Visualization on Mistral

Workflow, applications, future plans

Niklas Röber
Deutsches Klimarechenzentrum (DKRZ)

Hardware

- 12(24) nodes with 2x12 core Haswell CPUs
- 256 GB main memory
- Two Kepler GPUs
- Regular mistral nodes with XAS software tree:
  - avizo/9.0.1
  - paraview/4.3.1
  - simvis/3.4.4
  - vapor/2.4
  - idl/8.5
  - ncl/6.2.1
  - grads/2.0.2
  - ferret/6.9.3
  - gmt/5.1.2

Documentation

- How to get a user account
- Mistral
- Blizzard
- Wizard
- HPSS tape archive
- Data Processing
- Visualization
  - Software
  - Visualization on Mistral
  - Remote3D
  - Filesystems
- Cloud Storage
- Training
- FAQs & known issues
- Seminar Rooms
- IMDI
- Terms of use

News

Kick-off for ESiWACE and ESCAPE
Sep 29, 2015

Allocations 2016 - request resources
Sep 18, 2015

DKRZ@ISC'15
Jul 13, 2015

DKK publishes "Prospects for climate research"
Jun 10, 2015

More news…

Home → User Portal → Documentation → Visualization → Visualization on Mistral

Visualization on Mistral

Our new supercomputer Mistral has 12 GPU nodes, which can be used for 3D visualization, data analysis, and pre/post processing of data. This website explains how to reserve and access a GPU node, and how to run the 3D visualization software for the analysis of your data.

Access and reservation of a GPU node

Our supercomputer Mistral includes 12 GPU nodes with four GPUs in each node. Unlike the nodes in our visualization cluster Halo, these nodes are equipped with the same hard and software.

While we might later switch back to our web-based reservation system, currently the reservation has to be done by hand using a console on one of Mistrals login nodes. Furthermore, the vncserver has to be started by hand, as well as cleaned up after your work is done. To access Mistral, simply ssh into the machine.

```
somewhere:~> ssh user_name@mistral.dkrz.de
```

On Mistral, we have to allocate a GPU node. This is done using the SLURM command "salloc", in which you have to provide your account group ("-A <your project id>"), the number of nodes ("-N 1"), the maximum number of parallel tasks ("-n 24"), as well as the node type ("-p gpu"). Currently, the maximum time allowed is 4 hours and is set automatically. More information on SLURM and salloc can be found in our SLURM documentation.

After login to Mistral, you can allocate a GPU node and automatically ssh into the node reserved.

```
mistral:~> salloc -N 1 -n 24 -p gpu -A <project> -- /bin/bash -c 'ssh -X $SLURM_JOB_NODELIST'
salloc: Granted job allocation 284896

user_name@mg100's password:
```

Now you can start a VNC server to connect to the virtual desktop.

```
mg100:~> /opt/TurboVNC/bin/vncserver -geometry 1920x1200
Desktop 'TurboVNC: mg100:1 (user_name)' started on display mg100:1
```

At the first time, you have to supply a password that you later need to access your VNC session remotely. If everything is set, start a vncviewer in the console on your home computer, or using the gui of an application.

