

VOLcanic pLume chAracterization using sounNDing balloOns

VOLANDO



Final Meeting 19 March 2026
INGV-Rome

Welcome & Project Summary

Stefano Corradini
& the VOLANDO team

AGENDA

Time Duration	Title	Author(s)
14:30 - 14:50	Welcome & Project Summary	S. Corradini (INGV-ONT)
14:50 - 15:20	Balloon configurations and Volcanosonde development	A. Filippeschi, S. Marcuccio, I. Marsili, M. Gemignani (Uni. Pisa)
15:20 – 15:50	Gas sensors Calibration	M. Bitetto (Uni. Palermo), G. Giudice (INGV-OE)
15:50 - 16:20	Volcanosondes sensors measurements Validation – The April 2025 Vulcano Island field campaign	C. Naranjo (INGV-ONT)
16:20 - 16:50	Coffee break	
16:50 - 17:20	2025 Etna field campaign: measurements and products cross-comparison	L. Guerrieri, C. Naranjo, D. Stelitano, L. Merucci, S. Corradini (INGV-ONT)
17:20 - 17:40	Dissemination & Exploitation	R. Biondi (Uni. Padova - CIMA)
17:40 - 18:40	General discussion & Perspectives	All (mod. S. Corradini)

THE VOLANDO PROJECT

<https://progetti.ingv.it/it/volando>



VOLANDO (VOLcanic pLume chAracterization using sounNDing balloNs) is a PRIN (Progetti di Rilevante Interesse Nazionale) project financed by European Union – Next generation EU (Missione 4 Componente 1 CUP D53D23004910006). It started in September 2023 with a duration of 29 months.



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**Finanziato
dall'Unione europea**
NextGenerationEU

La suddivisione fondi è stata trasmessa il 01/06/2023

N°	Sede dell'Unità	Responsabile Scientifico	Contributo MUR per ricerca	Cofinanziamento Ateneo/Ente	Costo Totale	Gestione responsabile	Autorizzato
1	Istituto Nazionale Geofisica e Vulcanologia	CORRADINI Stefano	93.739	7.350	101.089		
2	Università di PISA	MARCUCCIO Salvo	84.648	5.600	90.248		
3	Università degli Studi di PADOVA	BIONDI Riccardo	5.506	3.153	8.659		
Totale			183.893	16.103	199.996		

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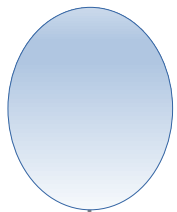
UNIVERSITÀ DI PISA



In this project, three balloon borne systems, equipped with different instrumentations for ash and gas measurements, will be developed. A customized “volcanosonde” sensor package will be designed, manufactured and airlifted by sounding balloons to provide a vertical profiles and time series of the species present in the volcanic plume. This will allow us to make a precise characterization of the volcanic cloud structure, ash and gases content, thus to improve and validate satellite, ground based and dispersion models products.



