

CHEESE

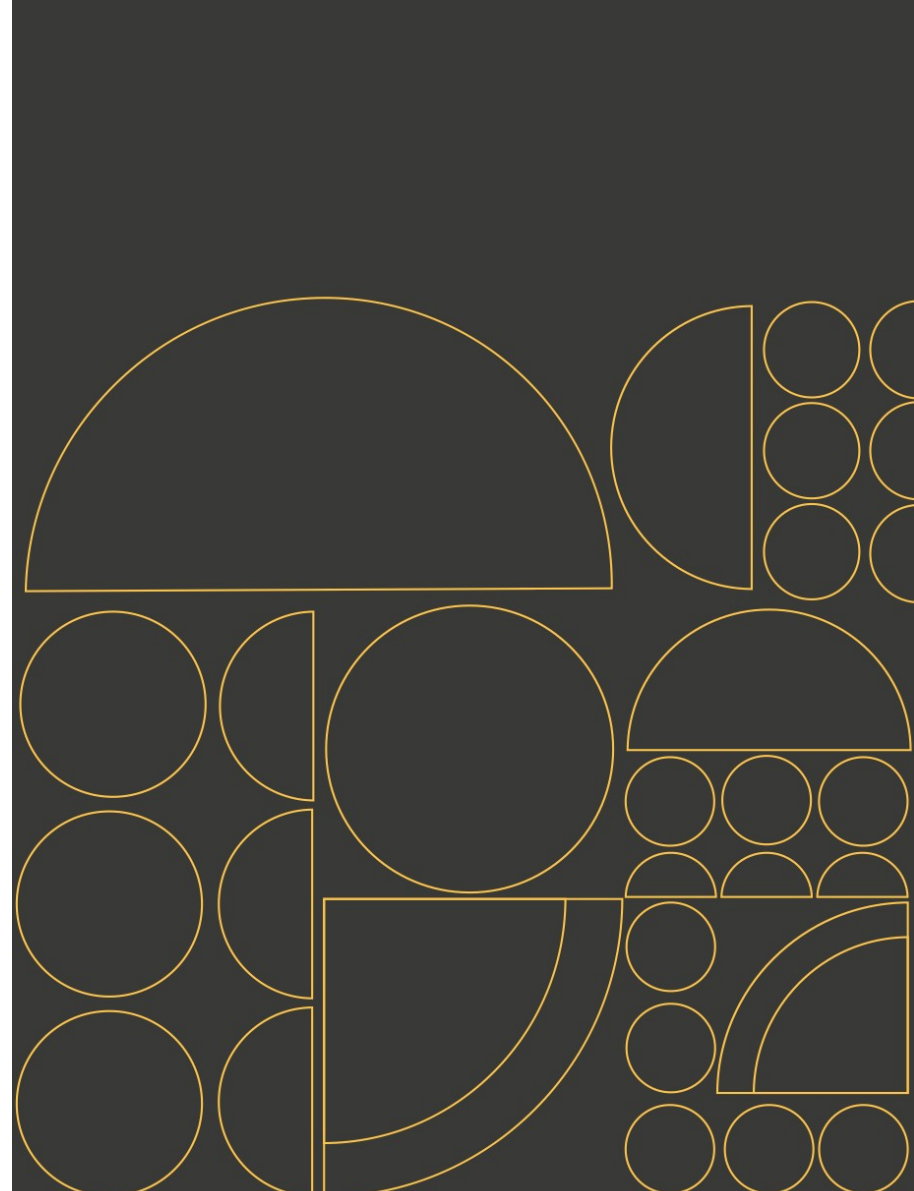
Work Package 5: Farming Pilot Demonstrators

Zoom meeting,
13 September 2023

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CNRS



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- WP5 quick overview
 - Task T5.2
TRL, next steps



WP5: Objectives

1

Implement novel features and coupling mechanisms in flagship codes for new PD workflows.

2

Develop the **new workflows** of the PD farm.



Task 5.1 : Novel features (physics) in flagship codes

Multiphysics

- coupling of codes
- new physical models

Multisource

- new sources for accurate representation
- forcing term

Multiscale

- capture physical effects from local to global scales

Timeline : Month 1 - Month 24

Deliverable D5.1 (TUM) : New version release of flagship codes

- Code version releases with the new functionalities available in the ChEES-2P Zenodo repository