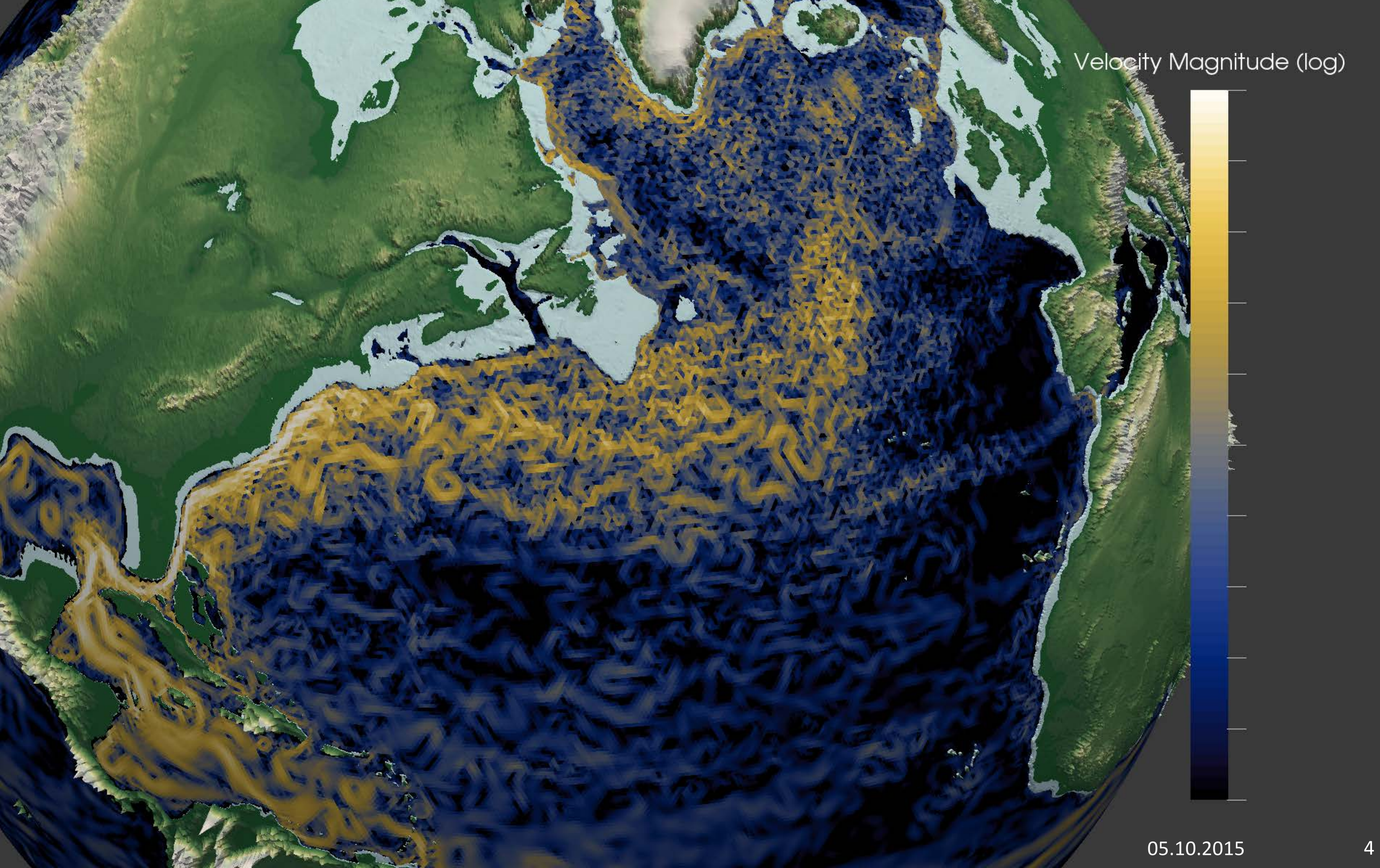
```
somewhere:~> vncviewer mg100.dkrz.de:1
```

