Overview and Outlook - Environmental Computing@LRZ

ISGC 2021 - Joint DMCC, UMD & Environmental Computing Workshop

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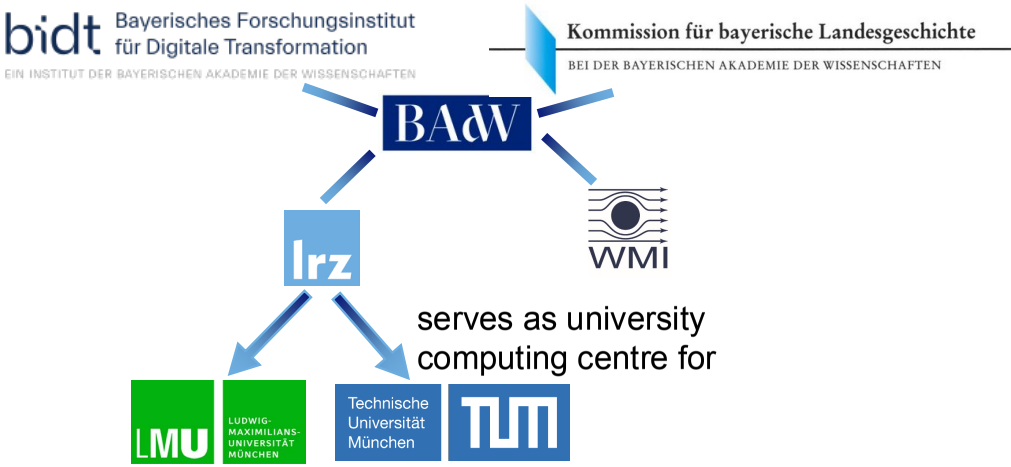
The Leibniz Supercomputing Centre



Institute of the Bavarian Academy of Sciences and Humanities

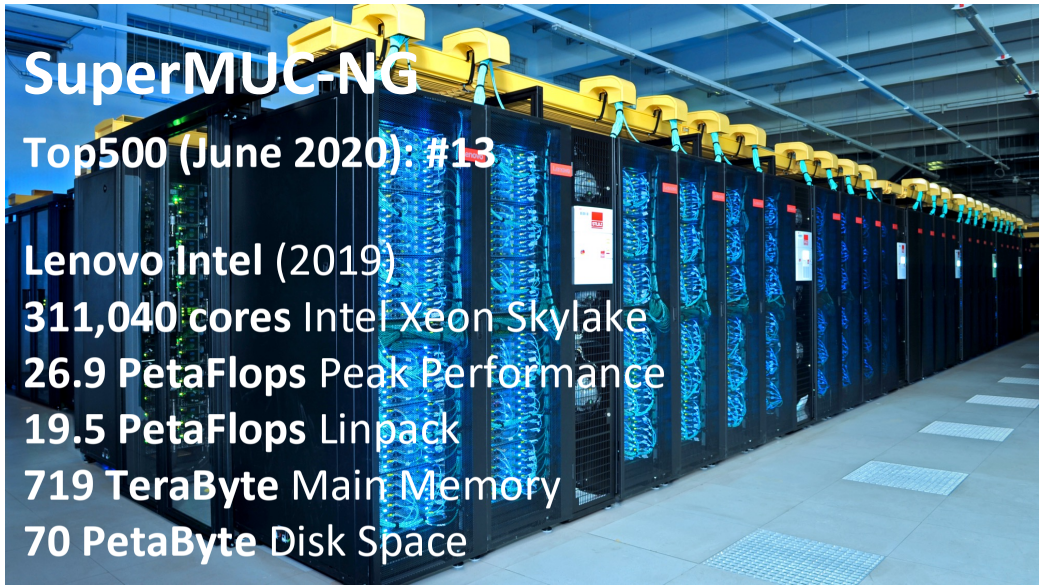
IT Service Provider for the Munich Universities

Regional Computing Centre for Research Institutions in Bavaria

German National Supercomputing Centre

European Supercomputing Centre

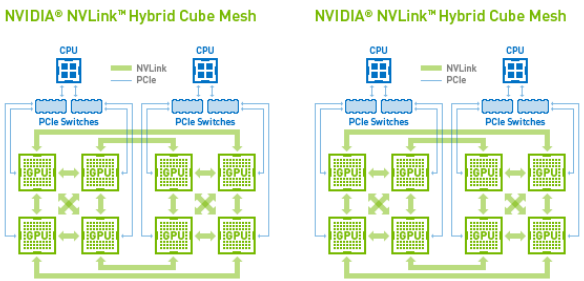
LRZ– Services and compute systems



- Email
- Network
- Storage (Cloud)
- Cloud Computing
- Cluster
- HPC

LRZ Compute Cloud

HPAI Systems



Environmental Computing @ LRZ

Environmental sciences provide challenging use cases:

