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The Leibniz-Rechenzentrum (LRZ) as a computation laboratory for the geoscience communities: systems, tools, services, and joint efforts for HPC-applications in geosciences

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The Leibniz-Rechenzentrum (LRZ) operates several HPC systems, with the 'SuperMUC' being the sixth fastest supercomputer worldwide (according to Linpack benchmark-ranking on Top500.org).
Project-proposals for compute-time can be submitted by all German research institutions directly to LRZ, and through PRACE (Partnership in Advanced Computing in Europe, prace-ri.eu) for all research groups with principal investigator in Europe. The LRZ also provides state-of-the-art on-site and remote visualization systems in connection with existing projects or for stand-alone visualization projects.
Three large computer centres inside Germany (LRZ, HLRS, FZJ) form the Gauss-Computer-Centre, in which the LRZ will have a special application focus on earth- and environmental sciences from now on.

In this paper we present the available compute facilities, software tools and services the Leibniz-Rechenzentrum (LRZ) provides as a supercomputing infrastructure provider. Moreover we present extended services the LRZ is presently setting up for the earth- and environmental science communities with large-scale computation requirements in order to let research groups and projects in the earth-sciences achieve their scientific goals faster and with less technical risk.
One aspect beneficial for the geosciences is, that the LRZ does not only provide unique large-scale HPC systems, but also extended support and guidance for optimization strategies for the user applications' compute-kernels, for programming paradigms, and for visualization solutions. As project-partner within the Verce-project (verce.eu) that aims at improving the e-infrastructure for computational seismology, we prospect and discuss the necessity of such joint efforts in the context of next generation HPC systems.

Example-wise we will showcase joint efforts of the LMU/TUM and LRZ for improving a computational-seismology finite-element research-application, making it production ready also for next-generation supercomputer-systems. We demonstrate a scale-up of the application for a large-scale earthquake scenario simulation on SuperMUC.