ChEESE

Experiences from the ChEESE CoE
Arnau Folch (CSIC)
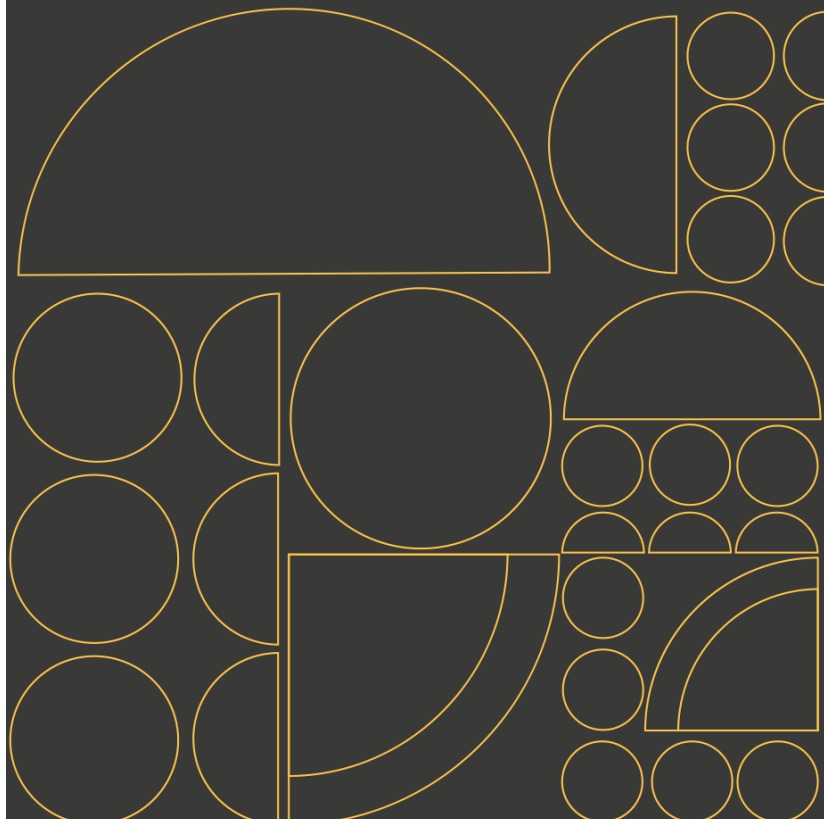Tomaso Esposti-Ongaro (INGV)

CASTIEL2 "dos & donts" 3rd workshop:
Interaction with public administration

Online, 27 May 2024

How the ChEESE CoE approaches exascale

1

Capability computing

Solve problems that traditionally have been parameterised because are unaffordable with current hardware

**Large monolithic (hero) runs
Exascale reached at code level**

2

Capacity computing

Solve ensembles of single problems affordable with petascale-range machines but that can aggregate into an exascale workflow (e.g. data inversion, model data assimilation, uncertainty quantification, etc)

