies



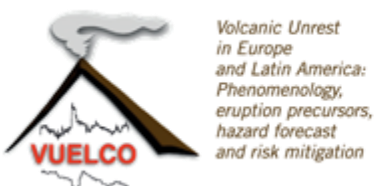
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4. Simulation actors

The simulation will include the following participants:

- “Volcano Team” (at the INGV headquarters in Rome) composed by: Christopher Kilburn (University College London), Antonio Paonita (INGV), Gilberto Saccorotti (INGV).
- INGV:
 - Operational Room of the Osservatorio Vesuviano (INGV- OV, at the headquarters in Naples), and technical-scientific teams working on the ground and in the other sections of the institute;
 - Communications Office of the Presidency of the INGV.
- Advisory Scientific Committee of the DPC (at the DPC headquarters in Rome). It is a Committee (composed by experts about monitoring and the volcano) not yet officially formalized. In case of volcanic crises advancing it would be activated to guarantee the necessary support on site.. In the simulation the Scientific Committee will be comprised of Italian scientists experts of the Campi Flegrei caldera and international scientists involved in the VUELCO project and will meet at DPC in Rome. In an effort to simulate a real situation, in which the meetings of the Scientific Advisory Committee might be held days or weeks apart, the composition of the Committee will be different at various phases of the simulation. In this way the largest number of participants will be given the opportunity to take an active role in the simulation. The Committee is composed of twelve (12) rotating persons, of whom eight (8) are chosen among Italian experts by DPC and four (4) foreign scientists involved in the VUELCO project, chosen by the project coordinator. At the beginning of each phase, it will be decided whether and how to alternate this representation. All participants in the simulation will assist at each stage, being able to speak with the Committee during the discussion, but not in the final evaluation process.
- Other Centri di Competenza (technical-scientific organizations and institutes working in agreement with the DPC, e.g. PLINIVS, ASI, IREA-CNR), which at the various stages of processing will provide support and processing pertinent to each.
- Other monitoring bodies (AMRA - University of Salerno) that cooperate with the INGV- OV.
- DPC:
 - Centro Funzionale (DPC- CFC) and the Seismic and Volcanic Risk Office, which will activate their own internal procedures for the coordination of the various Centri di Competenza.
 - Communication Office and Press Office, that will simulate some possible communication activities;
 - Emergency Management Office, as an observer.



- The Region of Campania as an observer for the purposes of the simulation.
- The structures of civil protection of the Canary Islands (Spain) and Dominica (West Indies) as observers.

It seems useful to point out that, in the event of a real crisis, after an initial phase, the Scientific Advisory Committee would likely meet in Naples and there would not therefore exist the need for video conferencing links, in as much as members of the INGV would be called to participate to the Committee.

The advice of foreign scientists would be possible, but would likely be limited to a few experts of calderas.

The Campania Region, which in the simulation is simply an observer, in reality, would play an important role in many operating phases.

5. Simulation rules

The simulation will start from the current real state of the volcano and therefore by the “level of attention” previously declared in December 2012; in any event, the evolution and outcome of the crisis will be decided solely by the “Volcano Team” and will not be made known until the end of the simulation itself.

The phases of the simulation will represent different moments of the evolution of an unrest and may therefore be imaginarily spaced in time over several weeks or even months.

At the beginning of each session the "Volcano Team" will explain what day is taking place, how much time has passed since the previous phase and what has happened in the meantime.

For each step of the simulation, the following cycle is repeated (also shown schematically in the flowchart that follows):

1. The "Volcano Team" notifies the Operational Room of the INGV- OV signals related to real-time monitoring networks (e.g. seismicity), or to macroscopic observations which may be reported by the public or by other sources (e.g. the occurrence of a phreatic explosion; the presence of rumblings; macroscopic abnormalities in the aquifer, etc.).

2. The Operational Room INGV- OV releases an initial rapid communicate to the DPC-CFC, analyzes the received data and organizes its work based on the anomalies encountered (upgrading equipment, mobile network, activation of teams for observations and field surveys, etc.).



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3. INGV- OV collects information and data also in cooperation with other monitoring bodies: AMRA for the data from the strain-meters and long-arm clinometers, ASI and IREA-CNR for satellite data (these latter through the DPC-CFC).

4. The INGV-OV informs the “Volcano Team” of the type of parameters that they have been able to measure/observe (not communicating the quantitative results of these observations/measurements, but only their types).

