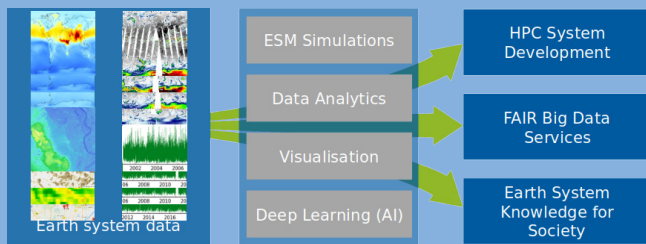


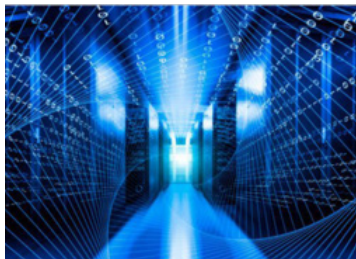
JOINT LAB EXASCALE EARTH SYSTEM MODELLING

GET EARTH SYSTEM MODELS READY FOR NEXT-GENERATION SUPERCOMPUTERS



- **Cross-cutting activity of the Helmholtz Association**
- **Develop new software paradigms to overcome the limited scalability of current ESMs**
- **Increase the flexibility and portability of ESM software and workflows**
- **Explore novel concepts for improving the transport of huge amounts of information on hierarchical and federated storage systems**
- **Better understand the computational and data demands of future ESM codes**
- **Explore the use of machine learning to optimize or replace numerical-expensive parametrizations in Earth system model components**

Activity 1: Exascale Code Scalability



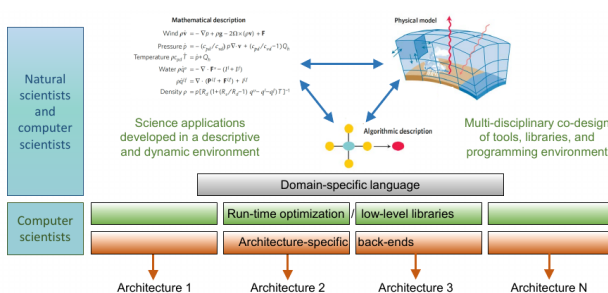
Achieve exascale readiness by

- improving scalability
- facilitating portability and
- future-proofing
- increasing resource and
- energy efficiency
- to enable ESM codes to run
- simulations at higher resolution
- resolving more processes

The Joint Lab activity can support this via

- fostering synergies
- optimising community-wide developments
- preparing the HGF ESM community for the first European exascale machine

Development of ESM dwarfs and separation of concerns



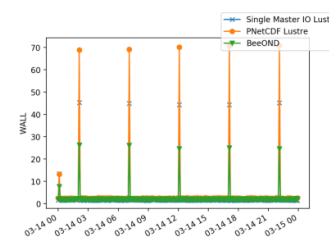
With ESM dwarfs, architecture-specific optimizations are implemented and explored, by employing low-level libraries or code developments, written as code in a domain-specific language (DSL).

Activity 2: Exascale Workflow Scalability

Prepare for extreme data processing by exploring

- Novel storage concepts for exascale
- Data staging and file size handling
- Extreme data services and exchange
- Postprocessing and analysis workflows

SSD-based fast storage tiers



I/O-intensive applications can greatly benefit from staging data to a faster storage tier. We explore the potential benefits of such SSD-based storage layers, either on cache or node-local, for typical ESM data workflows.

Pseudo-operational automated services

State	Masters	WorkerName	Recent Builds
🟢	1	Buildbot	DUMMY127, DUMMY125, DUMMY124, DUMMY122, BUILDBOT_MASTER123, DUMMY120, BUILDBOT_MASTER122
🟢	1	GENERAL_JURECA	WRF121, WRF119, WRF117, WRF116, WRF115, WRF114, WRF113
🟢	1	GENERAL_JUSUF	PARFLOW142, PARFLOW141, PARFLOW138, PARFLOW137, PARFLOW134, PARFLOW131, PARFLOW128
🟢	1	GENERAL_JUWELS	MPTRAC108, WRF_JUBE108, ICON_VW112, WRF_JUBE107, WRF122, PARFLOW143, MPTRAC107
🟢	1	GENERAL_JUWELS_BOOSTER	MPTRAC_GPU130, MPTRAC_GPU129, MPTRAC_GPU_NIGHTLY1, MPTRAC_GPU128, MPTRAC_GPU127, MPTRAC_GPU126, MPTRAC_GPU_TMP16

Access to ESM data for anonymous users or user groups is granted without knowing the authenticity of the user. HPC administrators and ESM scientists work together on responsibilities and firewall settings to define service accounts which can deal with the demands of such untrustable users.