**Large ensemble runs
Exascale reached at workflow level**
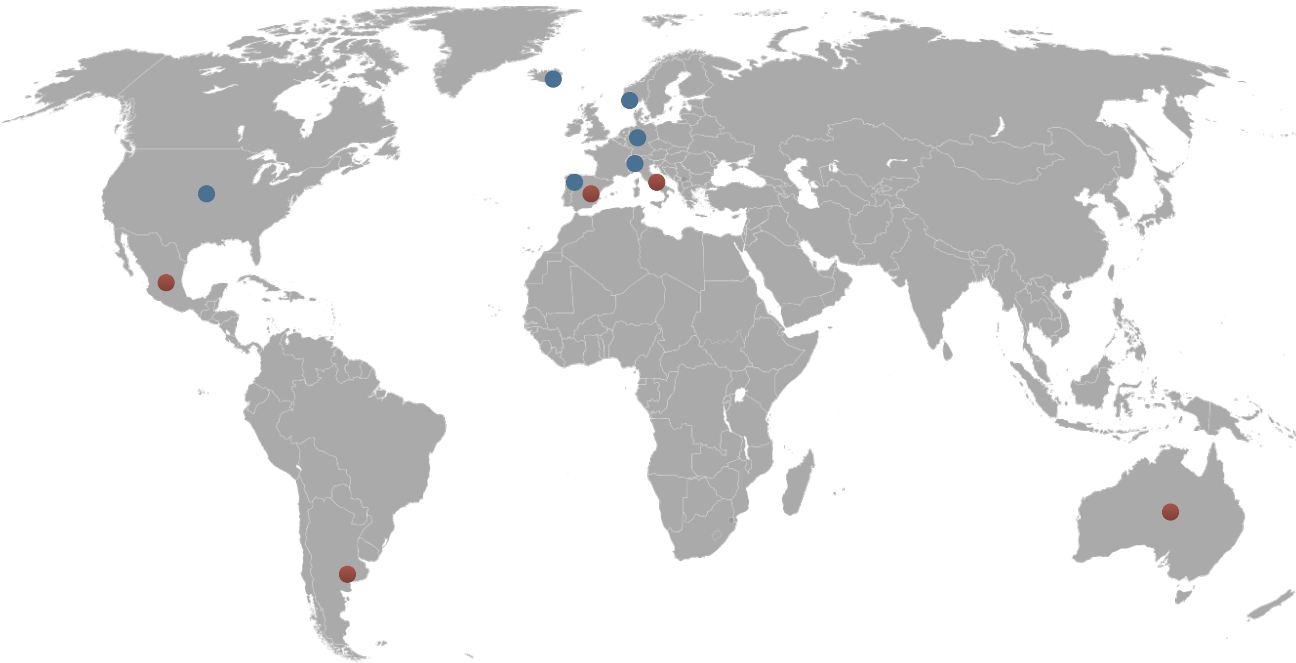
3

Urgent computing

Solve capability/capacity problems under strict time constrains in terms of time-to-solution (emergency situations)

Exascale machines to reduce time-to-solution to operational constrains

Involves service enabling in collaboration with public bodies in charge of emergency management (volcanoes, earthquakes, tsunamis)

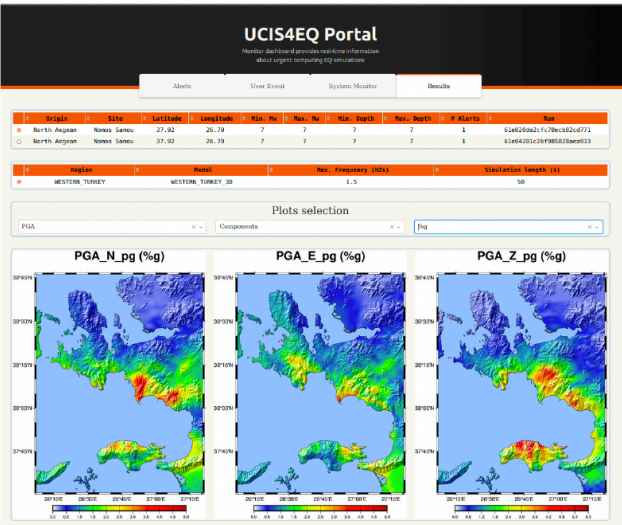# ChEESE-2P: The Industry and Users Board (IUB)

9 Full members ●

Italian Civil Protection Department (Italy)
Geographic National Institute (Spain)
European Plate Observing System (ERIC)
ARISTOTLE (Italy)
AuScope (Australia)
National Computational Infrastructure (Australia)
National Seismic Institute (Mexico)
Buenos Aires VAAC (Argentina)
Centro PLINIVS (Italy)

14 Observers ●

Icelandic Civil Protection (Iceland)
IAVCEI
IASPEI
Repsol
Schlumberger
INTEL
Global Parametrics
ARM
FAULT2SHA
Modeling Collaboratory for Subduction (MCS)
Water Resources and Energy Directorate (Norway)
International Center for Earth Simulation (ICES)
NVIDIA
Global Earthquake Modeling Foundation (GEMF)

