



Finanziato
dall'Unione europea
NextGenerationEU



Ministero
dell'Università
e della Ricerca



Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA



ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

WP10

Center of computational geoscience

Coordinators:

E. Casarotti

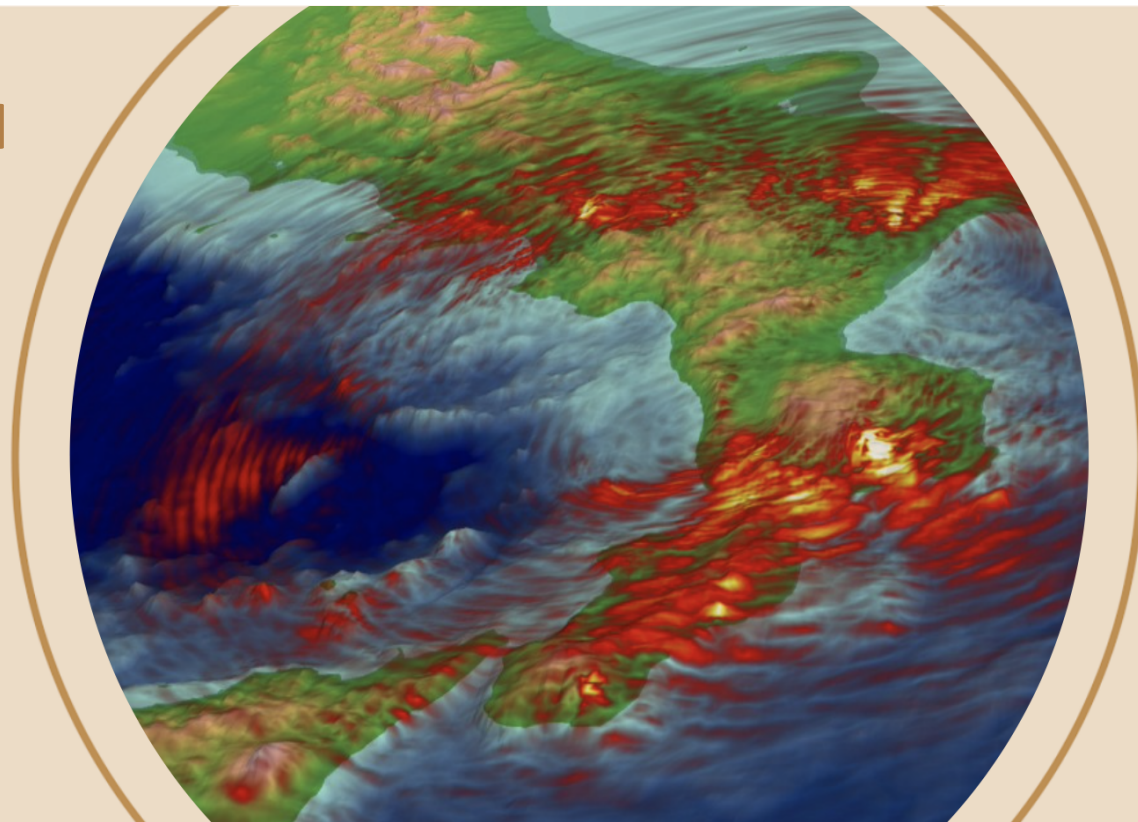
T. Esposti Ongaro

Wp leaders:

