HPC projects in the Solid Earth ecosystem

Arnau Folch

Consejo Superior Investigacions Cientificas, Barcelona, Spain (afolch@geo3bcn.csic.es)

The second phase (2023-2026) of the EuroHPC Center of Excellence for Exascale in Solid Earth (ChEESE-2P), funded by HORIZON-EUROHPC-JU-2021-COE-01 under the Grant Agreement No 101093038, will prepare 11 European flagship codes from different geoscience domains. Codes will be optimised in terms of performance on different types of accelerators, scalability, containerisation, and continuous deployment and portability across tier-0/tier-1 European systems as well as on novel hardware architectures emerging from the EuroHPC Pilots (EuPEX/OpenSequana and EuPilot/RISC-V) by co-designing with mini-apps. Flagship codes and workflows will be combined to farm a new generation of 9 Pilot Demonstrators (PDs) and 15 related Simulation Cases (SCs) representing capability and capacity computational challenges selected based on their scientific importance, social relevance, or urgency. On the other hand, the first phase of ChEESE was pivotal in leveraging an ecosystem of European projects and initiatives tackling computational geohazards that will benefit from current and upcoming exascale EuroHPC infrastructures. In particular, Geo-INQUIRE (2022-2024, GA No 101058518) and DT-GEO (2022-2025, GA No 101058129) are two on-going Horizon Europe projects relevant to the Solid Earth ecosystem. The former will provide virtual and trans-national service access to data and state-of-the-art numerical models and workflows for monitoring and simulation of the dynamic processes in the geosphere at unprecedented levels of detail and precision. The later will deploy a prototype Digital Twin (DT) on geophysical extremes including 12 self-contained Digital Twin Components (DTCs) addressing specific hazardous phenomena from volcanoes, tsunamis, earthquakes, and anthropogenically-induced extremes to conduct precise data-informed early warning systems, forecasts, and hazard assessments across multiple time scales. All these initiatives liaise, align, and synergise with EPOS and longer-term mission-like initiatives like Destination Earth.