IUBs play an important role in proposing, driving and evaluating the trial exercises and related services

Examples of exercises (service co-design with IUBs)

Live demonstration of the Urgent Computing Integrated Services for EarthQuakes (UCIS4QE) in Turkey coast and Samos island (Greece)
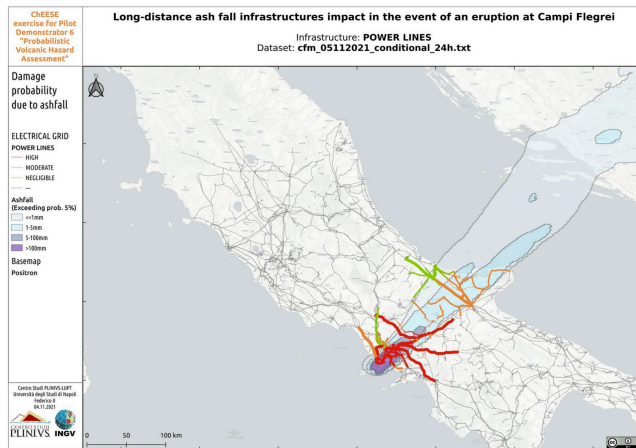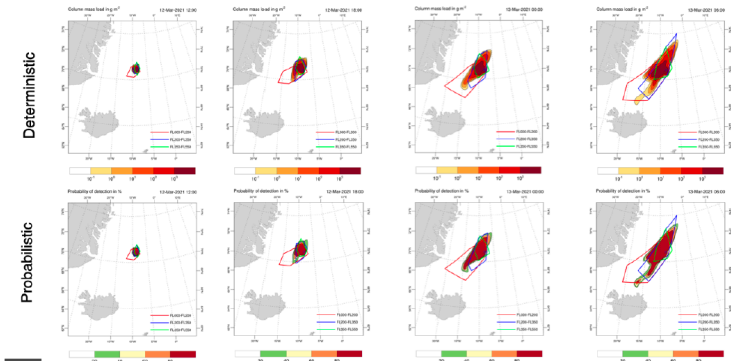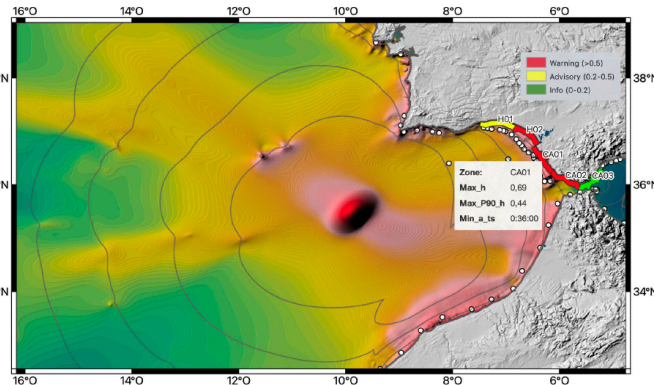

Figure 10: Medium size eruption impact on Electrical Grid POWER LINES

Live demonstration of Probabilistic Volcano Hazard Assessment in Napoli driven by PLINIUS and ARISTOTLE


Live demonstration of ash forecast driven by Volcanic Ash Advisory Center (VAAC)

Live demonstration of Tsunami Early Warning System (TEWS)

A real service case : La Palma eruption

- The eruption lasted for nearly 3 months (from 19 September to 13 December 2021).
- About 3,000 buildings were destroyed by lava flows and 8,000 people were evacuated (red zone).
- Occurrence of punctuated airport disruptions by ash fallout (imply runway cleaning, re-routing, etc).
- The crisis was successfully managed by the emergency committee (PEVOLCA); no fatalities.
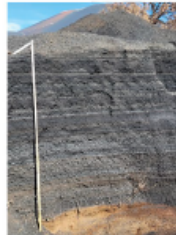
A real service case : La Palma eruption