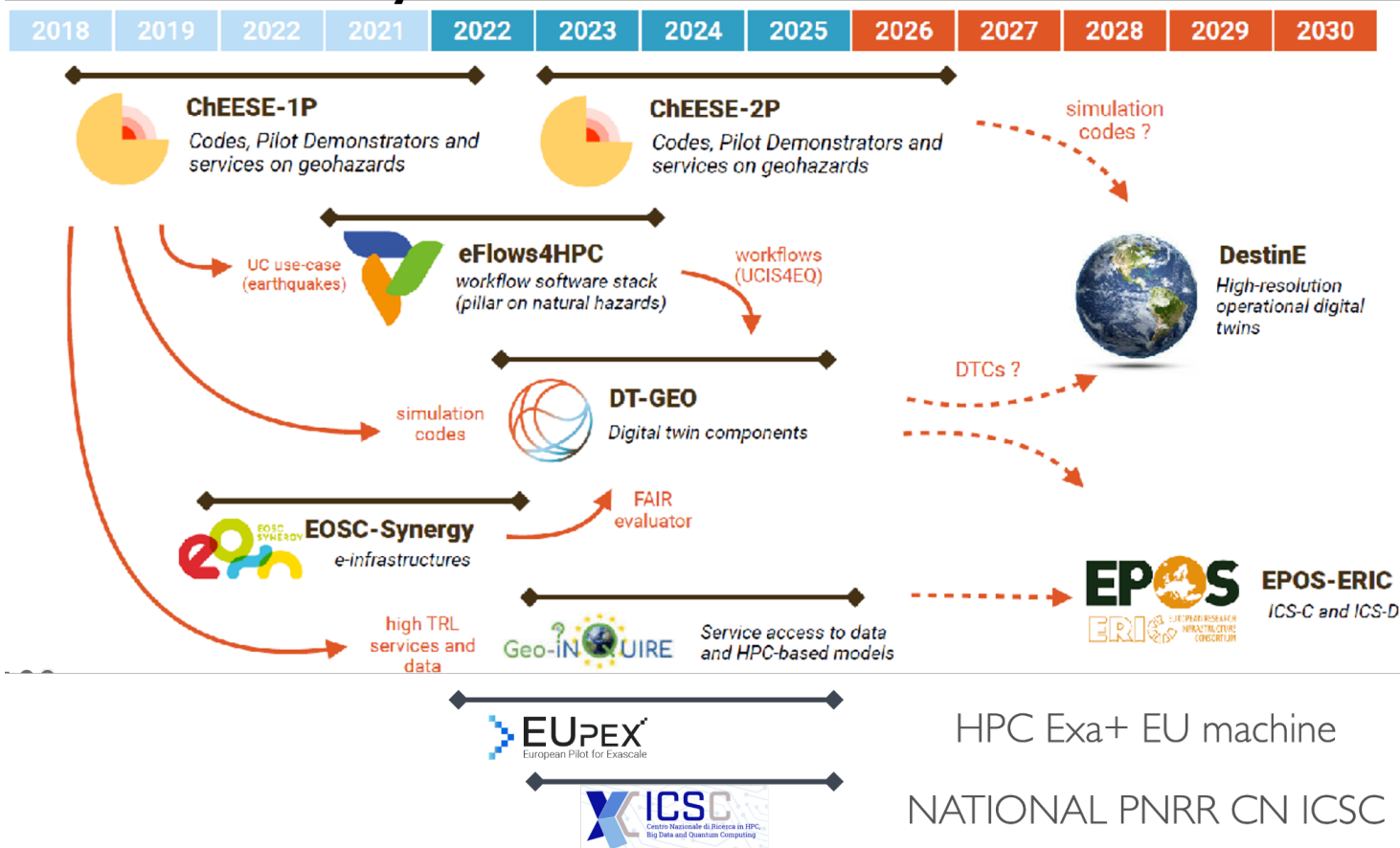
G. Scarpato, D. Melini

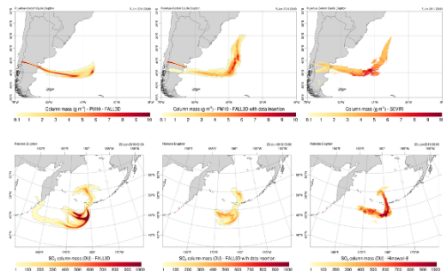
Assigned Budget

1.97M€, 4.6% of the project

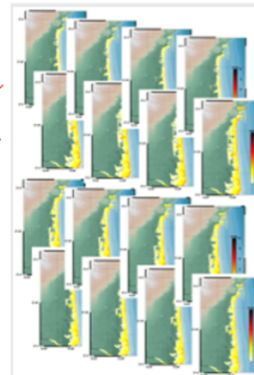


HPC EU ecosystem: a DIGITAL TWIN for GEO extremes

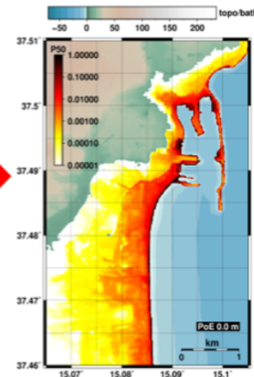




Inundation scenarios



Local hazard map

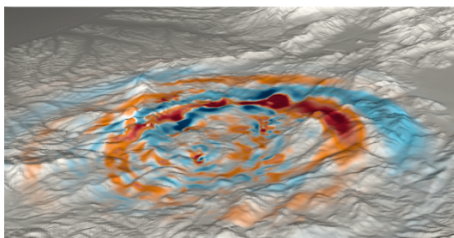


More data (assimilation)

Larger Ensemble size (reduce uncertainty)

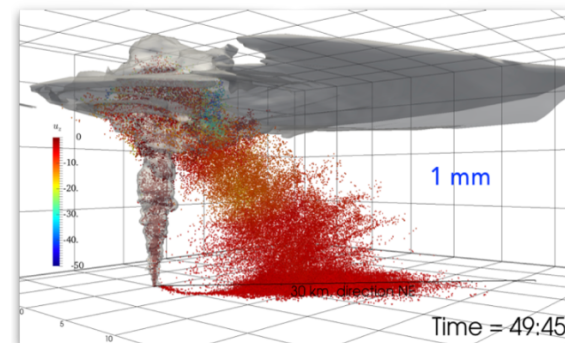
Larger spatial/temporal domains

Higher spatial/temporal resolution



More physics (increase complexity)

More output data (analysis)



HPC

Accessibility

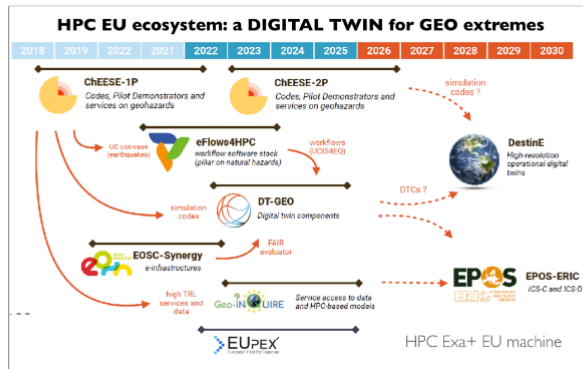
- Developing High Performance Computing (HPC), High Performance Data Analytics (HPDA) e Artificial Intelligence (AI) resources in a perspective of **scalability** and both **economic/ecological sustainability**.
- Hosting a **Tier 3 computing system**, to provide access to an increasing number of researchers/technologists to high performance computational resources.
- Promoting the **optimization** and **harmonization** of the distributed computational resources inside INGV.
- Providing **TransNational & Virtual Access** to HPC/HPDA/AI software and hardware resources.

Capacity building

- Coordinating INGV personnel **training**, knowledge sharing.
- Facilitating the **technological development** in HPC/HPDA/AI sector, the *porting and enabling* of HPC applications. Improving scientific production related to Computational Geosciences.
- Facilitating the access to HPC/HPDA/AI resources of higher level (Tiers2-1-0) in the Regional, National and European context, towards the **Exascale Computing** strategic objective.
- Developing HPC/HPDA/AI services for geophysical hazards, including **Urgent Computing, Early Warning, e Probabilistic Hazard Assessment**.
- Develop a **synergy with INGV centres**: Centro Allerta Tsunami, Centro Pericolosità Sismica, Centro di Pericolosità Vulcanica, Centro di Monitoraggio delle Eolie, Centro per il Monitoraggio del Sottosuolo, Centro Ossezioni Spaziali della Terra.