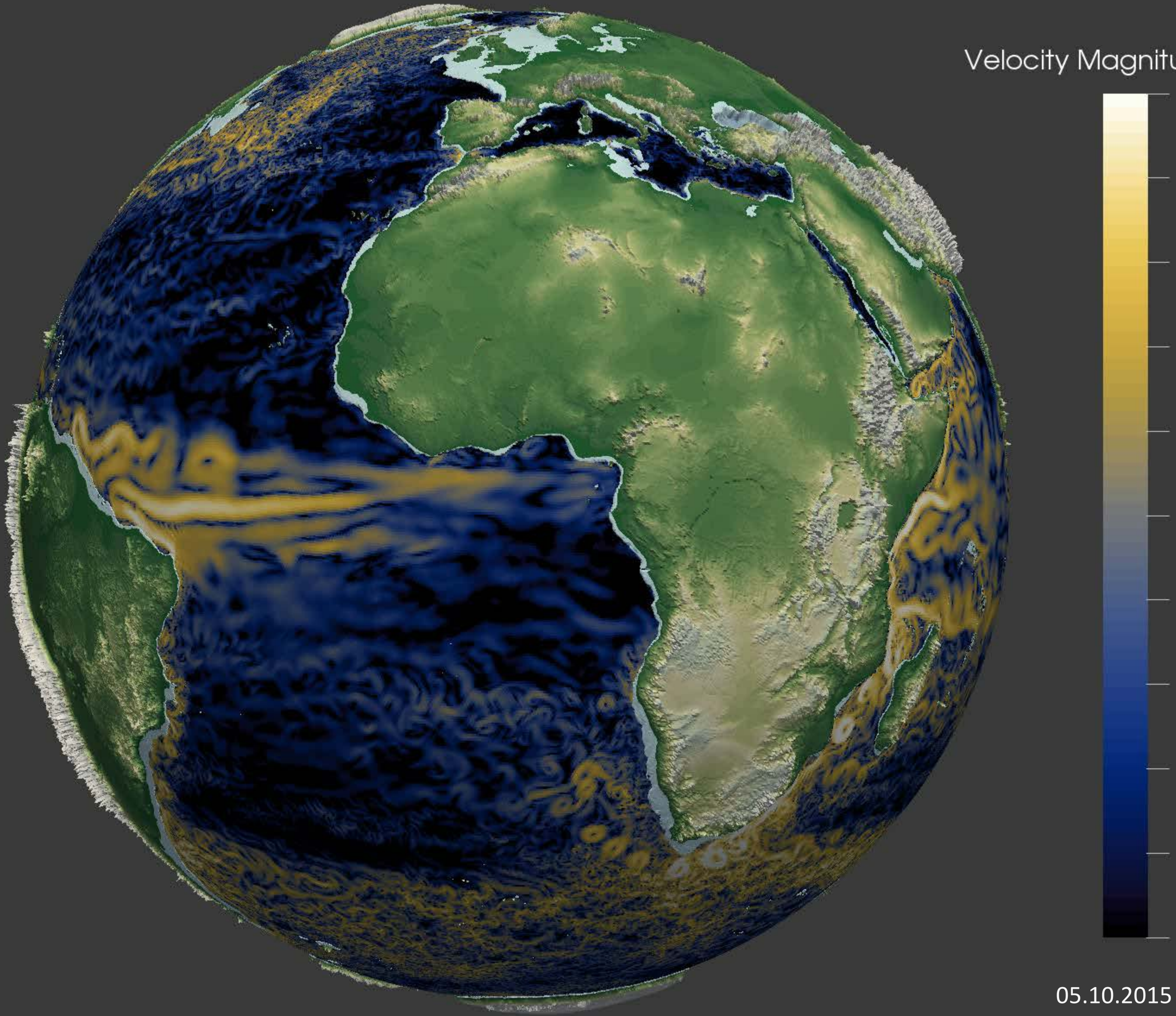
After you are done with your work, please stop the VNC server and clean up the node.

```
mg100:~> /opt/TurboVNC/bin/vncserver -kill :1
```