- A **daily operational forecast ChEESE service** delivered to the scientific committee of the PEVOLCA.
- Informed decision-makers about the next 48h in terms of civil aviation impacts and likelihood of low air quality scenarios (confinement of population even beyond the red zone).
- FALL3D simulations ran @MN4 on 2 different computational domains: archipelago (at 1 km grid resolution) and regional (at 5 km grid resolution).
- Showed the benefits of UC, informing authorities about expected scenarios and anticipating decision-making.
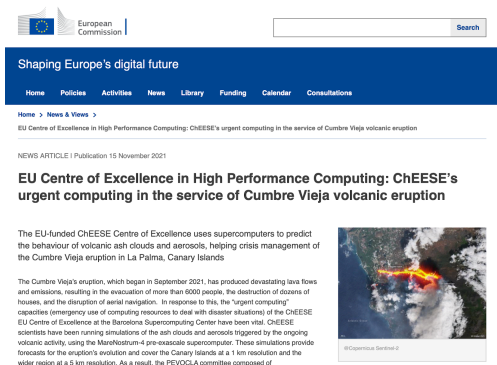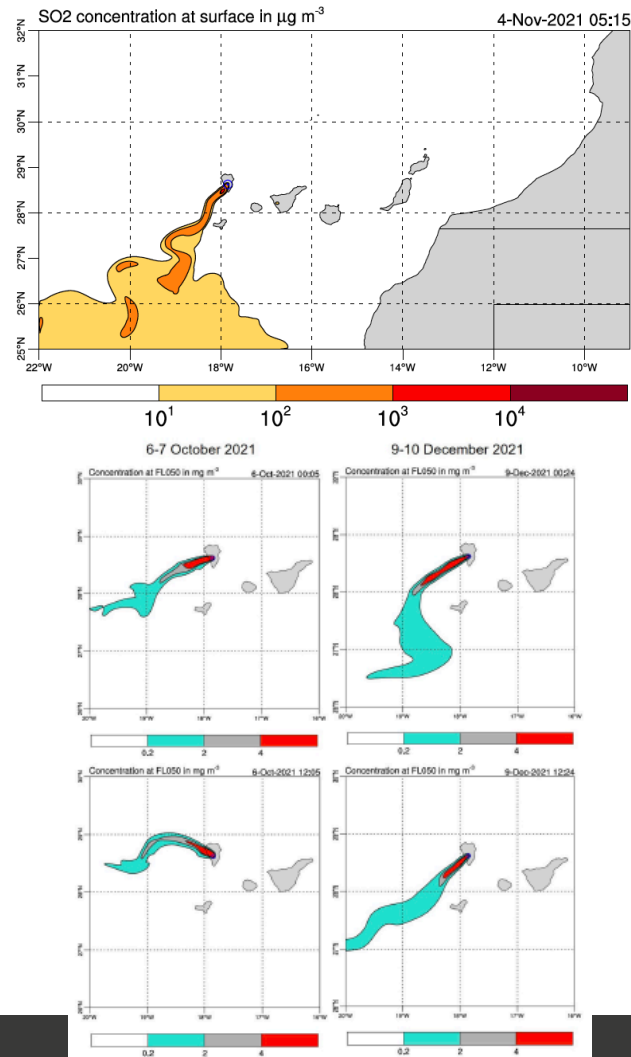
A real service case : UC tsunami service in Aristotle

