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ESCAPE-2

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ESCAPE-2 2nd Dissemination Workshop

Time	Title	Speaker
14:00-14:15	Welcome and Introduction to ESCAPE-2	Peter Bauer, Nils Wedi, Daniel Thiemert
14:15-14:30	WP1: Mathematics and algorithms	Luca Bonaventura
14:30-14:45	WP2: Programming models and DSL	Carlos Osuna
14:45-15:00	WP3: Weather and Climate Benchmarks: HPCW	Erwan Raffin, David Guibert, Ralf Mueller, Michiel Van Ginderachter
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ESCAPE-2 Objectives

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Headline objective:

ESCAPE-2 will develop world-class, extreme-scale computing capabilities for European operational numerical weather and climate prediction, and provide the key components for representative benchmarks to be deployed on extreme-scale demonstrators and beyond

Specific objectives:

1. Combine frontier research on **mathematics and algorithm development** and extreme-scale, high-performance computing applications with novel hardware technology → to design scientifically flexible and sustainable weather and climate prediction systems
2. Develop and apply a **domain-specific language (DSL) concept** for the weather and climate community → to maximize flexibility, programmability and performance portability to heterogeneous hardware solutions across different weather and climate models
3. Establish **weather and climate model benchmarks** based on world class European prediction models → to enable deployment on energy efficient and heterogeneous HPC architectures, in particular Extreme-scale Demonstrators (EsD)
4. Develop a **cross-disciplinary Verification, Validation, Uncertainty Quantification (VVUQ) framework** → to establish exascale-ready verification and uncertainty quantification tools for weather and climate prediction and beyond
5. Produce an **open-source software framework** → to accelerate mathematical algorithm development, foster continued leadership of European weather and climate prediction models and sustain commercialisation of weather-dependent innovative products and services in Europe

ESCAPE-2 Partnership

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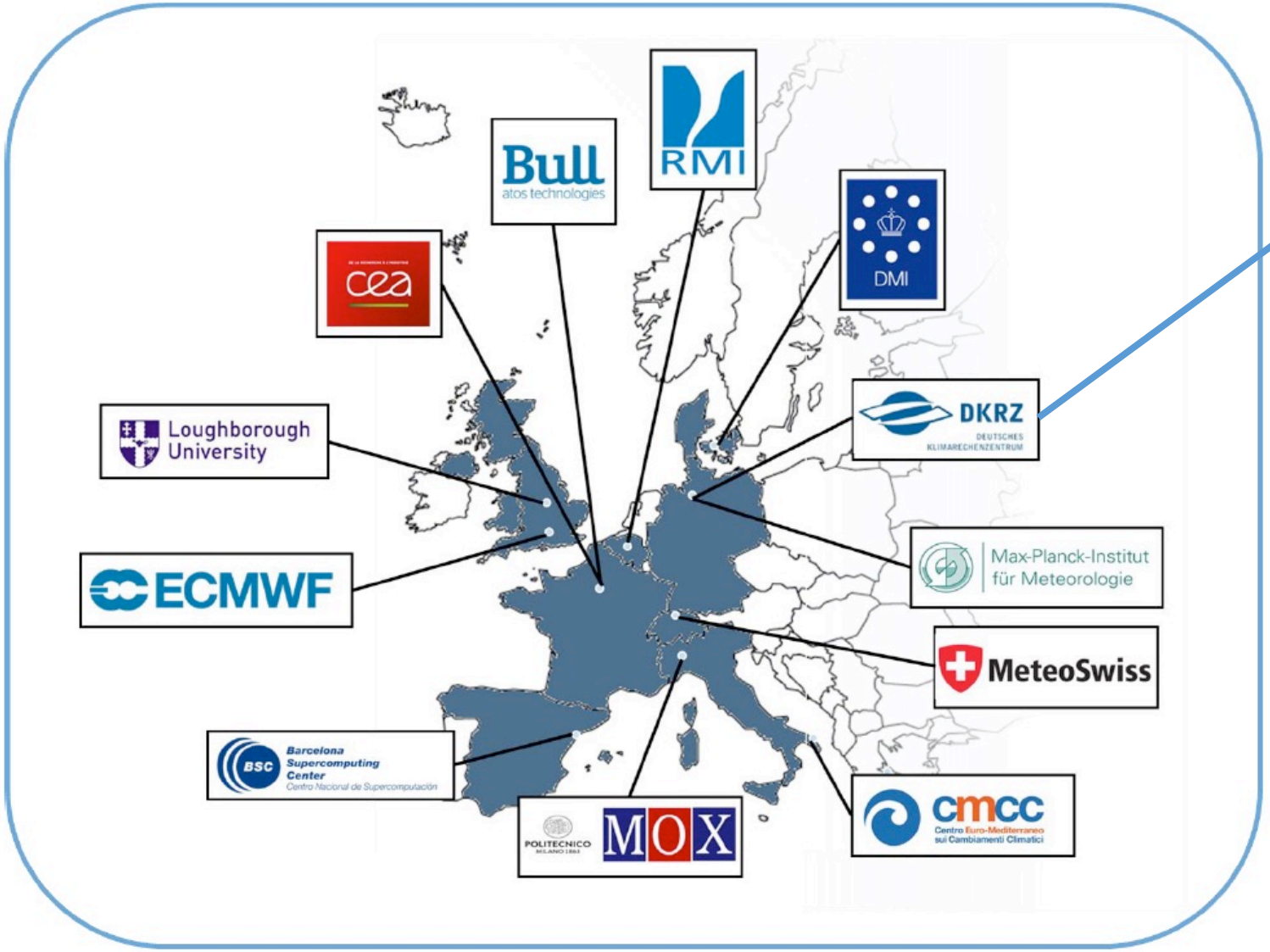

