

ECS: Enabling Climate Simulation at Extreme Scale

G8 project

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Participants

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Supercomputing Centers

- Blue Waters (U.S.)
- Marenostrum2 (Spain)
- Jugene (Germany)
- NextGen+Tsubame2 (Japan)

Motivation

- Climate codes need exascale performance for improved accuracy
 - 12 km runs with selective 1 km runs
 - Ensembles with 1000's of configurations
 - Better physics
- Better simulations necessary for driving action
 - Unfortunately, not sufficient

Research Focus

- Understand obstacles to the scaling of climate codes to exascale and propose solutions
- Three research areas:
 - Resilience
 - Node performance
 - System scalability
- Initial focus on CESM

Resilience (Franck)

- In order of difficulty
 - More efficient checkpoint-restart, taking advantage of features of the code
 - Restructure code to achieve local recovery (XscalableMP and StarSs)
 - Develop fault-tolerant iterative algorithms

Node Performance (Satoshi)

- Use of GPUs for compute-intensive kernels
 - Performance modeling
 - Autotuning
 - Scheduling – choice of location for tasks
 - Task decomposition for physics

System Scalability (Marc)

- Build performance models
 - Leverage Scalasca
 - Use sensitivity analysis
- Identify scalability bottlenecks and explore solutions
 - Data layouts for scalability
 - Communication/computation overlap
 - Jitter tolerance