- Computational demand continuously increasing
- Big data problems (high-resolution simulation/ monitoring data, data variety, …)
- Highly interdisciplinary and collaborative
- Uncertainty in model simulations and observation data
- Societal impact

Scientific partnerships to foster collaboration between environmental science domain and computer science/ IT-providers:

- Support for using IT infrastructure for environmental science
- Improve IT services with dedicated use cases

Environmental Computing @ LRZ

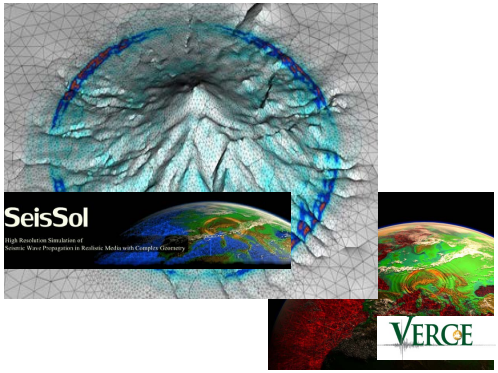
Climate

- Workflows for HPC simulations
- Computing On Demand
- Citizen Science
- VR visualization
- …

Hydrology

- Uncertainty quantification
- Model order reduction/ AI
- Model coupling
- Management for HPC simulation data
- Geodata processing
- Real-time workflows
- …

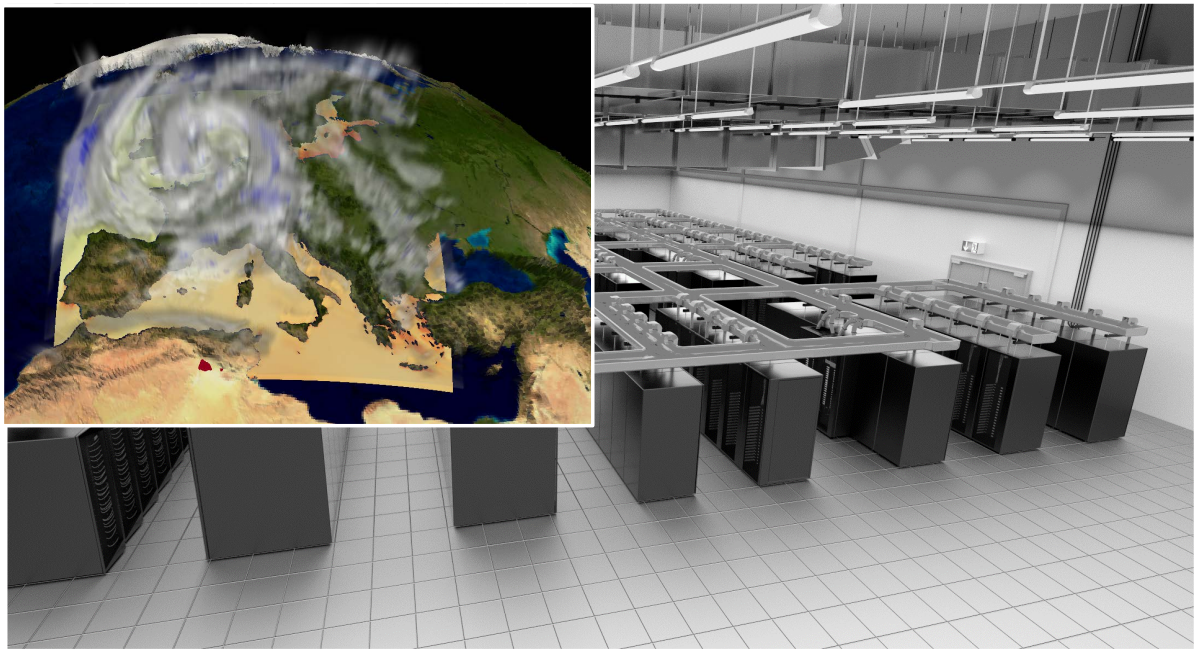
Solid Earth



- Optimization of HPC codes
- Community building
- Containers on HPC systems
- …

ClimEx

Assessment of the effects of climate change on hydrological extreme events (floodings and droughts)