esiwace2
CENTRE OF EXCELLENCE IN SIMULATION OF WEATHER AND CLIMATE IN EUROPE

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ESCAPE = ESCAPE-2 European impact map

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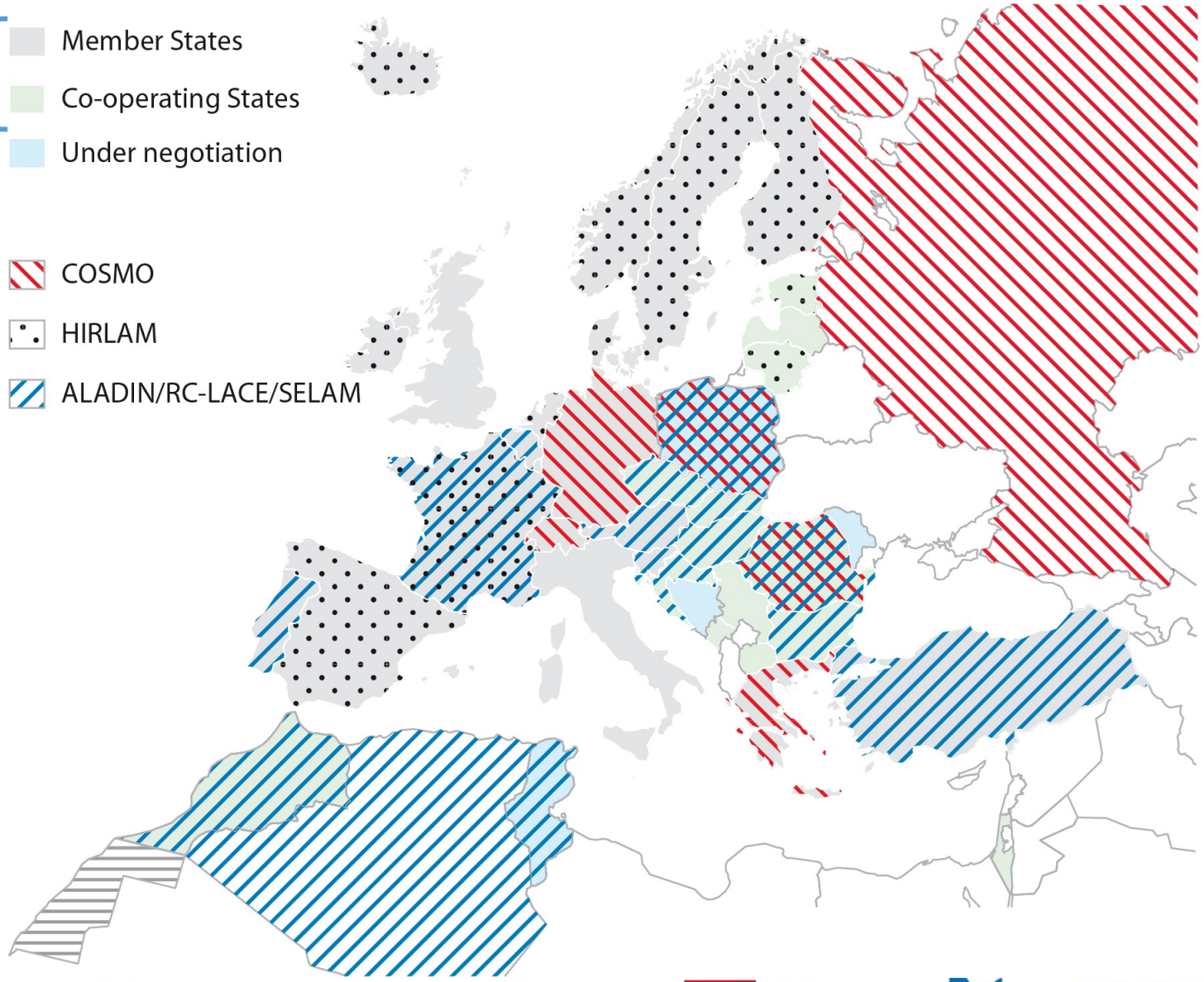
34 countries