Running visualization applications

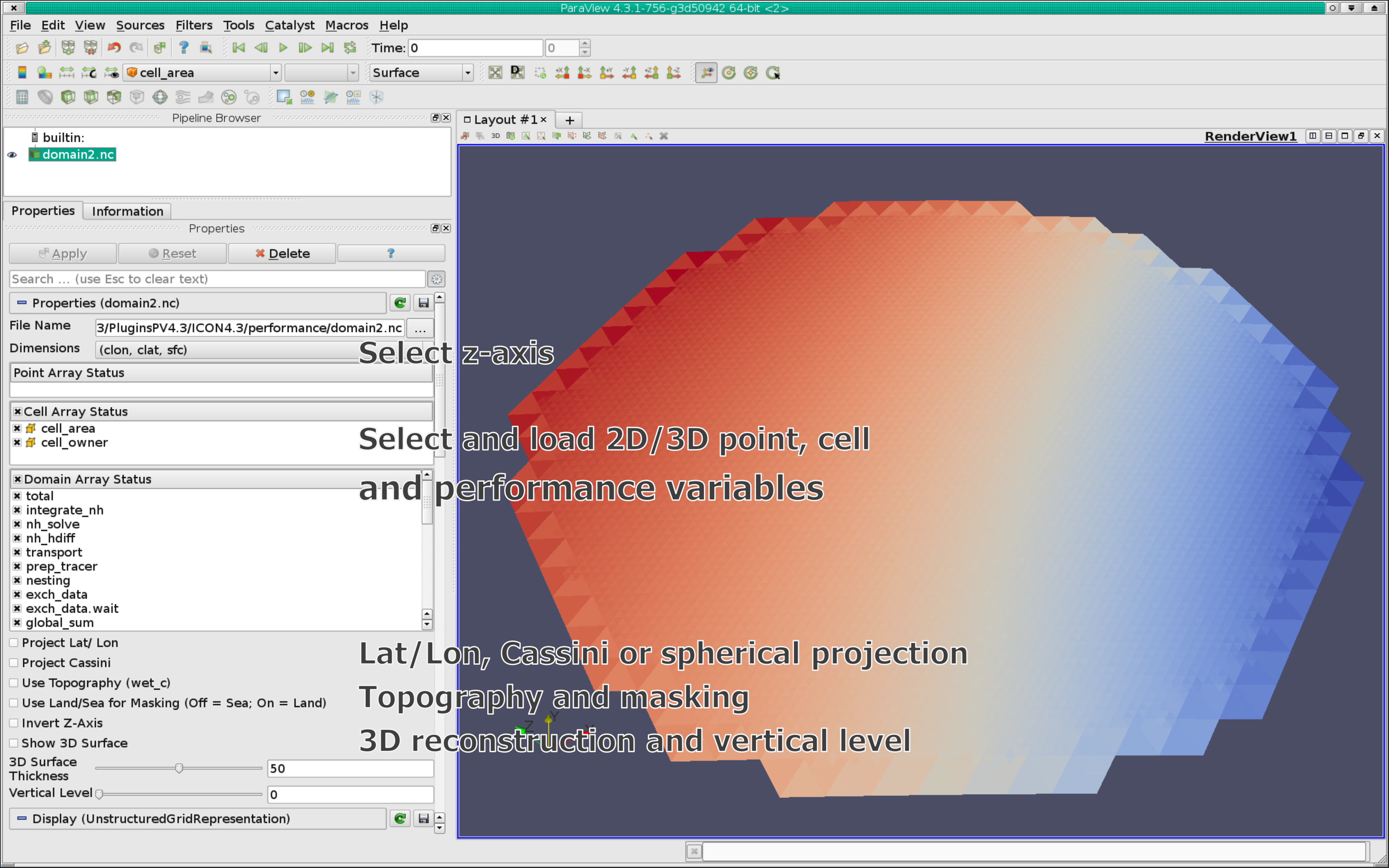
Now a window opens, showing you the virtual X11 session that is running on your GPU node. On Mistral, all our visualization software is made available using modules. The command


Velocity Magnitude (log)


Velocity Magnitude (log)

vtkCDIReader

- Reads ICON/CDI netCDF data
- 2D/3D cell/point data on all levels (depth, depth_2, …)
- Runs in Client/Server mode
- 3D reconstruction with correct layer thickness
- Spherical, Lon/Lat and Cassini projection
- Bathymetry masking (wet_c) and earth topography
- Visualization of performance data
- Plugin submitted to Kitware for official integration


ParaView 4.3.1-756-g3d50942 64-bit <2>
File Edit View Sources Filters Tools Catalyst Macros Help
Time: 0
0
cell_area
Surface
Pipeline Browser
builtin:
domain2.nc
Layout #1
RenderView1
Properties
Information
Apply
Reset
Delete
?
Search ... (use Esc to clear text)
Z
Y
X

Select z-axis

Select and load 2D/3D point, cell and performance variables

Lat/Lon, Cassini or spherical projection

Topography and masking

3D reconstruction and vertical level

Properties (domain2.nc)

File Name 3/PluginsPV4.3/ICON4.3/performance/domain2.nc

Dimensions (clon, clat, sfc)

Point Array Status

☒ Cell Array Status
- ☒ cell_area
- ☒ cell_owner

☒ Domain Array Status
- ☒ total
- ☒ integrate_nh
- ☒ nh_solve
- ☒ nh_hdiff
- ☒ transport
- ☒ prep_tracer
- ☒ nesting
- ☒ exch_data
- ☒ exch_data.wait
- ☒ global_sum

☐ Project Lat/ Lon

☐ Project Cassini

☐ Use Topography (wet_c)

☐ Use Land/Sea for Masking (Off = Sea; On = Land)