BALLOON CONFIGURATIONS



Atmospheric Balloon



Parachute



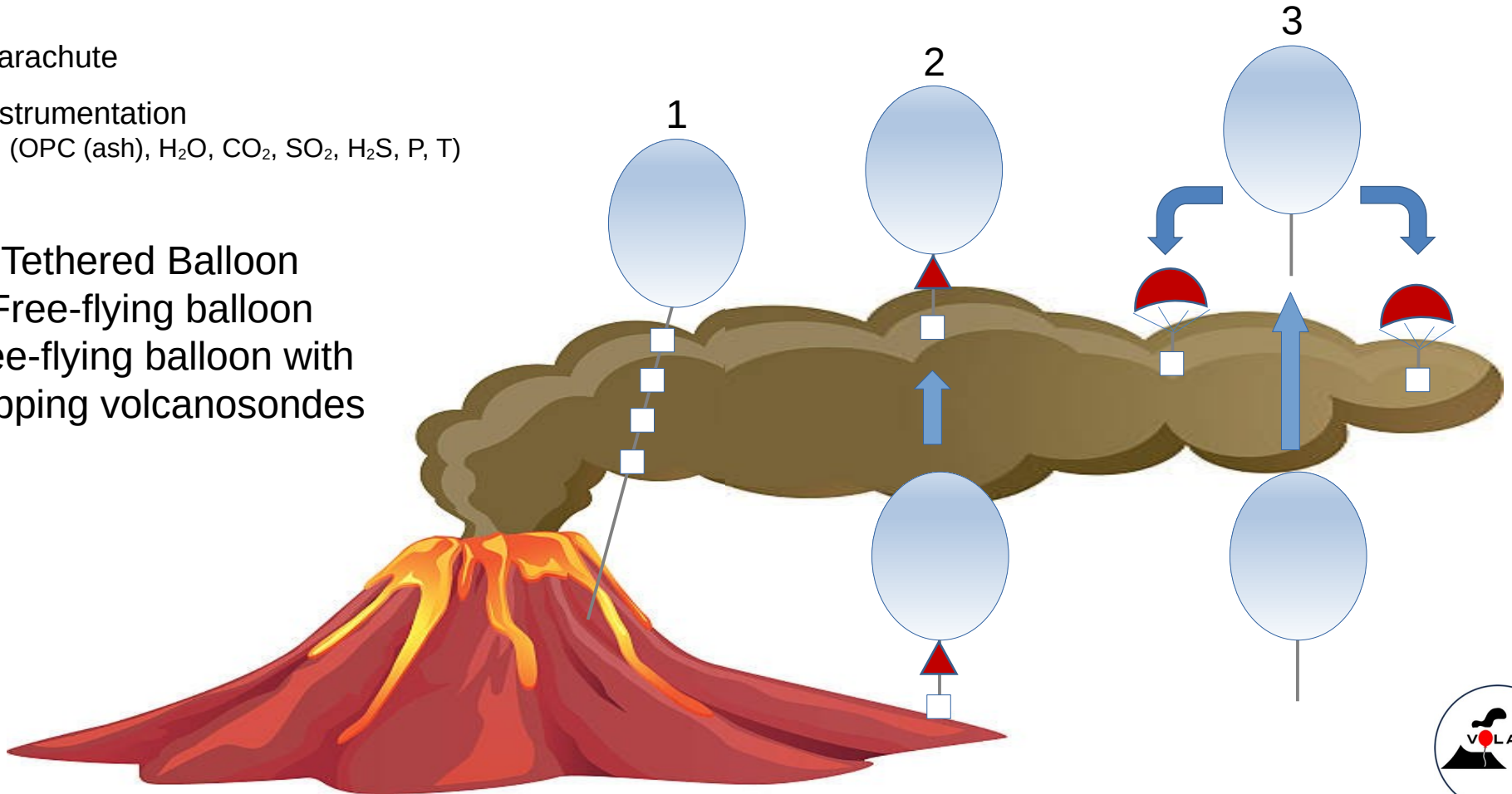
Instrumentation

(OPC (ash), H₂O, CO₂, SO₂, H₂S, P, T)

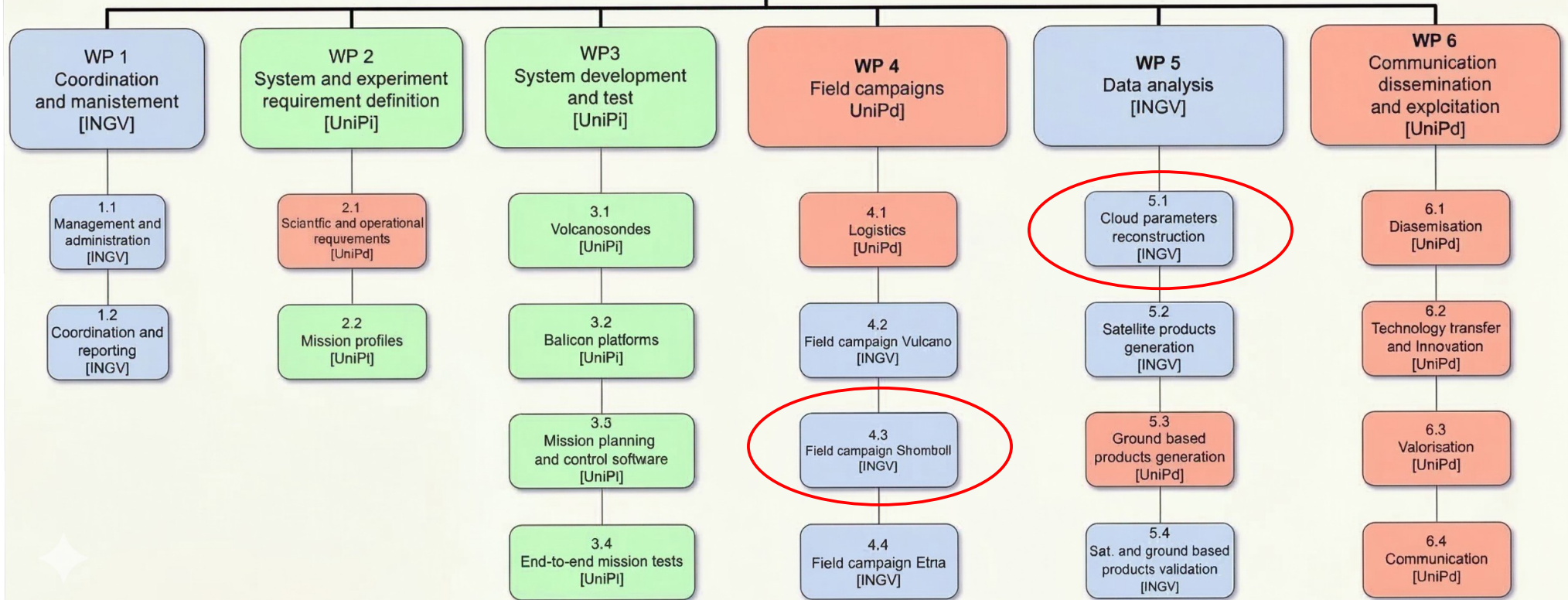
1) Tethered Balloon

2) Free-flying balloon

3) Free-flying balloon with dropping volcanosondes



VOLANDO



Project Objectives

Scientific Aspects	Evaluation
Development, test and deployment of innovative in-situ platforms based on atmospheric balloons	Completed
Estimation of the complete ash PSD, composition, ash/H ₂ O/SO ₂ /CO ₂ /HCl content and VC geometry	Partially Completed
Provision of the inputs to models and remote sensing instruments to train retrieval algorithms	Not Completed
Validation of ground- and satellite-based volcanic ash and gas retrievals	Completed