- Member States
- Co-operating States
- Under negotiation

7 countries — COSMO

11 countries — HIRLAM

16 countries — ALADIN/RC-LACE/SELAM



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Key elements to progress

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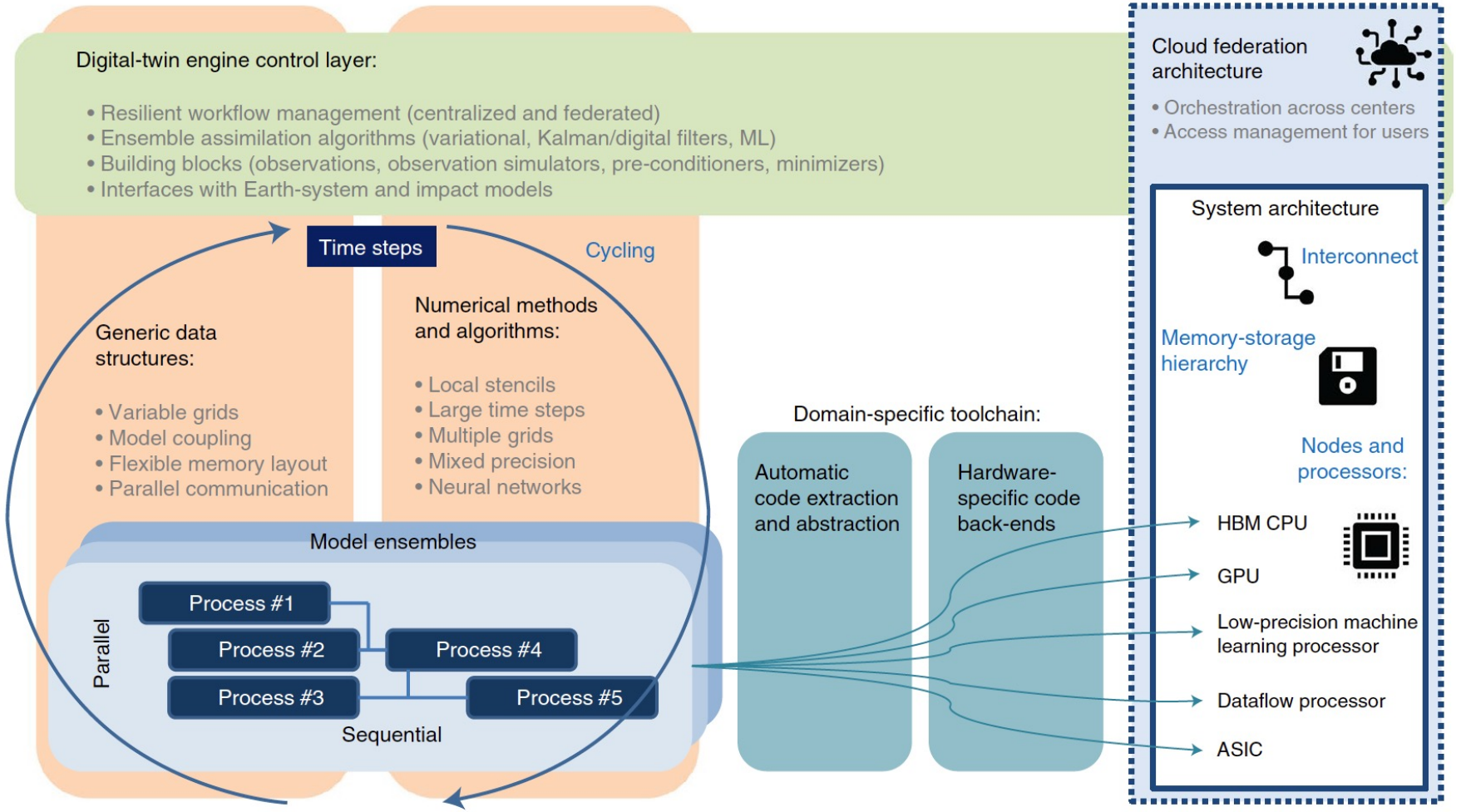
PERSPECTIVE
https://doi.org/10.1038/s43588-021-00023-0
nature computational science
Check for updates

