



Integrated Activity I-5: Visualization

CliSAP Retreat Lübeck, 25.09.2014









Overview

The "Climate Visualization Lab" integrates:

- Visualization Infrastructure
- Visualization Services
- Visualization Research & Development











Participating Scientists (1)

CliSAP funded:

- Felicia Brisc, since 1 November 2012
 - Visualization services, development of new technical solutions, teaching (ParaView, Avizo)
- Michael Vetter, since 1 October 2013
 - Visualization research, improving visualization algorithms and methods, especially enhance DSVR framework for actual climate simulation models (ICON), teaching (Lecture Data Visualization)









Participating Scientists (2)

Non-CliSAP funded:

- DKRZ
 - Michael Böttinger: Head DKRZ Vis Group Visualization applications, documentation, teaching, ...
 - Niklas Röber: Application and development, Vis-projects, documentation, teaching: Avizo, Paraview, ...
 - Karin Meier-Fleischer: 2D and 3D Visualization: NCL, Avizo, GrADS, ...
 - Dela Spickerman (student worker): Geophysics vis-applications, educational documents
- Visualization research at Lothar Collatz Center for Computing in Science
 - Ingo Breuer: PhD student









Visualization Infrastructure

Technical visualization infrastructure at DKRZ:

- Visualization cluster for 3D remote rendering
- Stereoscopic virtual reality powerwall
- Video editing studio
- Omniglobe for spherical data projection











Visualization Services (1)

Our visualization services in general:

- Assistance in visualization tasks
- Visualization projects on request
- Access to the visualization cluster
- Domain specific visualization software
- Hands-on tutorials and courses
- 3D stereoscopic work environment
- Public relations and communication











Visualization Services (2)

Tasks (Felicia Brisc):

- Provision of high-quality services in visualizing climate information
 - Numerous visualizations at the request of scientists and students:
 <u>www.clisap.de/research/ia:-integrated-activities/ia-5:-visualization/video-gallery/</u>
- Expansion of these services with new software solutions
 - Two graphics software loader components for ParaView were developed
 - UGRID and Trajectory Readers for unstructured and adaptive meshes
- Teaching of visualization capabilities to students and scientists
 - Scientific visualization course was developed and taught
 - Complemented by support and additional training









Visualization Services (3)

Tasks (DKRZ):

- Provision of high-quality services in visualizing climate information
 - Numerous visualizations on request <u>http://www.dkrz.de/about/media/galerie/Vis</u>
 - CMIP 5 Visualizations of MPI-ESM results

http://www.dkrz.de/Klimaforschung-en/konsortial-en/ipcc-ar5/ergebnisse

- Software enhancements and extensions: e.g. ICON Reader for Paraview
- Hands-on tutorial courses and tutorial documents for visualization solutions
 - Avizo Green, Avizo Earth, NCL, Paraview, SimVis
 - Complemented by support and additional training









Visualization Research & Development (1)

Our research topics in general:

- Development and application of our innovative software framework DSVR for "big data" extraction and visualization
 - Scenarios: Post-processing data files / In-situ integration in simulations
 - Scalability: Parallelized data extraction, on-the-fly processing, streaming
 - Presentation: Browser-based 3D animation, supporting stereoscopic devices
- Parallel isosurface extraction with integrated polygon simplification
- Parallel pathline extraction with property based post-filtering
- Integration of the developed techniques into research workflows
 - File reader, generalization of grid types, coordinate transformations, ...









Visualization Research & Development (2)

Tasks:

- Development of NetCDF reader to enable post-processing with DSVR
- Demonstration and comparison of DSVR with Avizo results
 - Batch-processing of time-dependent scalar and vector fields => 3D scenes
 - Interactive 3D visualization needs only installation of our browser plugin
- Networking with MPI-M at DKRZ and invited talk at ICON all staff meeting
 - Michael Vetter: "In-situ visualization using DSVR", 12 June 2014

Next steps:

- Support and evaluation of "real" post-processing and in-situ applications
- Development of DSVR in-situ integration in the ICON simulation model











Demonstration (1)

Pathline visualization of time-dependent vector field

- U, V, and W; includes post-filtering current magnitude /vertical component
- 3D animation using DSVR: <u>dvr\pathlines\00000.html</u>



DSVR-based 3D rendering and H.264 video encoding:

https://lecture2go.uni-hamburg.de/veranstaltungen/-/v/16683



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Demonstration (2)

Isosurface visualization of time-dependent scalar field

- Relative humidity, threshold: 90 %
- 3D animation using DSVR: <u>dvr\isosurface_smooth\00000.html</u>



DSVR-based 3D rendering and H.264 video encoding:

https://lecture2go.uni-hamburg.de/veranstaltungen/-/v/16684



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Thank you!



