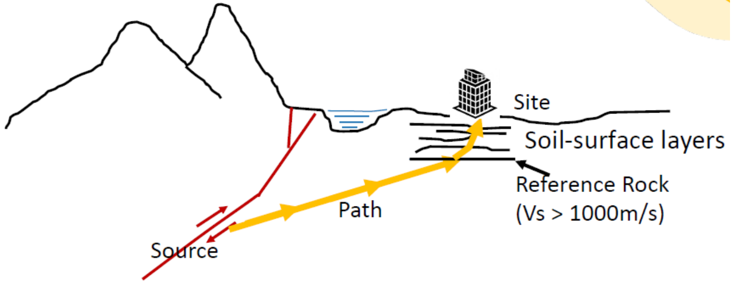

Regional-**S**cale **E**arthquake Ground Motion Predi**C**tions Thro**U**gh Pyhsics-based and Empi**R**ical Approach**E**s: A Case study Central Italy (**SECURE**)

Aybige Akinci

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PIANETA DINAMICO
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SECURE
REGIONAL-SCALE EARTHQUAKE **GROUND MOTION PREDICTIONS**
THROUGH PYHSICS-BASED AND EMPIRICAL APPROACHES:
A CASE STUDY CENTRAL ITALY

Riunione Plenaria SECURE (Progetto Pianeta Dinamico 2023-25), 30 Gennaio 2024, Roma

9:15	**Opening**	Akinci A.
9:30	**WP1. Miglioramenti dei Modelli Esistenti di Velocità della Crosta e Dati Sismici**	Resp. De Gori P.
9:30	Modelli di tomografia sismica locale /Vp, Vp/Vs) nelle tre aree studio del progetto SECURE: stato dell'arte e lavori in preparazione.	De Gori P.
9:45	Nuovo catalogo sismico della sequenza dell'Aquila 2009 determinato attraverso l'applicazione di tecniche di Machine Learning.	Fonzetti R.
10:00	Vincoli geologici superficiali e profondi per lo sviluppo dei modelli tomografici nelle tre aree studio del Progetto SECURE.	Burrato P.F.
10:15	Costruzione e analisi di dataset di registrazioni e dati macrosismici per le attività di ricerca del progetto SECURE.	Lanzano G.
10:30	**Discussione Q/A**	
10:45	**Pausa**	
11:00	**WP2 - Caratteristiche della Sorgente dei Terremoti e Propagazione delle Onde Sismiche nell'Appennino Centrale**	Resp.CalderoniG.
11:00	Risultati preliminari del confronto dei parametri di sorgente stimati applicando diversi metodi.	Calderoni G.
11:15	Alcune tecniche per la stima dei parametri di sorgente in Centro Italia	Morasca P.
11:30	Evoluzione temporale dell'attenuazione coda/S waves in funzione della frequenza nell'Appennino Centrale.	Gabrielli et al.
11:45	Variabilità spazio-temporale del parametro di attenuazione in alta frequenza (κ) e parametrizzazione ingegneristica degli effetti di direttività di sorgente.	Colavitti et al.
12:00	**Discussione Q/A**	
12:15	**Invited Talk**: Seismic Source Characteristics and Ground-Motion Variability in Central Italy: a bridge between WP2 and WP3.	Bindi D.,Picozzi, M.,Spallarossa,D.
13:00	**PAUSA PRANZO**	
14:30	**WP3 - Previsioni del Moto del Suolo Utilizzando Approcci Innovativi**	Resp. Pacor F.
14:30	Risultati preliminari dell'analisi della variazione spaziale e temporale del moto sismico osservato in Italia.	Pacor F., Sgobba S., Lanzano, G.
14:45	Simulazioni numeriche 3D del moto del suolo per il terremoto di Amatrice e Norcia.	Akinci A.
15:00	Simulazioni basate sul metodo 1D-FK deterministico per i terremoti dell'Appennino centrale.	Artale Harris, P.
15:15	Modelli di attenuazione dell'intensità macrosismica calibrati in Mw per l'Italia.	Gomez-Capera,A.
15:30	**Discussione Q/A**	
15:45	**WP4. Prestazioni dei Modelli di Moto del Suolo e delle Relazioni Empiriche**	Resp. Taroni M.
16:00	Caratteristiche dello scuotimento sismico negli Appennini Meridionali	Zimmaro P.
16:15	Nuovi metodi per confrontare e testare i Ground Motion Models: applicazione al caso studio dell'Appennino Centrale in Italia.	Taroni et al.
16:30	**Pausa**	
17:00	Tavola Rotonda	Tutti Partecipanti

WP1 - INGV-ONT (**Ref.** Pasquale De Gori). **Partecipanti (14):**
WP1.1 Pasquale De Gori, Francesco P. Lucente, Luisa Valoroso, Mario Anselmi, Samer Bagh, Claudio Chiarabba.
WP1.2 Pierfrancesco Burrato, Paola Vannoli, Andrea N. Rovida, Antonio Gomez, Giovanni Lanzano, Vera D'Amico, Sara Sgobba, Aybige Akinci.

WP2 - INGV-Roma1 (**Ref.** Giovanna Calderoni). **Partecipanti (16):**
WP2.1 Giovanna Calderoni, Paola Morasca, Daniele Spallarossa, Dino Bindi, Matteo Picozzi, Antonella Cirella, Antonella Megna, Pietro Artale Harris, Frantisek Gallovic.
WP2.2 Simona Gabrielli, Leonardo Colavitti, Aybige Akinci, Edoardo Del Pezzo, Luca De Siena, Raul Castro.