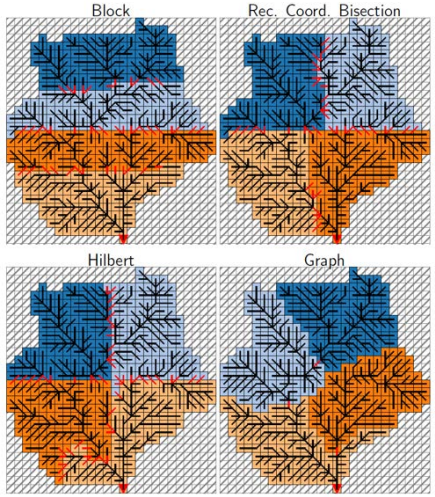


- Code porting and optimization
- HPC workflows for ensemble simulations with hydro-climatological process chain
- Data management for simulation output (~ 400 TB)
- Support for ML analysis of model output
- VR-visualization

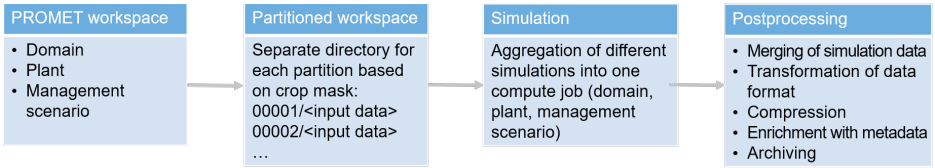
Single model large ensemble climate & hydrological simulations (50 members, 1950-2100)

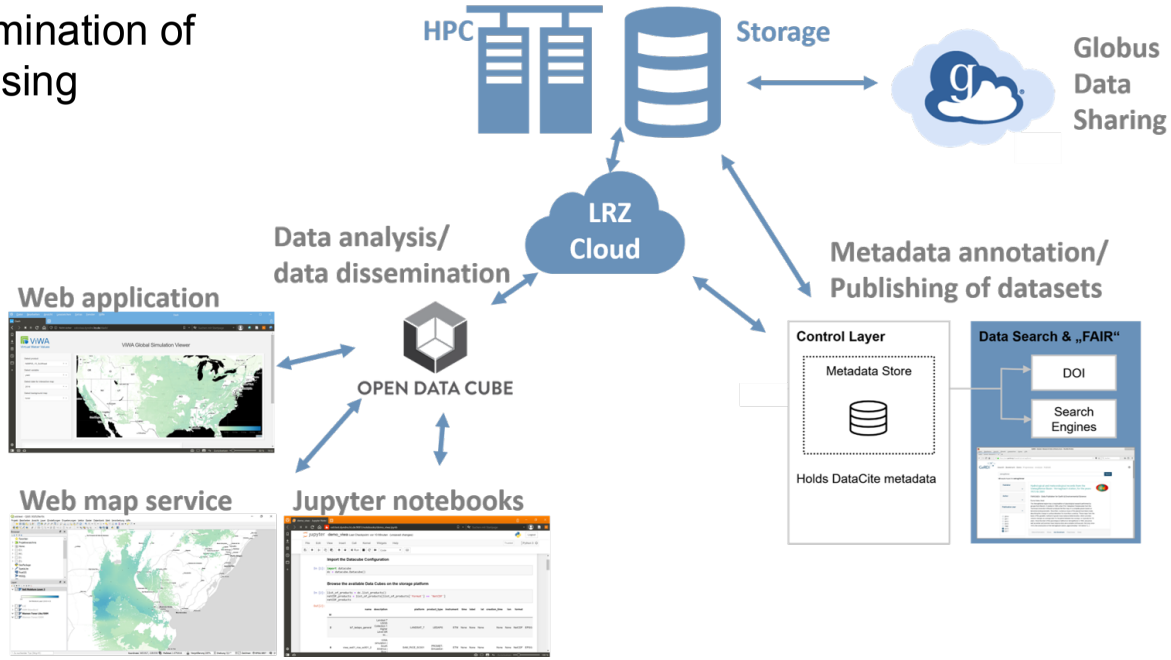
Virtual Water Values (ViWA)

Local to global scale monitoring system for water related SDGs



- High-throughput computing for global ensemble simulations
- Analysis of different domain decomposition methods for load balancing
- Cloud-based dissemination of simulation results using OpenDataCube