Flagship codes

No	Code	Area	Level	Lead	Presentation	Roadmap
1	SeisSol	CS, T	1	LMU	14 June 2023 (?)	?
2	SPECFEM3D	CS	1	CNRS	12 April 2023 (X)	X
3	ExaHyPE	CS, T	2	TUM	12 April 2023 (X)	?
4	Tandem	CS	2	LMU	14 June 2023 (X)	?
5	xSHELLS	MHD	1	CNRS	10 May 2023 (?)	X
6	HySEA	T	2	UMA	10 May 2023 (X)	?
7	FALL3D	V	2	CSIC	12 April 2023 (X)	?
8	OpenPDAC	V	2	INGV	14 June 2023 (?)	?
9	LaMEM	GD	1	UM	10 May 2023 (X)	?
10	pTatin3D	GD	1	SU	14 June 2023 (X)	X
11	Elmer/Ice	GL	2	CSC	14 June 2023 (X)	X

→ Upload presentations and roadmaps :

<https://saco.csic.es/index.php/s/5paFC4EyEfeKy7w?path=%2FWP5>

→ Update your roadmap (activity monitoring (every 6 months?))



WP5: Task 5.2 Developments in Pilot Demonstrators

Pilot Demonstrator (PD): Workflow based on flagship codes

- Capacity/capability simulation on (pre-)exascale computer
- Farm 9 PDs (2 in CS, 2 in tsunamis, 2 in physical volcanology, 1 in MHD, 1 in geodynamics, and 1 in glacier hazards)
- Basic research, subsurface imaging, hazard assessment, urgent computing early warning system.
- Increase the Technology Readiness Level (TRL) of each PD by at least 2 points

Timeline : 7-42

Deliverables : D5.(2-10) (1 per PD)

TRL	1	2	3	4	5	6	7	8	9
	basic principles observed	technology concept formulated	experimental proof of concept	technology validated in lab	tech valid in relevant environment	demonstration in relevant environment	demonstration in operational environment	system complete and qualified	system proven in operational environment





Horizon Europe

Work Programme 2021-2022

13. General Annexes

(European Commission Decision C(2022)2975 of 10 May 2022)



Technology Readiness Levels

Where the specific call conditions require a Technology Readiness Level (TRL), the following definitions apply, unless otherwise specified:

- TRL 1 — Basic principles observed
- TRL 2 — Technology concept formulated
- TRL 3 — Experimental proof of concept
- TRL 4 — Technology validated in a lab
- TRL 5 — Technology validated in a relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 — Technology demonstrated in a relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 — System prototype demonstration in an operational environment
- TRL 8 — System complete and qualified
- TRL 9 — Actual system proven in an operational environment (competitive manufacturing in the case of key enabling technologies, or in space)

https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-13-general-annexes_horizon-2021-2022_en.pdf



WP5: Task 5.2 Developments in Pilot Demonstrators

No	PD name	Aera	Related flagship codes	Initial TRL	Target TRL	Underpinning concept	ECC
1	Extreme-scale modeling of seismic hazards	CS	All CS codes	5	7	multiphysics multiscale	ECC1 ECC3
2	High-resolution seismic inversion and tomography	CS	SPECFEM3D	4	6	multisource	ECC1
3	Global tsunami hazard and uncertainty quantification	T	HySEA	6	8-9	multiscale	ECC6
4	Complex multi-source tsunami modeling	T	HySEA, ExaHype, SeiSol	3	5	multisource multiphysics	ECC4 ECC5
5	Ensemble-based volcanic dispersal at multiple scales	V	FALL3D	5	7-8	multiscale	ECC7 ECC9
6	Multiphase 3D volcanic explosion modeling	V	OpenPDAC	4	7	multiphysics multiscale	ECC8
7	The Earth's dynamo model	MHD	xSHELLS	3	5	multiscale	ECC10
8	Geodynamics to geohazards	GD	LaMEM, pTatin3D	3	5	multiscale	ECC11 ECC12
9	Glacial outburst floods	GL	Elmer/Ice	2	4	multiphysics	none





Questions

- Should TRLs be documented precisely?
 - Show how the initial TRL is respected?
 - What must be checked for the targeted TRL?
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Initial TRL for PD

TRL		Related PD
1	Basic principles	None
2	Concept formulated	PD9
3	Initial script & functions to solve the desired problem.	PD4, PD7, PD8
4	Alpha version of the PD tested internally by the development team .	PD2, PD6
5	Alpha version of the PD functionalities tested by outsiders of the development team .	PD5, PD1
6	Beta version of the PD functionalities tested by selected end-user under a control mode.	PD3
7	Beta version of the PD functionalities widely open to end-users .	None
8	Stable version of the PD available for labs, observatories, companies, ...	None
9	Stable version of the PD operational for labs, observatories, companies, ...	None