Integration within the Italian and European HPC ecosystem.

1. Integration with **ESFRI** roadmap (European Strategy Forum for Research Infrastructures), in particular with EMSO e EPOS ERIC (European Research Infrastructure Consortia) and **ICDI** (Italian Computing and Data Infrastructure).
2. Eu initiatives



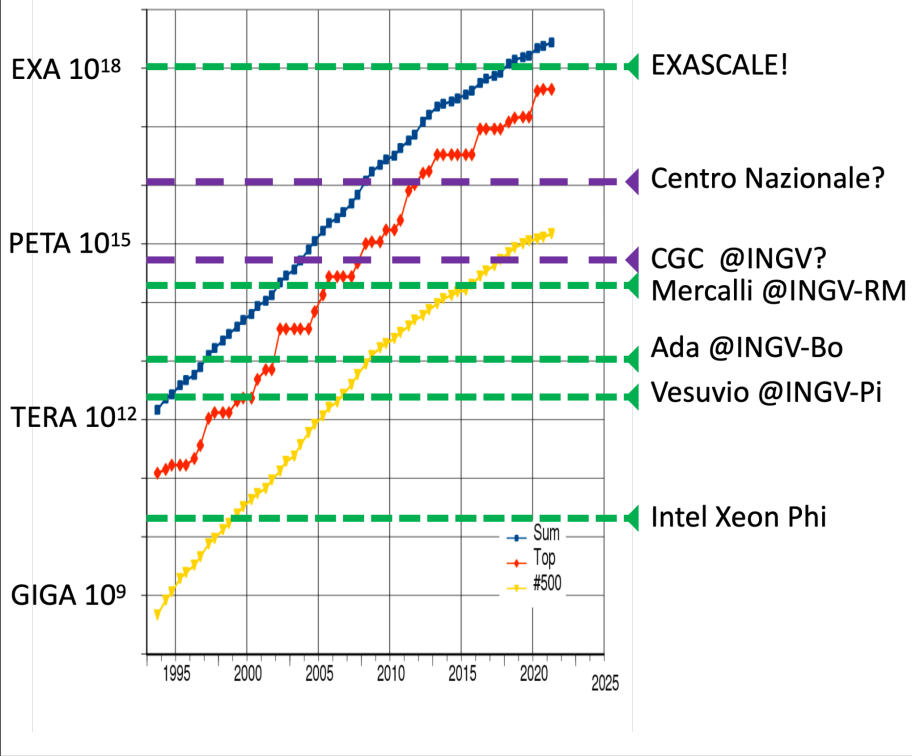
Present state of the INGV HPC infrastructure

Tot. 8000 CPU; 60 GPU

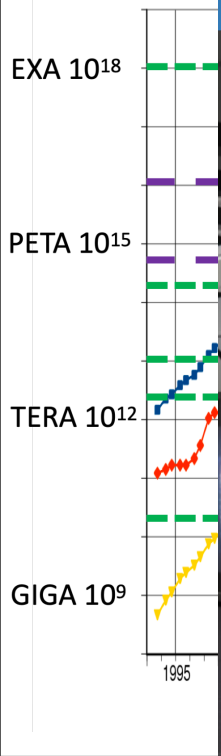
Capacità complessiva di calcolo
superiore a 500 TFLOPS



GFlops = 10^9 Floating-point operations/second



GFlops = 10^9 Flo



CINECA



HIGH PERFORMANCE COMPUTING



INFORMATION SYSTEMS FOR UNIVERSITIES AND RESEARCH



SUPPORT TO THE ITALIAN MINISTRY OF EDUCATION, UNIVERSITIES AND RESEARCH

LEONARDO RANKED 4TH IN THE TOP500 LIST

This milestone rewards CINECA's 50-year commitment to supporting research through HPC and confirms Italy's role as a strategic asset in the building of the European HPC ecosystem



HPC & Data Centers

Target

Risorse di calcolo

Target

Sostenibilità

~ **exaFLOPS**

- Centres of Excellence
- PRACE

- Scientific excellence (grand challenges)
- Urgent computing
- Probabilistic hazard assessment / forecast / early warning

European Commission (Long-term?)