WP3 – INGV-Milano (**Ref.** Francesca Pacor). **Partecipanti (9)**:
WP3.1 Francesca Pacor, Giovanni Lanzano, Sara Sgobba,
WP3.2 Aybige Akinci, Pietro Artale Harris, Arben Pitarka, Irene Munafò, Daniele Melini, Paola Bordoni

WP4 - INGV-Roma1 (**Ref.** Matteo Taroni). **Partecipanti (6)**: Matteo Taroni, Giovanni Lanzano, Gianluca Regina, Paolo Zimmaro, Ilaria Spassiani, Aybige Akinci

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SECURE REGIONAL-SCALE EARTHQUAKE GROUND MOTION PREDICTIONS THROUGH PHYSICS-BASED AND EMPIRICAL APPROACHES: A CASE STUDY CENTRAL ITALY

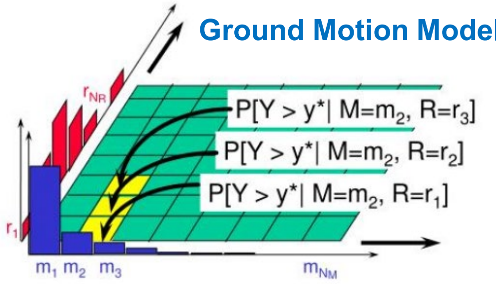
Motivations & Objectives

SECURE is designed to address questions related to predicting ground motions during important seismic events

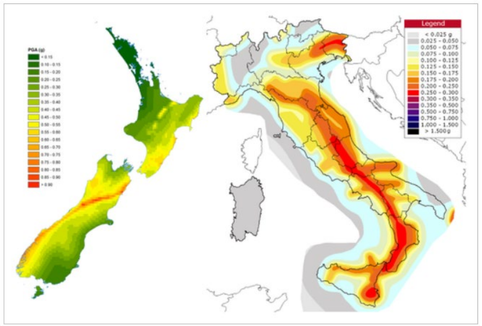
The reliable quantification of earthquake ground motions as a function of magnitude, distance, and frequency is directly linked to seismic hazard analysis for **engineering, civil protection purposes, and systems designed to provide earthquake rapid response and early warning**.

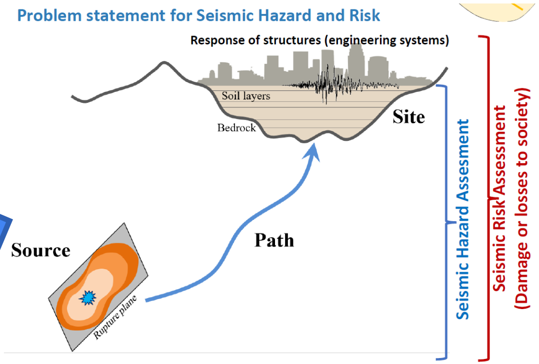
Realistic modeling of earthquake ground motions can be achieved only when the rupture process on causative fault, the **medium property of the seismic wave path, and the local site condition** *are accurately represented*

Ground Motion Models, GMMs



Probabilistic Seismic Hazard Maps, PSHA





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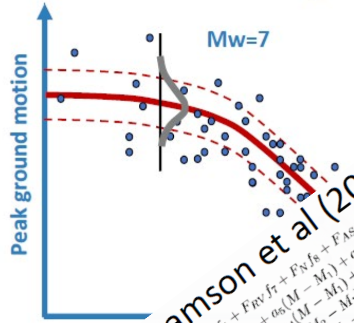
SECURE REGIONAL-SCALE EARTHQUAKE **GROUND MOTION PREDICTIONS** THROUGH PYHSICS-BASED AND EMPIRICAL APPROACHES: **A CASE STUDY CENTRAL ITALY**

Motivations

- Ground ... dictive Equations or Models (GMPE, GMMs) derive from ... procedure on worldwide strong motion database
- An ergodic assumption is ... made in Probabilistic Seismic Hazard Assessment.

Abrahamson and Young (1992)

$$\ln(Y) = f_{src}(M, \dots) + f_{path}(R, M, \dots) + f_{site}$$



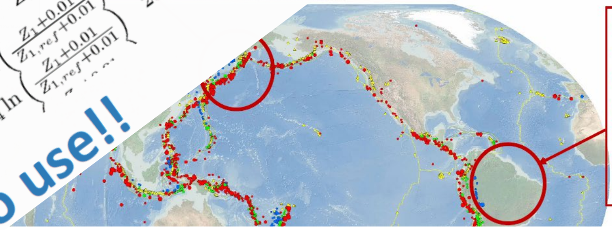
Abrahamson et al (2014)

GMPEs are becoming very complex to use!!

$+ bM + d\ln(r + c) + eF$

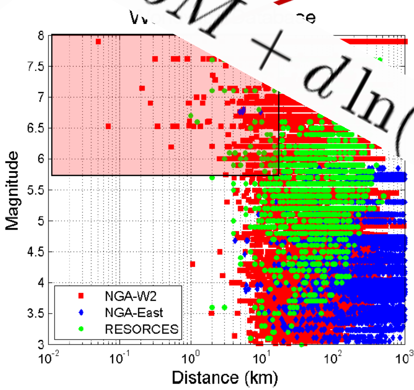
- To ... dataset that c... ces.
- Unfortunately ... construct GMMs are limited (par... ng events)

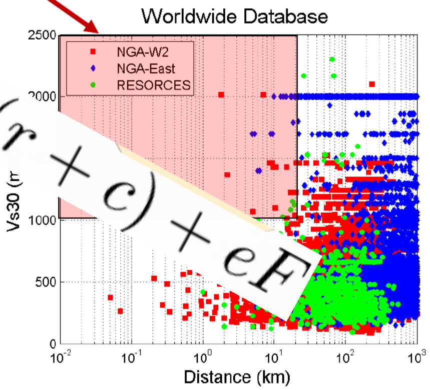
Ergodic: ... of a process can be deduced from ... It means, any sample of the ... f the process as a whole.