Target TRL for PD

TRL		Related PD
1	Basic principles	None
2	Concept formulated	None
3	Initial script & functions to solve the desired problem.	None
4	Alpha version of the PD tested internally by the development team .	PD9
5	Alpha version of the PD functionalities tested by outsiders of the development team .	PD4, PD7, PD9
6	Beta version of the PD functionalities tested by selected end-user under a control mode.	PD2
7	Beta version of the PD functionalities widely open to end-users .	PD1, PD6, (PD5)
8	Stable version of the PD available for labs, observatories, companies, ...	PD5, (PD3)
9	Stable version of the PD operational for labs, observatories, companies, ...	PD3





- Next steps :

send me 1 or 2 slides for each PD

- Objectives of PD,
 - Planned development,
 - Initial TRL description
 - How to asses the final TRL
- 

ChEESE 1 used definition for TRL

ChEESE Technology Readiness Levels

LEVEL	TRL Definition (European Commission)	TRL for ChEESE Pilot Demonstrator	Target	WP
TRL 1	Basic principles observed	Equations and Quantities of Interest (QoI) defined. HPC parallel numerical code deployed.	Developers	n.a.
TRL 2	Technology concept formulated	Efficiency metrics defined and strategy towards <i>exascale</i> preliminarily assessed.	Developers	2,3
TRL 3	Experimental proof of concept	Proof of scalability and efficiency of individual components ^[1] . Simplified tests performed.	Developers	2,4
TRL 4	Technology validated in lab	Proof of models/data interoperability in workflows.	Developers	3,4
TRL 5	Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)	Individual components of the prototype service ^[2] validated in relevant environments ^[3] . Error checking.	Field specialists	2,4,5
TRL 6	Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)	Component integration and interoperability. Real-case tests demonstrated in relevant environments. Assessment of required resources.	Field specialists	3,4,5
TRL 7	System prototype demonstration in operational environment	Individual components of the prototype service demonstrated in operational environments ^[4] . Training of users.	End-users	5
TRL 8	System complete and qualified	Component integration and interoperability. Real-case tests demonstrated in operational environments. Assessment of Ethical aspects.	End-users	5
TRL 9	Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)	The service is deployed and operation-ready for different scenarios. Agreement on Ethical and Liability issues ^[5] .	End-users	n.a.



Notes

[1]. A Component is each individual step of a workflow (e.g., the simulation software, data conversion algorithms, pre-processing and post-processing procedures, data transfer). Moving from TRL 3 to 4, TRL 5 to 6, TRL 7 to 8, we demonstrate in different environment the successful integration of the individual components into Workflows. In ChEESE, WP2 is mostly dedicated to Components, WP3 to Workflows optimization and enabling.

[2]. ChEESE HPC *Services* are defined for those PDs achieving TRL ≥ 5 .

[3]. The TRL scale differentiates between laboratory (where technology is developed), relevant (where technology is tested) and operational (where technology is applied) environments.

For ChEESE products, the main difference between the three different environments will concern the target users, the service interface, and the (data/software/workflow) access policy.

TRLs	Target	Interface	Software access	Workflows access	Products access
TRL3-4	Developers	Mostly command line	YES	YES	YES
TRL5-6	Field Specialists	Some interface	NO	YES	YES
TRL7-8	End-Users	Friendly interface	NO	YES/NO	YES

[4]. Typical Operational Environment in ChEESEs include:

- Volcano Observatories
- Earthquake and Tsunami Warning Centres
- Civil Protection Operative Centres
- Governmental Agencies

[5]. We stress the distinction between Operational Environment and Operational Service. To implement an Operational Service (i.e., a Service used to take actions), an agreement between the developers and users on the Ethical and Liability issues must be formalized. No service will be operational in this sense in ChEESE.

WP5: Deliverables

D	Deliverable name	Lead	Type	Level	M	Date
5.1	New version release of flagship codes	TUM	OTHER	PU	24	Dec 2024
5.2	Demonstrator of PD1	TUM	DEM	PU	30	Jun 2025
5.3	Demonstrator of PD4	NGI	DEM	PU	30	Jun 2025
5.4	Demonstrator of PD6	INGV	DEM	PU	30	Jun 2025
5.5	Demonstrator of PD7	CNRS	DEM	PU	30	Jun 2025
5.6	Demonstrator of PD8	UM	DEM	PU	30	Jun 2025
5.7	Demonstrator of PD2	CNRS	DEM	PU	36	Dec 2025
5.8	Demonstrator of PD3	UMA	DEM	PU	36	Dec 2025
5.9	Demonstrator of PD5	IMO	DEM	PU	36	Dec 2025
5.10	Demonstrator of PD9	CSC	DEM	PU	36	Dec 2025



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- Next meeting October 11, 10am ?