- Tsunami hazard assessment (triggered by submarine earthquakes).
- Operational product for the EU Emergency Response Coordination Centre (ERCC) to be prepared for humanitarian aid (before potentially affected countries ask for it through official channels).
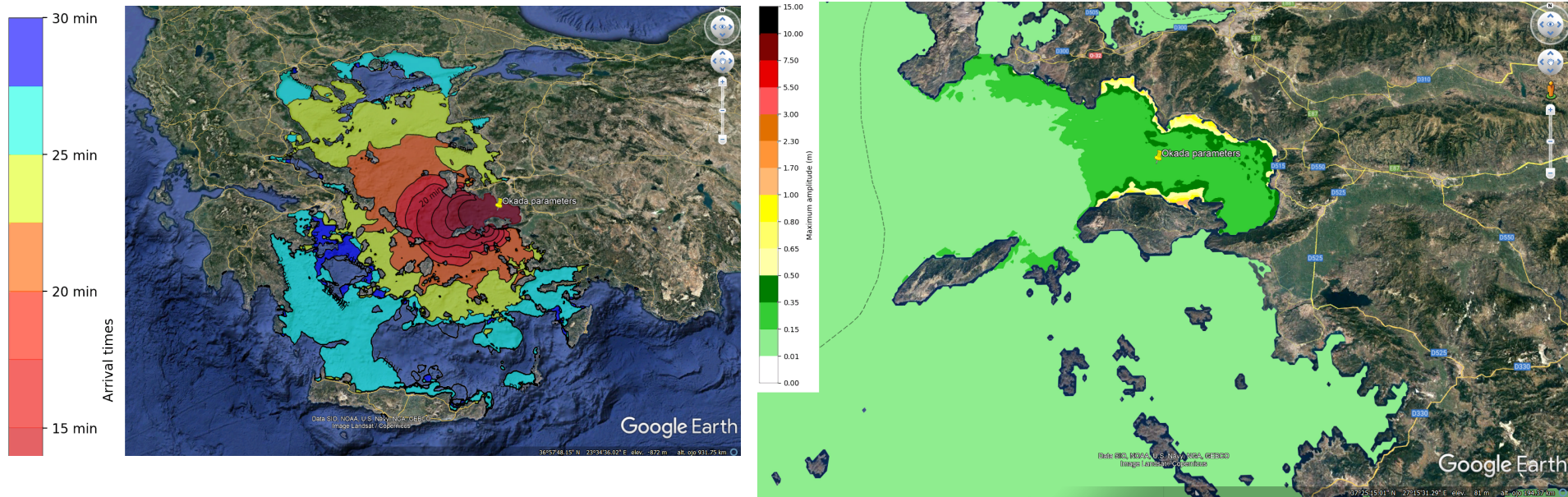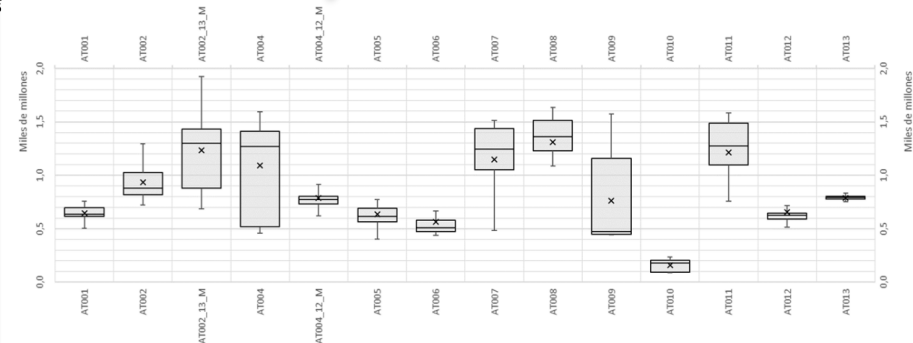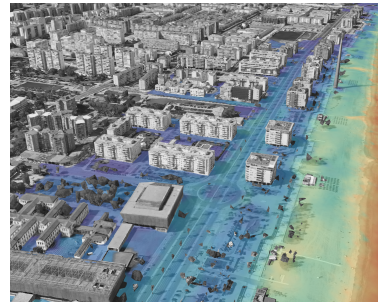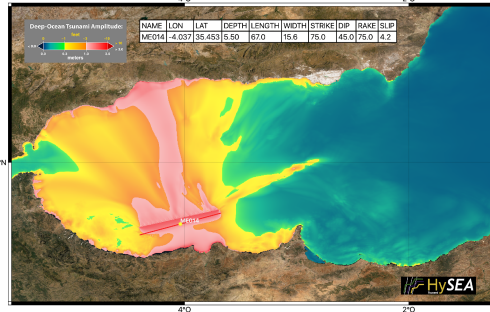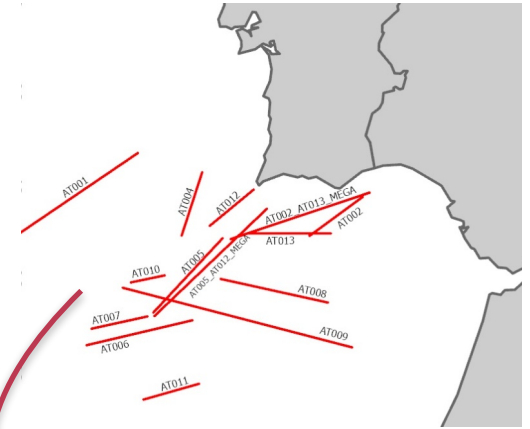
A real service case : long-term tsunami hazard assessment

