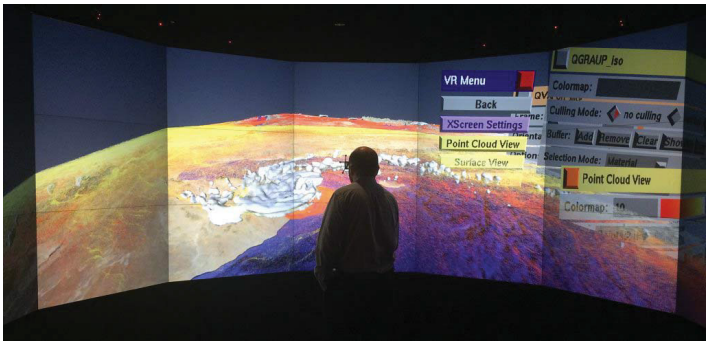
In-Situ Visualization of Large-Scale Simulation Data

Project Description



This project investigates techniques for in-situ visualization of large time-dependent volume data. Since state of the art large scale simulations can generate petabytes of data, not all data can be stored to permanent storage media [3]. Usually the spatial dimensions are downscaled or only a small subset of the temporal series is stored [1]. Our approach to in-situ visualization analyzes the results as simulation time progresses and extracts the essential data characteristics from the preliminary results. Very low data transfer rates can be achieved by exploiting temporal coherence of successive simulation timesteps. Only a small subset of the data is transferred progressively to the visualization client. The reconstruction of the data in an early stage of the simulation run, combined with interactive steering approaches, reduces the risk of running unnecessary simulations and enables the informed modification of simulation parameters.

Your Role in this Project

You will work on software prototypes that decrease the amount of data transferred from the simulation server to the visualization client by methods that are tailored to the in-situ use case. Other tasks in this project include the implementation of in-situ steering scenarios to support the needs of domain scientists.
The software is prototyped on regular desktop machines with the option to run them on Shaheen II [2], KAUST's large-scale computing infrastructure.

Requirements

You need to have:
- prior experience in C++ or MATLAB programming
- fluent English language skills
- openness for a multicultural environment

References

[1] In Situ Methods, Infrastructures, and Applications on High Performance Computing Platforms (state of the art report) http://vis.lbl.gov/Publications/2016/LBNL-1005709.pdf
[2] Shaheen II: https://www.top500.org/system/178515
[3] T. Theussl et al., Simulation and visualization of the cyclonic storm chapala over the arabian sea: a case study, KACSTIT, 2016