~ **10 petaFLOPS**

- Centro Nazionale HPC

- Hazard and risk assessment for natural catastrophes (**High TRL**)
- Service to the society (**High TRL**)

• **PNRR**
• ?

< **1 petaFLOPS**

- Centro Geofisica Computazionale INGV

- Fundamental research (**Low TRL**)
- Service to the scientific community (**Intermediate TRL**)

• **PNRR**
• Progetti Infrastrutturali
• Servizi HPC

~ **10-100 teraFLOPS**

- Sezioni INGV (**federazione**)

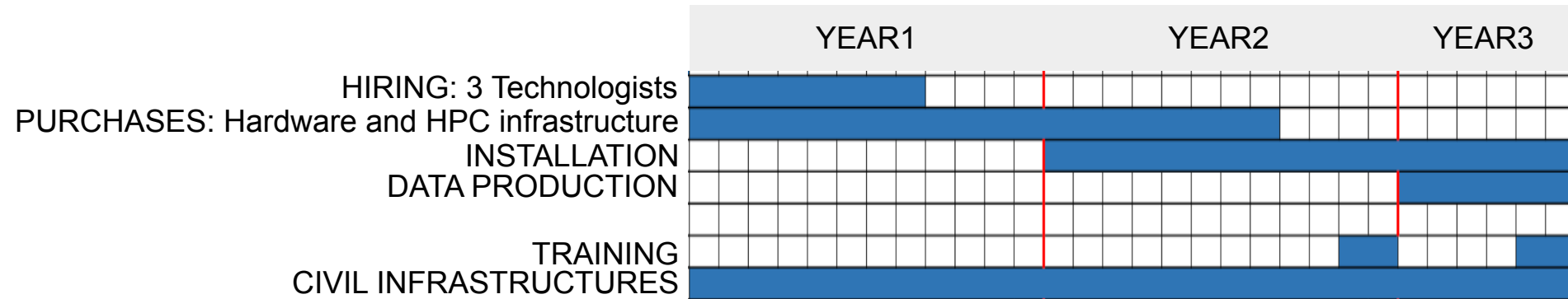
- Fundamental research and development (Low TRL)

• Progetti PON
• EOSC
• Fondi ordinari

WP10 Center of computational geoscience

- Data Center infrastructure design and implementation: Design a scalable, energy-efficient, sustainable Data Center able to host HPC systems (ROMA)
- Strengthening, design, acquisition of HPC resources: Make available to the (enlarged) INGV community a hybrid HPC system close to Tier III category
- HPC Software and system management: Provide access to software, scientific workflows and large datasets for HPC, HPDA, AI to the geosciences (INGV and wider EPOS) community, following the FAIR principles.

WP10 Center of computational geoscience



WP10		Casarotti	PERSONNEL	INSTRUMENTATION, EQUIPMENT, SOFTWARE, PATENT	OPEN ACCESS, TNA, FAIR	CIVIL INFRASTRUCTURES AND RELATED SYSTEMS	TRAINING ACTIVITIES	INDIRECT COSTS	TOTAL
10.1	Data Centre infrastructure design and implementation	Scarpato	113K€	99K€		700K€	2.5K€	64K€	979K€
10.2	Strengthening, design, acquisition of HPC resources	Melini	113K€	600K€			10K€	50.6K€	774K€
10.3	HPC Software and system management	Esposti Ongaro	113K€	25K€	54K€		12.5K€	14K€	219K€