In places with no data, we could use the data from other places

...e of major interest used for PSHA





Objectives

Ergodic and non-ergodic process :Ground Motion Variability

Ground Motion Variability of GMPEs

GMPE: $\ln(Y) = f_{src}(M, \ldots) + f_{path}(R, M, \ldots) + f_{site}(Vs_{30} \ldots) + \Delta$

Total variability: $\Delta = \Delta B + \Delta W$

ΔB is the ***between-events variability*** *with* standard deviation τ

- Earthquake-to-earthquake variability
- Represent average source effects
- Effects of stress drop, slip velocity, rupture speed, geometrical fault complexity, etc. not captured by the source terms in the GMPE

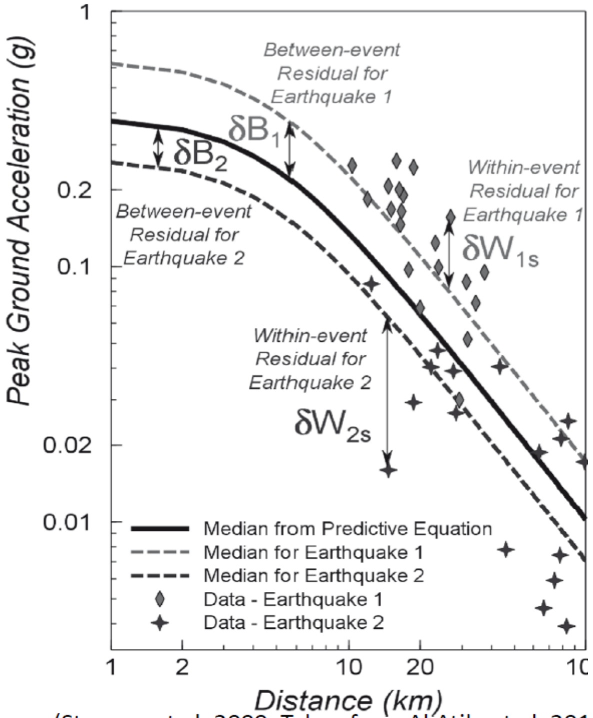
ΔW is the **within-events variability** with standard deviation ϕ

- Record-to-record variability
- Represent azimutal variation in source, path and site effects
- Effects of crustal heterogeneities, deeper geologicat structures, basins, near surface layering, etc, not captured by the path and site terms in the GMPE

ΔB and *ΔW* are uncorrelated, then total standard deviation is

$$\sigma = \sqrt{\tau^2 + \phi^2}$$

Note: The variability or residuals are the deviation of the observed quantity with respect to the median predictor model



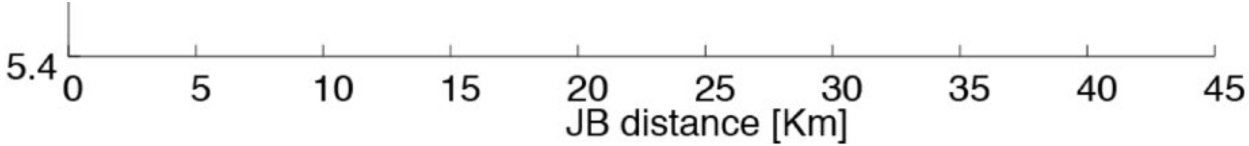
(Strasser et al, 2009. Taken from Al Atik, et al, 201

Objectives

We can develop a database of synthetic earthquakes To fill the gaps of lack of data (Dalguer and Mai, 2011)

Developments of Physics-based earthquake models

- Contribute to substantial advances in our understanding of different aspects related to earthquake mechanism and near-source ground motion.
- Input data to the model (fault geometry and geological structure) can be generic or constrained to the site or region of interest



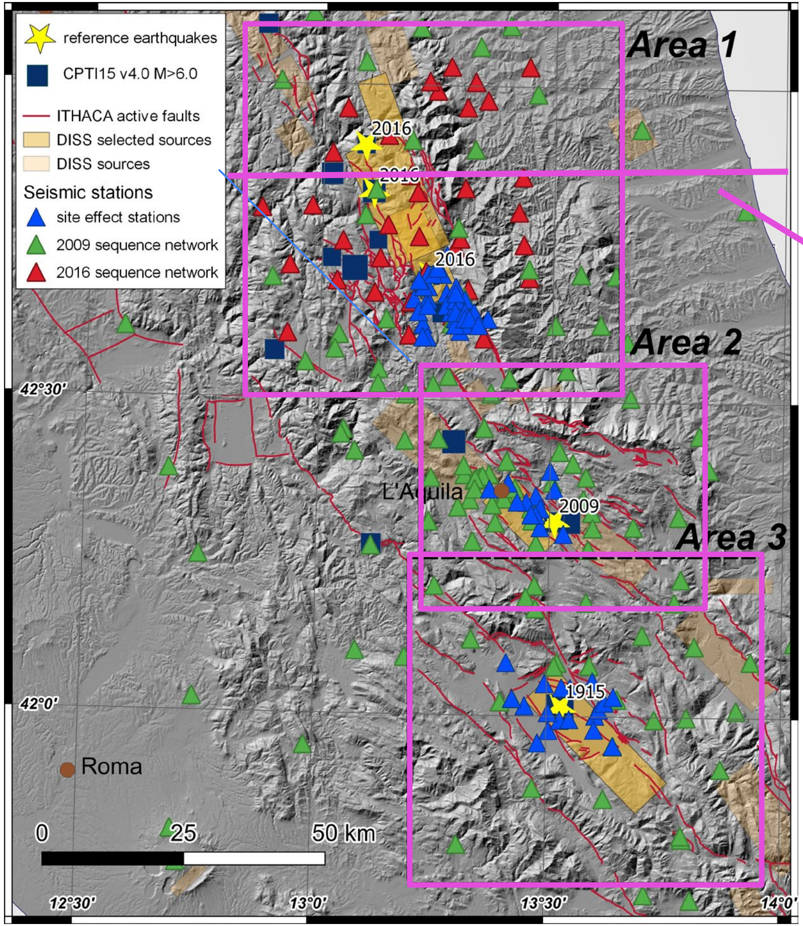
they are intrinsically non-ergodic models

Main Objectives of SECURE

The main goal of **SECURE** is to study earthquake ground motion characteristics, through innovative techniques to improve ground motion predictions for seismic hazard mitigation in the Central Apennines.