The digital revolution of Earth-system science

Peter Bauer[1], Peter D. Dueben[1], Torsten Hoefler[2], Tiago Quintino[3], Thomas C. Schulthess[4] and Nils P. Wedi[1]



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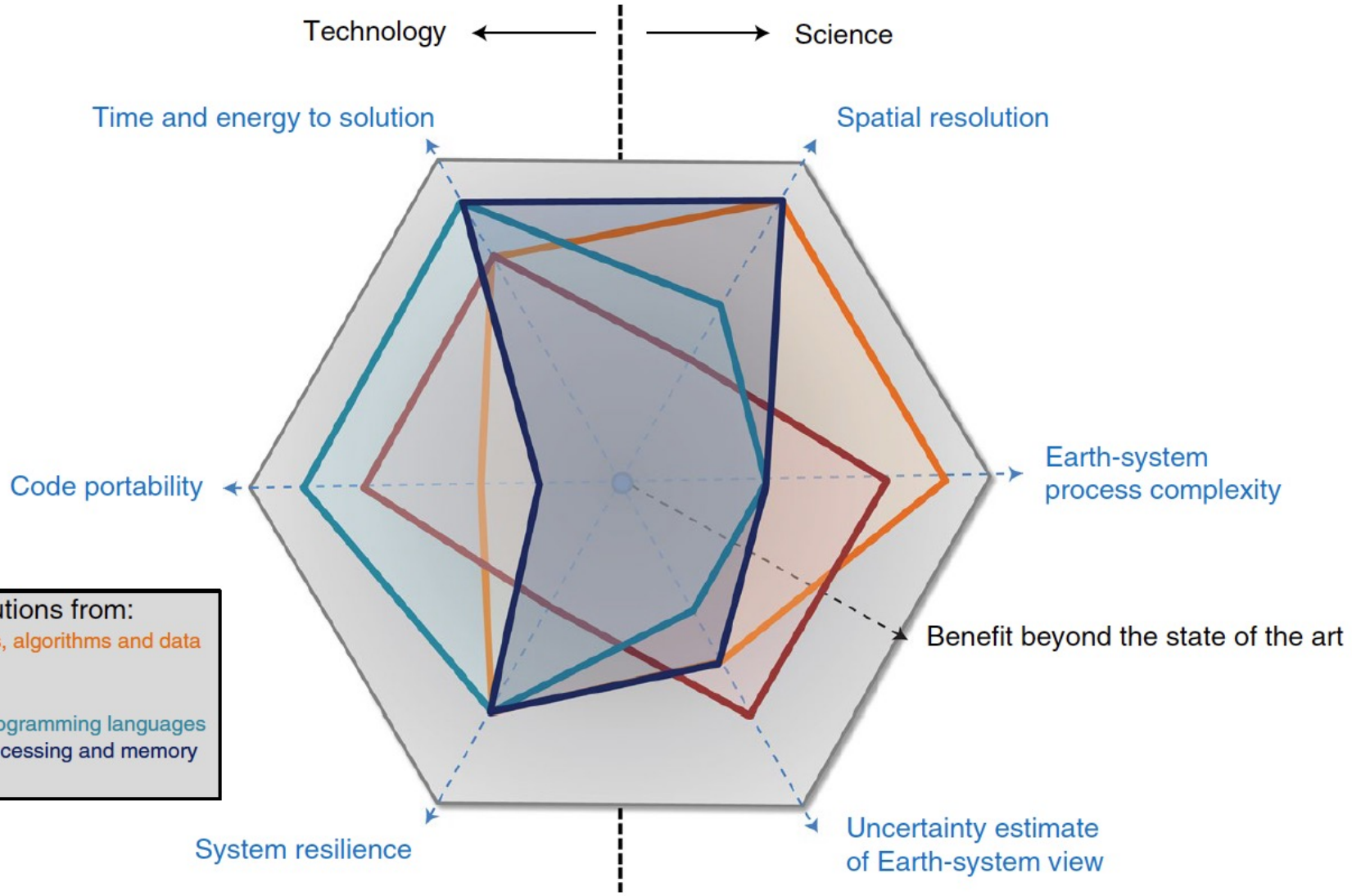

Individual contributions from:

- Numerical methods, algorithms and data structures
- Machine learning
- Domain-specific programming languages
- Heterogeneous processing and memory architectures