Technological Aspects	Evaluation
Use of sounding balloons as the base for sensor deployment schemes	Completed
Novel “volcanosonde”: a complete, yet compact sensor package suited for VC investigation from balloon-borne platforms	
Dedicated mission management software, including trajectory forecast, operation planning and telemetry data handling	Completed

Completed
Partially Completed
Not Completed

FIELD CAMPAIGNS (2024)

Parco delle Biancane,
17 - 18 June, 2024



Etna,
25 - 29 June,
2024



Etna, 26 August – 1
September, 2024



FIELD CAMPAIGNS (2025)

Etna, 2 - 6 June 2025

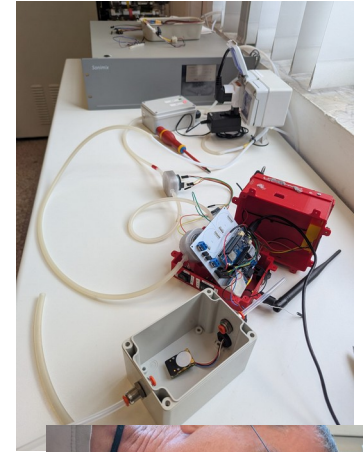
Vulcano Island, 8 - 10 April 2025



Etna, 21 - 24 October 2025



Palermo, March &
September 2025



MAIN PROJECT OUTPUTS

- ✓ Development of a cheap and lightweight “Volcanosonde” systems containing ash, gases, atmospheric parameters sensors and telemetry;
- ✓ Realization of a dedicated software for the real time data analysis;
- ✓ Demostration of the measurements feasibility (in certain conditions);
- ✓ Validation of the volcanosonde measurements with well established multigas systems (April 2025 Vulcano Island field campaign);
- ✓ Demonstration of the ability of the tethered balloon to realize time series of the different species for a significative period of time (June 2025 Etna field campaign).



CRITICALITIES AND PROPOSED SOLUTION

- ✓ When the extension of the degassing plume is limited (weak plume), the interception of the plume is critical with the free balloon
- ✓ Some anomalous behaviour has been found with gas sensors as altitude increases
- ✓ Tests conducted seem indicate interactions between volcanic plume constituents and balloon lattice, that lead to a balloon deflation
- ✓ The possibility to make measurements is limited to wind speed (about 10 m/s)



CRITICALITIES AND PROPOSED SOLUTION

- ✓ When the extension of the degassing plume is limited (weak plume), the interception of the plume is critical with the free balloon
- ✓ Integrate balloon forecast model with volcanic plume models (to define the best balloon launch site)
- ✓ Some anomalous behaviour has been found with gas sensors as altitude increases
- ✓ Made laboratory tests to verify the sensors calibration also varying pressure (first tests already realized at University of Palermo)
- ✓ Tests conducted seem indicate interactions between volcanic plume constituents and balloon lattice, that lead to a balloon deflation
- ✓ Selection of new material for the balloon
- ✓ The possibility to make measurements is limited to wind speed (about 10 m/s)
- ✓ Possible stability enhancements under study with aerodynamic surfaces and/or propellers



LAST ACTIONS TO CLOSE THE PROJECT

- ✓ Complete the entries into the PRIN portal

The screenshot displays the PRIN 2022 portal interface. On the left is a dark sidebar with navigation links: 'PRIN 2022', user profile 'Stefano CORRADINI' with ID 'CRRSFN711' and a 'Logout' button, 'CONSULTAZIONE' (Valutazione, Personale reclutato), and 'FUNZIONI' (Suddivisione fondi, Atto d'Obbligo, Partecipanti, Varianti scientifiche, Data fine progetto). The main header is blue with the text 'PRIN 2022 - Progetti di Rilevante Interesse Nazionale'. The central content area features the European Union flag, the text 'Finanziato dall'Unione europea NextGenerationEU', and the title 'Bando PRIN 2022' with the decree 'Decreto Direttoriale n. 104 del 02-02-2022'. On the right, a white box titled 'AMMESSO AL FINANZIAMENTO' lists project details: 'Principal Investigator: CORRADINI Stefano', 'Codice progetto: 2022XPAHA8', 'Settore ERC PE10', and 'Durata: 24 mesi', with a 'Pdf Domanda' button below.

- ✓ Scientific Reporting (by mid April)

THANK YOU!!

Gaetano Giudice
(INGV-OE)



Marcello Bitetto
(UniPa)



Daniela Fucilla
(INGV-ONT)