- explore the links between earthquake **source physics**, **wave propagation**, and ground motion variability.
- investigate the variability of ground motion both in space and time.
- develop data-driven non-ergodic and physics-based ground-motion models.
- generate physics-based 3D simulations at near-fault regions, (shaking significant, and missing data from large earthquakes).
- test, and validate the predicted ground motions against the seismic recordings, GMMs, and macroseismic intensity (MI) data available in the study area.
- ranking scheme in accordance with well-established engineering metrics (e.g. fragility curves for different types of structure) to provide direct means for engineering applications.

Study Area/s

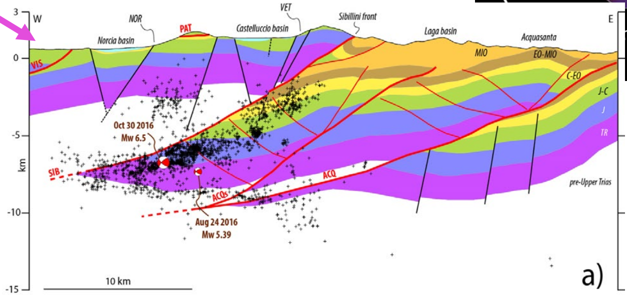


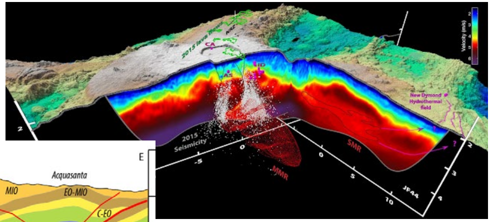
Central&North Central Italy

Area 1 ***Amatrice-Visso-Norcia***

Area 2 ***L'Aquila Basin***

Area 3 ***Fucino Basin***





Mw ≥ 6.0 earthquakes from the CPTI15 catalog (blue squares; Rovida et al. 2022) and seismic station networks deployed to monitor the space-time evolution of the 2009 and 2016-2017 seismic sequences (green and red triangles). The small blue triangles are temporary stations deployed for measuring site effects after the 2009 and 2016-2017 sequences and, in the Fucino basin, in the frame of the 2008-2009 and 2012 DPC projects The epicenters of the mainshocks of the three sequences are shown as yellow stars. In orange are the individual seismogenic sources of the DISS v3.3.0 database (https://diss.ingv.it/). The "selected" individual sources are those associated with the main shocks of the three sequences. Red lines are the active and capable faults of the ITHACA database.

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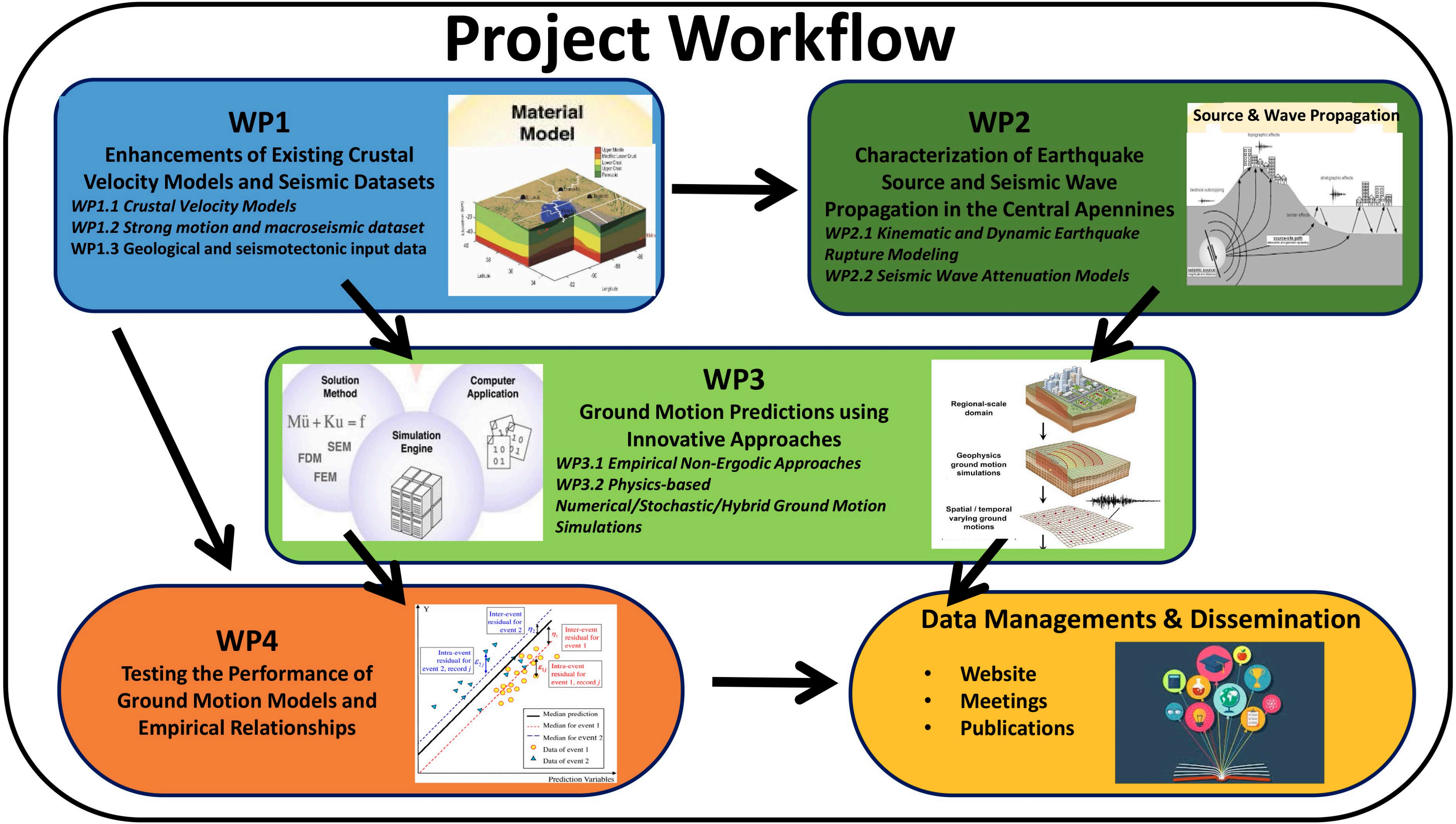
REGIONAL-SCALE EARTHQUAKE **GROUND MOTION PREDICTIONS** THROUGH PYHSICS-BASED AND EMPIRICAL APPROACHES: **A CASE STUDY CENTRAL ITALY**