5. The “Volcano Team” tells the INGV-OV the quantitative results of the measurements and observations.

6. INGV-OV carries out its own analyses and evaluations (e.g. simulating areas of dispersion and ash fallout; updating the map of probable vent openings; reviewing, if possible, the probability of invasion by pyroclastic flows; using the BET to estimate the probability of eruption in different time windows; and responding in general terms as established by agreement with DPC). INGV-OV draws up its own report, that is promptly sent to the DPC-CFC, which in an official manner represents the work done by INGV and the assessments made.

7. The DPC organizes the work of the Scientific Advisory Committee; it involves other Centri di Competenza (in addition to ASI for the acquisition of satellite -data, IREA-CNR for satellite interferometry, the PLINIVS center for the development of damage scenarios) and manages the related information flow.

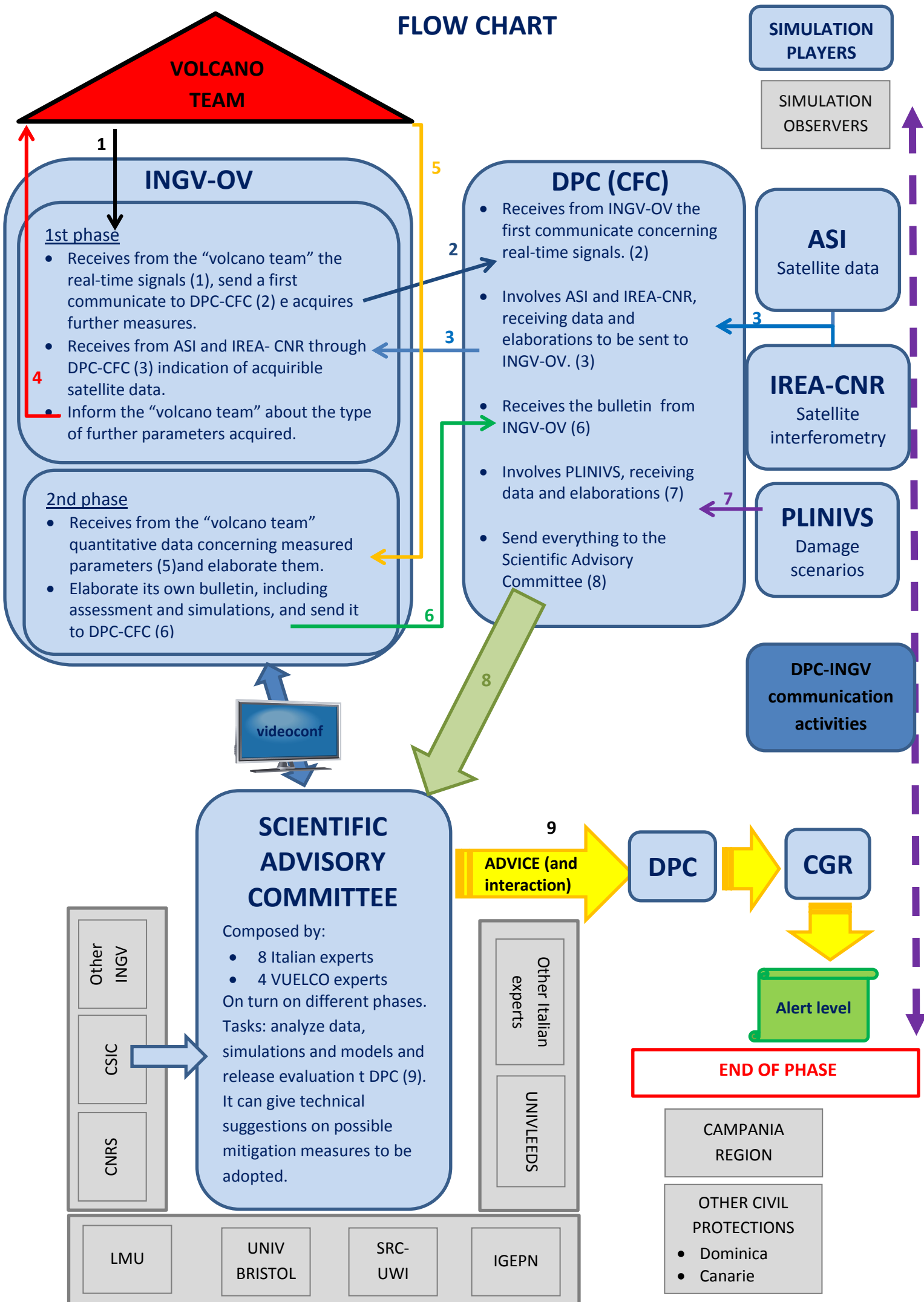
8. The Scientific Advisory Committee reviews the data, reports and results of the models sent by the INGV, being enabled to ask technical clarifications, if necessary, via a videoconference link. It can also make use of products developed during the VUELCO project (e.g. probabilistic forecasting models developed by CSIC). The Committee examines the situation and provides its own assessments to the DPC in writing, including elements of probabilistic forecasts. The Committee may also provide guidance and technical suggestions on possible mitigating actions to be taken.