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ESCAPE-2: HPCW

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Linpack Benchmark → HPCG →

High-**P**erformance **C**limate and **W**eather benchmark

HPCW benchmark tier	Specification	Options for novel developments to be included
Models	ICON ocean FV	Mathematics (finite-difference, time stepping), DSL
	NEMO ocean FD	Mathematics (time stepping), DSL
	IFS atmosphere FV	Mathematics (discretization, time stepping, fault tolerance), DSL
	IFS atmosphere DG	Mathematics (discretization, time stepping, fault tolerance), DSL
	IFS atmosphere ST	N/A (only as reference)
	ICON atmosphere FV	Mathematics (neural networks), DSL
Systems	Kronos workload simulator	Simulating the above

Important:

→ Also for further development by ESiWACE-2

→ Candidate benchmarks for EuroHPC

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Weather & climate roadmap

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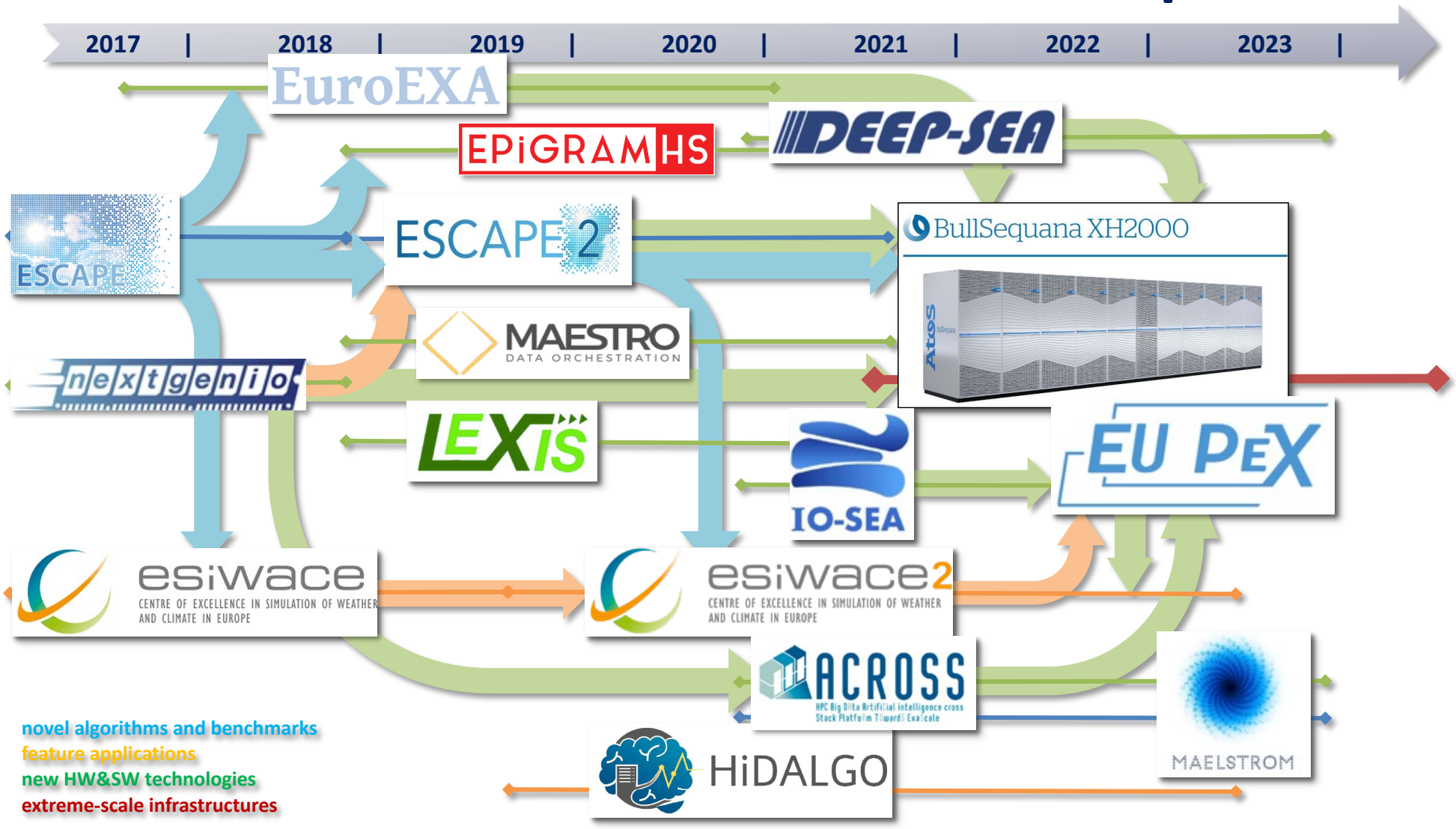

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