Project Workflow
WP1
Enhancements of Existing Crustal Velocity Models and Seismic Datasets
WP1.1 Crustal Velocity Models
WP1.2 Strong motion and macroseismic dataset
WP1.3 Geological and seismotectonic input data
Material Model
WP2
Characterization of Earthquake Source and Seismic Wave Propagation in the Central Apennines
WP2.1 Kinematic and Dynamic Earthquake Rupture Modeling
WP2.2 Seismic Wave Attenuation Models
Source & Wave Propagation
WP3
Ground Motion Predictions using Innovative Approaches
WP3.1 Empirical Non-Ergodic Approaches
WP3.2 Physics-based Numerical/Stochastic/Hybrid Ground Motion Simulations
Solution Method
Computer Application
Simulation Engine
Mü + Ku = f
SEM
FDM
FEM
Regional-scale domain
Geophysics ground motion simulations
Spatial / temporal varying ground motions
WP4
Testing the Performance of Ground Motion Models and Empirical Relationships
Inter-event residual for event 2
Inter-event residual for event 1
Intra-event residual for event 2, record j
Intra-event residual for event 1, record j
Median prediction
Median for event 1
Median for event 2
Data of event 1
Data of event 2
Prediction Variables
Data Managements & Dissemination
• Website
• Meetings
• Publications

Gantt Chart X 2024

MONTHS	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
WP1.1	X	X	X	X	X	X	X	X	X	X	X	X						
WP1.2	X	X	X	X	X	X	X	X	X									
WP1.3	X	X	X	X	X	X	X	X	X	X	X	X						
WP2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
WP2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
WP3.1			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WP3.2				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WP4				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[X la rendicontazione scientifica dell’anno 2023: ST_SECURE (Aybige Akinci) - Google Drive]

WP1. Enhancements of Existing Crustal Velocity Models and Seismic Datasets

Deliverable	Description	Months
WP1_D1	A detailed crustal model with the P and S wave speeds, V_P and V_S, and densities which are assigned to each crustal volume (up to 20-30km depth) including basin structures embedded in tomographic crust and upper mantle	10 area1 14 area2 20 area3
WP1_D2	Mesh files to be used in WP3.2 and be refined through the SW4. These files contain the values of the model features (P-velocity, S-velocity, density, and optionally the attenuation factors Q_P and Q_S) as a function of depth at points on a regular lattice covering the horizontal extent of the computational domain	12 area1 16 area2 24 area3

In **WP1.1,** we expect to construct 3D velocity models of the three target regions by merging the results of high resolution 3D tomographic models and detailed geological information for the shallower geological units.

Deliverable	Description	Months
WP1_D3	Macroseismic intensity data linked with measured ground motion parameters	12
WP1_D4	Macroseismic intensity data linked with three-dimensional source parameters of the causative earthquakes.	18
WP1_D5	A dataset of weak and strong motion recordings in central Italy, classified in mainshock/aftershocks	12

In **WP1.2**, the main results are: i) the improvement and enhancement of the comprehension of ground motion propagation in terms of macroseismic intensity; ii) the creation and validation of datasets suitable for testing the results of ground motion scenarios and finite-fault simulations.

Deliverable	Description	Months
WP1_D6	The same GIS repository will also contain the different seismogenic source models published for the earthquake sequences that hit the three study areas, containing some of the ground motion simulation results	24

In **WP1.3** we expect to build a GIS repository containing the homogenized publicly available geological and structural data of the three study areas.

WP2. Characterization of Earthquake Source and Seismic Wave Propagation in the Central Apennines

Deliverable	Description	Months
WP2_D1	The source parameters for earthquakes M>3.0 are moment magnitude, stress drop, apparent stress, and radiated energy in the Central Apennines	12
WP2_D2	Spatial and temporal variation of the stress drop parameter in the study areas	24
WP2_D3	Kinematic earthquake source model for events with M>6, estimated by jointly inverting for seismic and geodetic data	18
WP2_D4	A series of stochastic and deterministic/hybrid physics/based kinematic earthquake rupture models for faults activated during M>6.0 earthquakes (L'Aquila M6.2, Amatrice M6.0, Norcia M6.5, and Fucino M7.0) in the Central Apennines	30
WP2_D5	Integration of Frequency-dependent directivity effects from seismic sequence into traditional GMMs	30

In **WP 2.1**, we expect to estimate several earthquake source-related parameters, such as moment magnitude, stress drop, apparent stress, and radiated energy, that will be determined using independent approaches (spectral ratios, spectral fitting and coda methods).

Deliverable	Description	Months
WP2_D6	The spatial distribution and temporal evolution of the total attenuation of S-waves (Qs) as a function of frequency in the Central Apennines, focusing on the seismic sequences of L’Aquila and Amatrice, Visso, Norcia.	18
WP2_D7	Spatial and temporal evolution of spectral decay parameter kappa	18

In **WP2.2** we expect to estimate the anelastic attenuation of the S-wave in space and time. This can affect the variability of ground motion in the central Apennines before, during, and after the occurrence of significant earthquakes.