9. The DPC, after it has received the assessments and any eventual suggestion, may seek clarifications from the Scientific Advisory Committee, after which, on the basis of all of the assessments received, in a real situation the Major Risk Commission (CGR) would become involved for any eventual change in the alert level.

10. During the entire cycle of each phase, INGV and DPC simulate (without executing) their external communication activities (e.g. writing press releases, updating the website, requesting information from the scientific community through interviews, etc.); the product of these activities is then made known to the participants.



FLOW CHART



The simulation will have four phases, each one will cover a half-day: 10-12 February (for the component “Volcano Team”, INGV, ASI, CNR-IREA and DPC-CFC) and 11-12 February for the rest of the participants (Italian experts invited by the DPC, VUELCO members , etc.).

To better simulate what might happen in reality, INGV and the Scientific Advisory Committee of the DPC will work with timing out of phase by half a day. In a real situation, in fact, the first phase of the work would be carried out by INGV and lead to the issuing of a bulletin to DPC. Subsequently, if the situation would make it opportune, DPC would convene the Scientific Advisory Committee, which would then be made aware of the situation.

As for the Italian experts invited by the DPC and the members of the VUELCO project, every step of the simulation will begin with a meeting of the Scientific Advisory Committee. The entire preceding portion, related to the occurrence of signals and their processing by the INGV, will then already have taken place in the previous half-day, but it will be made known to the Committee only at the beginning of each meeting.

In the table is a schematic drawing detailing the sequence of phases. Each phase is highlighted by a different color. The part played by INGV before that of the Scientific Committee (and thus hidden from the Committee until it is convened) is characterized by the same color, but with a diagonally-striped background.



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		VOLCANO	INGV-OV	SCIENTIFIC COMMITTEE	DPC - CGR
LUN 10/02	15	Signals outcome 1	Start of 1 st phase-release of 1 st comm.		
	16				
	17				
	18		Release of 1 st INGV bulletin		
MAR 11/02	8			Start of 1st phase works	
	9		Videoconference		
	10	Signals outcome 2	Start of 2 nd phase-release of 2 nd comm.		
	11			Releasing of advice n.1	Alert level definition-end of 1st phase
	12			Lunch	Lunch
	13		Release of 2 nd INGV bulletin		
	14		Lunch	Start of 2nd phase works	
	15		Videoconference		
	16	Signals outcome 3	Start of 3 rd phase-release of 3 rd comm.		
	17				
	18			Releasing of advice n.2	
19		Release of 3 rd INGV bulletin		Alert level definition-end of 2nd phase	
MER 12/02	8			Start of 3rd phase works	
	9		Videoconference		
	10	Signals outcome 4	Start of 4 th phase-release of 4 th comm.		
	11			Releasing of advice n.3	Alert level definition-end of 3rd phase
	12			Lunch	Lunch
	13		Release of 4 th INGV bulletin		
	14		Lunch	Start of 4th phase works	
	15		Videoconference		
	16				
	17				
	18			Releasing of advice n.4	
19				Alert level definition-end of 4th phase	



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6. Contacts

During the simulation it will be necessary to guarantee an efficient transfer of information. The following is a list of contacts:

INGV

Operational room INGV-OV:

email: monitoraggio.vulcanico@ov.ingv.it

tel: +39.081.610.8300

Remote sensing laboratory:

email: malvina.silvestri@ingv.it

tel: +39.06.51860.732

email: christian.bignami@ingv.it

ASI

email: simona.zoffoli@asi.it

IREA-CNR

email: casu.f@irea.cnr.it

PLINIVS

email: stefano.nardone@tiscali.it

tel: +39.081.253.8925

DPC

Centro Funzionale Centrale (volcanic sector):

email: centrofunzionale.vulcanico@protezionecivile.it tel: +39.06.6820.2390

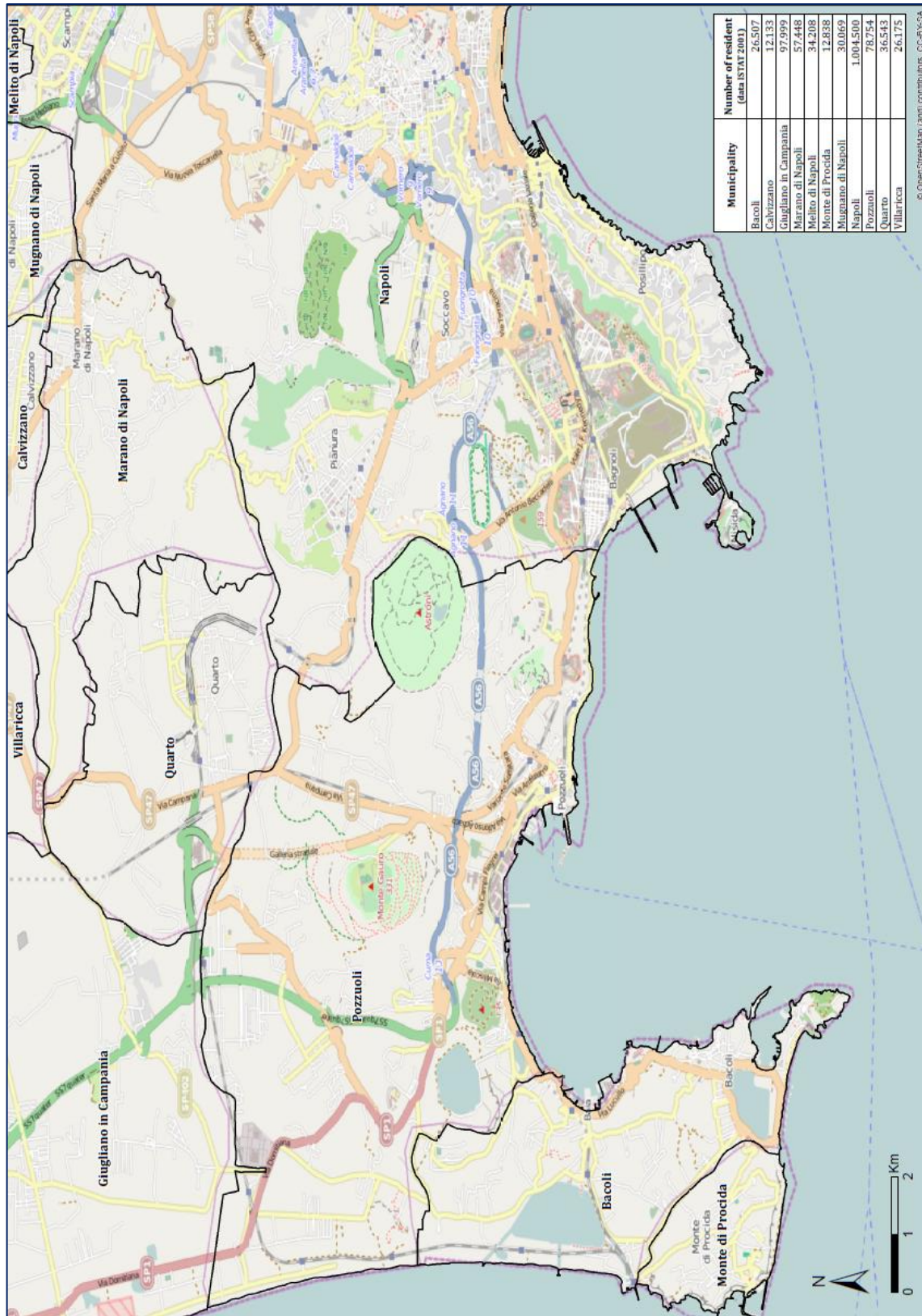
7. Attachments

- Simulation agenda.
- Summary report on Campi Flegrei volcanic hazard.
- Document of description of Campi Flegrei monitoring system, with details of monitored parameters, timing for collecting/valuating/plotting.
- Paper on IREA-CNR activities on Campi Flegrei caldera



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