- Studies in Andalucía (Spain) for IGN, including estimation of economic losses depending on the source.
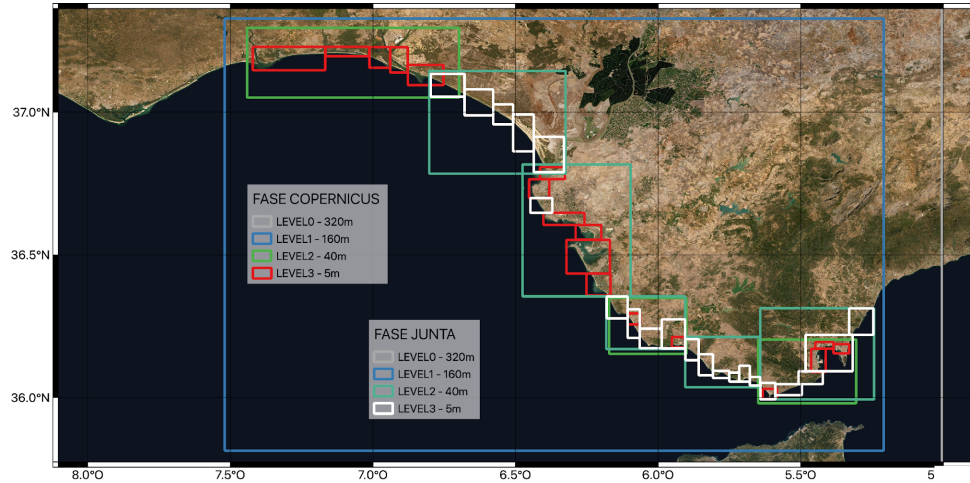

14 mapped faults

Conclusion

Donts

- Do not expect end-users (public administration) to adopt your products "as they are".

Dos

- Involve them from the very beginning; co-design is fundamental to cover user needs.
- Regulations, roles and protocols are important, particularly in emergency situations (UC service).
- Clarify "who does what", including access to computational resources.

Thank you!

@cheese-coe

http://cheese2.eu
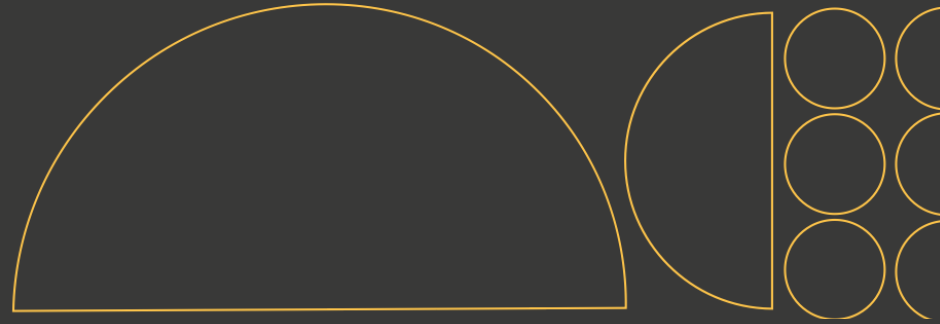
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