WP3. Ground Motion Predictions using Innovative Approaches

Deliverable	Description	Months
WP3_D1	Stationary NE-ground motion model for central Italy	12
WP3_D2	Stationary NE-ground motion model for Italy	24
WP3_D3	Non-stationary NE-ground motion model	36
WP3_D4	An updated Intensity Prediction Equation (IPE) for the Italian area	24
WP3_D5	A regional intensity attenuation model for central Italy, obtained by means of regional correctives assessed with the analysis of the residuals	36

In **WP3.1,** we expect to produce non-ergodic ground-motion models, with improved accuracy through the inclusion of spatial and temporal non-stationarities.

Deliverable	DESCRIPTION	MONTHS
WP3_D6	Georeferenced shaking scenarios from physics-based ground motion simulations for the selected M>6.0 earthquakes in Central Apennines	34
WP3_D7	Time histories and a series for ground motion parameters including the permanent displacement	34
WP3_D8	Distribution of the simulation codes that developed and used in the project	36

In **WP3.2**, we expect to capture the impact of earthquake source rupture (fault geometry and the kinematics, slip heterogeneity, and nucleation points), seismic wave attenuation (Q(f)), and 3D earth structure (basins, topography) on the ground shaking intensities, particularly in the near field.

WP4. Testing the Performance of Ground Motion Models and Empirical Relationships

Deliverable	Description	Months
WP4_D1	A set of tables and figures presenting the LLH and WLLH values for each ground motion model for the whole dataset as well as for the specific set of information relative to the distance and the magnitude.	36
WP4_D2	A set of tables indicating the specific weights to be associated with each selected ground motion model determined from the whole dataset as well as for the specific set of information relative to the distance and the magnitude	36
WP4_D3	A table with the results of the statistical tests for the empirical relationships between the macroseismic intensities and the observed ground motion parameters.	36
WP4_D4	Final report where we describe the data method and results in detail	36

In **WP4** we will evaluate GMM predictions against independent observations of ground motions. Such tasks will be performed for various IMs such as peak ground acceleration and velocity, PGA and PGV, and spectral accelerations at various periods, Sa(T).

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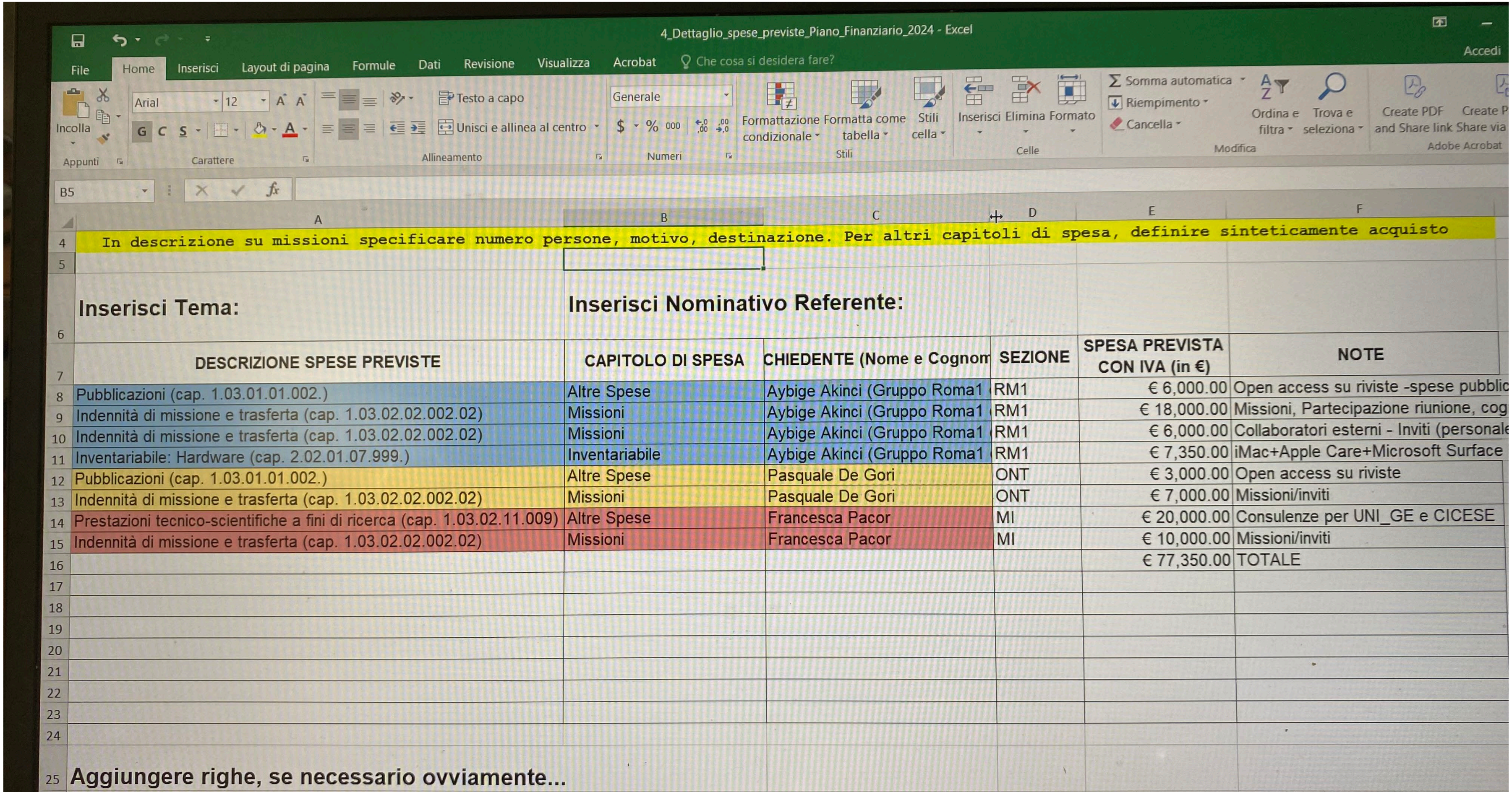
Budget 2024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In descrizione su missioni specificare numero persone, motivo, destinazione. Per altri capitoli di spesa, definire sinteticamente acquisto