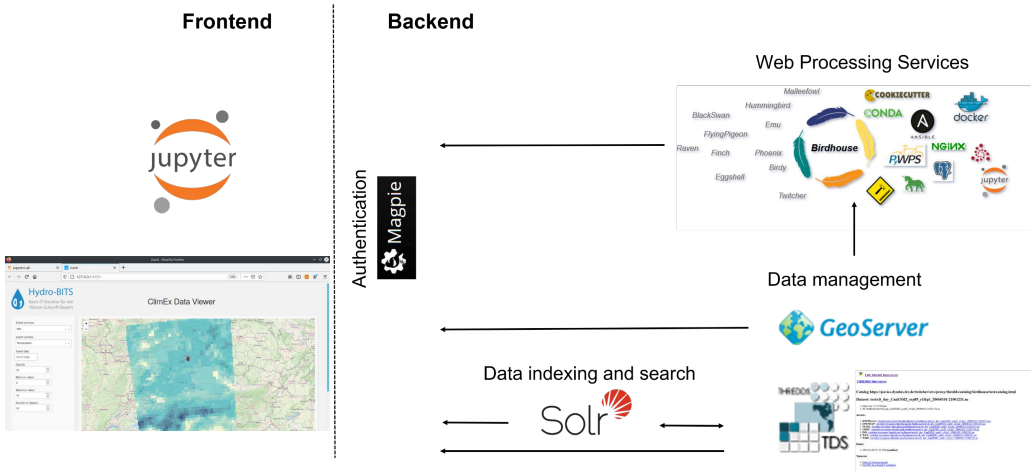


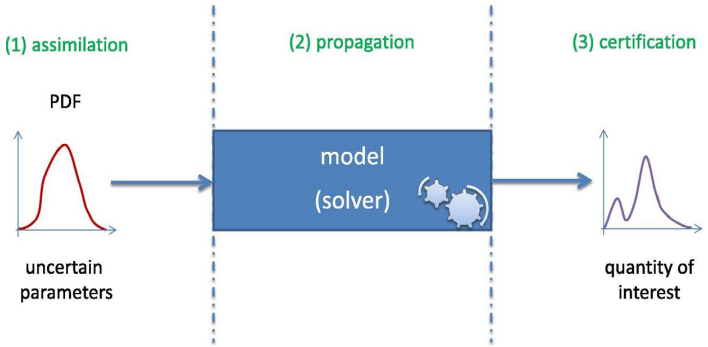
Global high-resolution agro-hydrological ensemble simulations for different crops and management practices

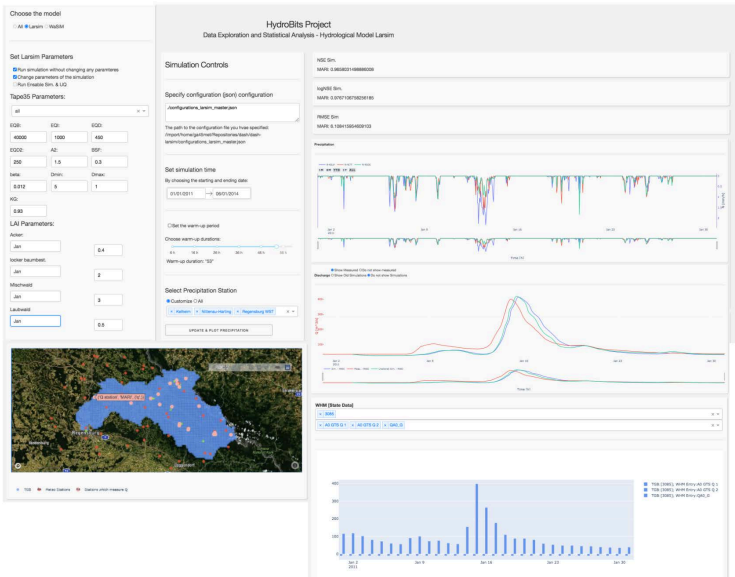
Hydro-BITS

Hydro-BITS
Basis IT-Struktur für die Wasser-Zukunft-Bayern

Basic IT-infrastructure for the ‘Water Future Bavaria’ project







- Data exchange and analytics platform for HPC simulation data (e.g. ClimEx)
- Uncertainty quantification workflows (Cloud & LinuxCluster)
- Cloud-based testbed for flood forecasting workflows
- Model benchmarking

Outlook

- Creating synergies by consolidation of existing software environments/ components from projects
- Establish (basic) geoscience services for users (not project-driven)

Upcoming topics:

- Closer integration of environmental monitoring data with AI analytics
- Near real-time management of water resources with sensor networks
- Long-term integration into national research data management infrastructure