Inserisci Tema: **Inserisci Nominativo Referente:**

DESCRIZIONE SPESE PREVISTE	CAPITOLO DI SPESA	CHIEDENTE (Nome e Cognom	SEZIONE	SPESA PREVISTA CON IVA (in €)	NOTE
Pubblicazioni (cap. 1.03.01.01.002.)	Altre Spese	Aybige Akinci (Gruppo Roma1	RM1	€ 6,000.00	Open access su riviste -spese public
Indennità di missione e trasferta (cap. 1.03.02.02.002.02)	Missioni	Aybige Akinci (Gruppo Roma1	RM1	€ 18,000.00	Missioni, Partecipazione riunione, cog
Indennità di missione e trasferta (cap. 1.03.02.02.002.02)	Missioni	Aybige Akinci (Gruppo Roma1	RM1	€ 6,000.00	Collaboratori esterni - Inviti (personale
Inventariabile: Hardware (cap. 2.02.01.07.999.)	Inventariabile	Aybige Akinci (Gruppo Roma1	RM1	€ 7,350.00	iMac+Apple Care+Microsoft Surface
Pubblicazioni (cap. 1.03.01.01.002.)	Altre Spese	Pasquale De Gori	ONT	€ 3,000.00	Open access su riviste
Indennità di missione e trasferta (cap. 1.03.02.02.002.02)	Missioni	Pasquale De Gori	ONT	€ 7,000.00	Missioni/inviti
Prestazioni tecnico-scientifiche a fini di ricerca (cap. 1.03.02.11.009)	Altre Spese	Francesca Pacor	MI	€ 20,000.00	Consulenze per UNI_GE e CICESE
Indennità di missione e trasferta (cap. 1.03.02.02.002.02)	Missioni	Francesca Pacor	MI	€ 10,000.00	Missioni/inviti
				€ 77,350.00	TOTALE

Aggiungere righe, se necessario ovviamente...

List of Publications

Akinci, Pitarka, Artale Harris, De Gori, Buttinelli, (2023). Impact of the Earthquake Rupture on Ground Motion Variability of the August 24, 2016 Mw6.2 Amatrice Earthquake, Italy. Submitted, BSSA.

Munafò, Akinci, Rovida, Taroni, Lanzano, Gomez-Capera, Antonucci, Faenza and Oliveti, (2023). Studying Historical Observations with Modern Techniques: Ground Motion Simulations for the 11 January 1693 Noto Earthquake in Italy. In preparation, SRL.

Artale Harris, Pitarka, Akinci, (2023). Comparing 1D/3D Ground Motion Simulations for Earthquakes in Central Italy, Proceeding Submitted to WCEE 2024.

Artale Harris, Pitarka, Akinci, (2023). Ground Motion Simulations through 1D-FK siulation for Earthquakes in Central Italy, In Preparation, BSSA.

Taroni, Akinci, Regina, Zimmaro, (2023). A flexible weighting scheme to evaluate and rank ground motion models, in Preparation, ES.

Artale Harris, Pitarka, Akinci, (2023). Comparing 1D/3D Ground Motion Simulations for Earthquakes in Central Italy, Abstract AGU 2023.

Akinci, Munafò, Rovida, Taroni, Lanzano, Gomez-Capera, Antonucci, Faenza and Oliveti. (2023). Advancing Historical Observations with Modern Techniques: Ground Motion Simulations for the 1693 Noto Earthquake in Italy. Abstract AGU 2023.

Akinci, Anil Dindar, Bal, Ertuncay, Smyrou and Cheloni,(2023). Characteristics of the Strong Ground Motions and Structural Damage Patterns from the February 6th, 2023 Kahramanmaras Earthquakes, Türkiye. Abstract AGU 2023.

Akinci, A., Pitarka, A., Artale Harris, P., Buttinelli, M., De Gori, P ., (2023). Implication of Rupture Model Parameterization Uncertainty in Simulated Ground Motions From the Mw 6.2, 24 August 2016 Amatrice, Italy Earthquake. SSA Meeting 2023.

Gabrielli S., Akinci, A., Gutiérrez, C., Ojeda, J., Arriola, S., Ruiz, S., (2023). Understanding the Impact of Anelastic Attenuation on Ground Motion Parameter Estimation in Central Italy., SSA23 GMM Meeting.

Gomez-Capera, A.A., Santulin, M., D'Amico, M. *et al.* Macroseismic intensity attenuation models calibrated in Mw for Italy. *Bull Earthquake Eng* (2023). https://doi.org/10.1007/s10518-023-01822-8.

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Mascandola C., Pacor F., Lanzano G., Ramadan F., Traversa P. (2023). Earthquake depth and between-event residuals: what is the link? Geophysical Journal International (submitted)

Castro R.R., Colavitti L., Pacor F., Lanzano G., Sgobba S. (2023). Temporal Variation of S-Wave Attenuation During the 2009 L'Aquila, Central Italy, Seismic Sequence. Bulletin of the Seismological Society of America (submitted)

Lanzano, G., Sgobba, S., Brunelli, G., Luzi, L., Pacor, F. Toward a regionalized ground motion model for shaking scenarios in Italy. 28th General Assembly of the International Union of Geodesy and Geophysics (IUGG), 11-20 July 2023, Berlin, Germany

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Castro, R. R., Colavitti, L., Pacor, F., Lanzano, G., Sgobba, S., Spallarossa, D. (2023). Temporal Variation of S-Wave Attenuation during the 2009 L'Aquila, Central Italy, seismic sequence, Annual Meeting of Southern California Earthquake Center, Poster Presentation, Palm Springs (USA), September 2023.

Colavitti, L., Lanzano, G., Sgobba, S., Pacor, F., Gallovič, F. (2023). Evidence of frequency-dependent directivity effects from non-ergodic ground motion modeling of Spectral Acceleration in Central Italy, General Assembly of European Geosciences, Oral Presentation, abstract EGU23-13574, Vienna (Austria), Aprile 2023.

Working Groups:

29 Internal 10 External participants

WP1 - INGV-ONT (**Ref.** Pasquale De Gori). **Partecipanti (14):**
WP1.1 Pasquale De Gori, Claudio Chiarabba, Samer Bagh, Francesco P. Lucente, Luisa Valoroso, Mario Anselmi,
WP1.2 Pierfrancesco Burrato, Paola Vannoli, Andrea N. Rovida, Antonio Gomez, Giovanni Lanzano, Vera D'Amico, Sara Sgobba, Aybige Akinci.

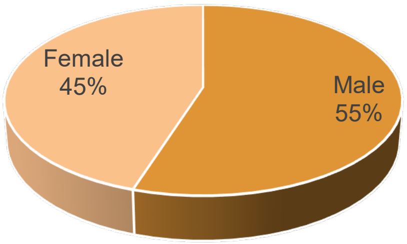
WP2 - INGV-Roma1 (**Ref.** Giovanna Calderoni). **Partecipanti (16):**
WP2.1 Giovanna Calderoni, Antonella Cirella, Antonella Megna, Paola Morasca, Daniele Spallarossa, Dino Bindi, Matteo Picozzi, Pietro Artale Harris, Frantisek Gallovic,
WP2.2 Aybige Akinci, Edoardo Del Pezzo, Luca De Siena, Raul Castro (AR ***Simona Gabrielli, Leonardo Colavitti***)

WP3 – INGV-Milano (**Ref**. Francesca Pacor). **Partecipanti (9)**:
WP3.1 Francesca Pacor, Giovanni Lanzano, Sara Sgobba,
WP3.2 Aybige Akinci, Pietro Artale Harris, Paola Bordoni, Arben Pitarka, Irene Munafò, Daniele Melini

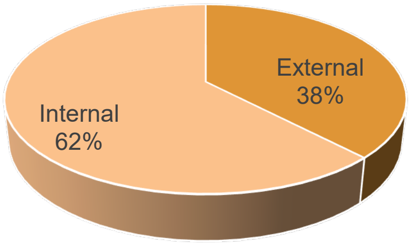
WP4 - INGV-Roma1 (**Ref.** Matteo Taroni). **Partecipanti (6)**: Matteo Taroni, Giovanni Lanzano, Paolo Zimmaro, Gianluca Regina, Ilaria Spassiani, Aybige Akinci

WP Data Management and Dissemination, Partecipanti (3): Fawzi Doumaz, Maurizio Pignone, Aybige Akinci

GENDER BALANCE



INTERNAL-EXTERNAL PARTICIPANTS



ANNUAL SCIENTIFIC REPORT - 2023

- ST_SECURE (Aybige Akinci) - Google Drive

ANNUAL BUDGET REPORT -2023

SECURE_rimodulazione_PPD2023_2025_FINAL - Excel

A5 | Acronimo Progetto: Responsabile:

	A	B	C	D	E	
7	1.06 RM1	Pubblicazioni (cap. 1.03.01.01.002.)	Spese Riviste	Gruppo WP Roma1 (11 ricercatori)	€ 3,500.00	+2000
8	1.06 RM1	Materiale informatico consumabile (cap. 1.03.01.02.006)	2/3 dischi esterni	Gruppo WP Roma1 (11 Ricercatori)	€ 1,500.00	OKAY – GABRIELLI- DE GORI
9	1.06 RM1	Prestazioni tecnico-scientifiche a fini di ricerca (cap. 1.03.02.11.009)	Collaborazione di Ricerca - Lawrence Livermore National Laboratory, LLNL, CA, USA	Gruppo WP Roma1	€ 25,000.00	OKAY - LLNL
10	1.06 RM1	Indennità di missione e trasferta - Personale INGV (cap. 1.03.02.02.002.02)	Partecipazione riunione, cognvegni nazionale e internazionale	Gruppo WP Roma1 (11 ricercatori)	€ 13,000.00	OKAY – GABRIELLI – TARONI – AKINCI - ARTALE
11	1.06 RM1	Indennità di missione e trasferta - Altro Personale (cap. 1.03.02.02.002.02)	Inviti a ricercatori esterni INGV	Gruppo WP Roma1 (collaboratori esterni)	€ 3,500.00	ABERCROMBIE - +1200- OK GNGTS 24
12	1.06 RM1	Inventariabile: Hardware (cap. 2.02.01.07.999.)	Mac Book Pro 14" + Apple Care	Pietro Artale Harris	€ 4,500.00	OKAY – ARTALE MAC
13	1.08 ONT	Pubblicazioni (cap. 1.03.01.01.002.)	Spese Riviste	Gruppo WP ONT	€ 3,000.00	
14	1.08 ONT	Indennità di missione e trasferta - Personale INGV (cap. 1.03.02.02.002.02)	Partecipazione a convegni	Gruppo WP ONT	€ 7,500.00	
15	1.08 ONT	Inventariabile: Hardware (cap. 2.02.01.07.999.)	Pc laptop	Richiedente WP ONT	€ 6,000.00	
16	1.03 MI	Pubblicazioni (cap. 1.03.01.01.002.)	Spese Riviste	Gruppo WP MI	€ 3,000.00	
17	1.03 MI	Prestazioni tecnico-scientifiche a fini di ricerca (cap. 1.03.02.11.009)	collaborazione di ricerca università (Politecnico Milano, Cicese, Messico, Università di Praga)	Gruppo WP MI	€ 20,000.00	
18	1.03 MI	Indennità di missione e trasferta - Personale INGV (cap. 1.03.02.02.002.02)	partecipazione riunione e convegni	Gruppo WP MI	€ 6,000.00	
19	1.03 MI	Indennità di missione e trasferta - Altro Personale (cap. 1.03.02.02.002.02)	Inviti a ricercatori estreni INGV	Gruppo WP MI (collaboratori esterni)	€ 3,500.00	
20	TOTALE				€ 100,000.00	