☐ Invert Z-Axis

☐ Show 3D Surface

3D Surface Thickness 50

Vertical Level 0

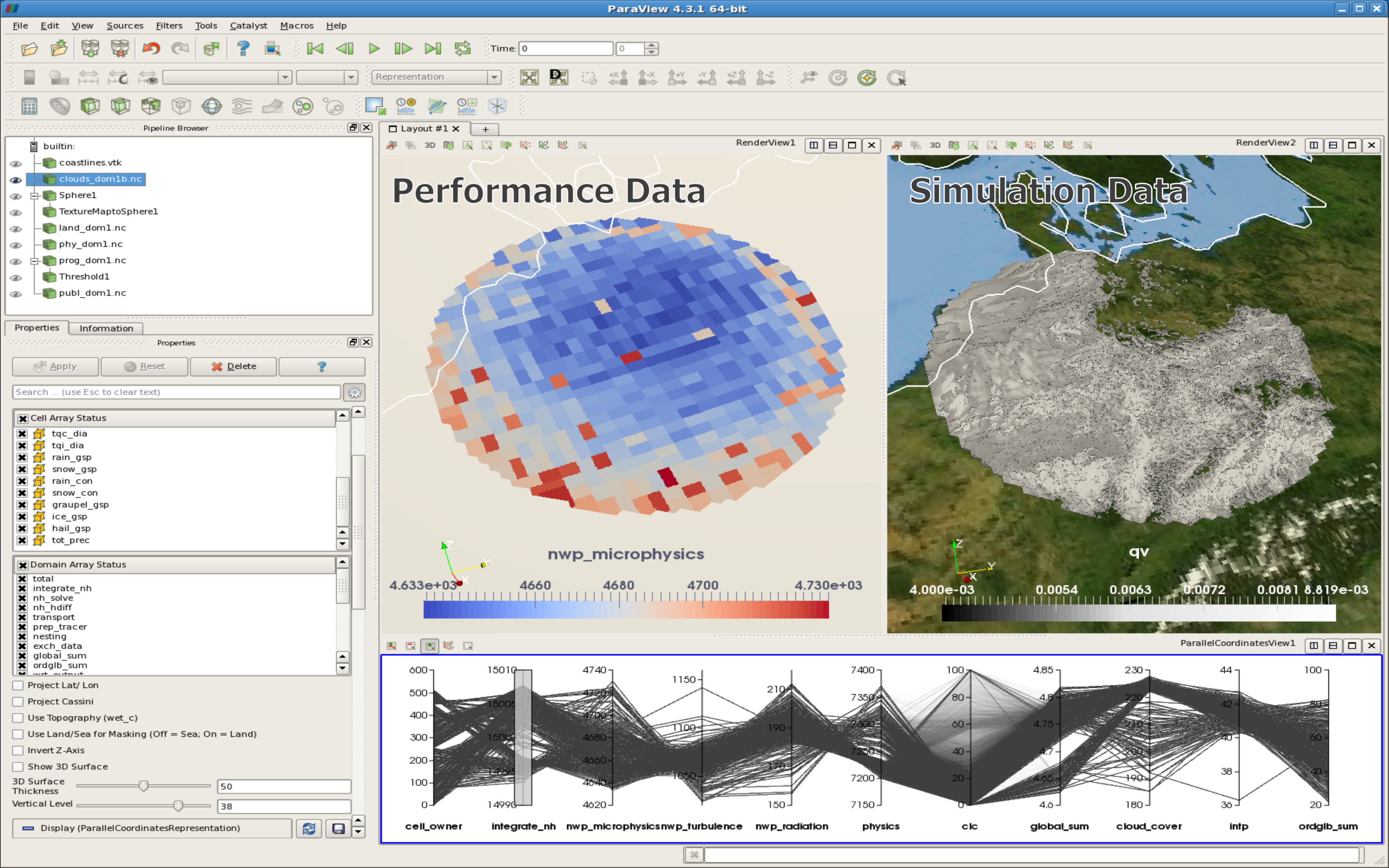
Display (UnstructuredGridRepresentation)

Visualization of performance data

- ICON data with cell/point variables **and** performance data
- Select interesting areas and display results using parallel coordinates view
- Integrated into vtkCDIReader
- Requires domain decomposition and performance data

Next Slides:

HDCP2 Example (350.000 cells; 512 processors)



ParaView 4.3.1 64-bit

Time: 0

Pipeline Browser

- builtin:
  - coastlines.vtk
  - clouds_dom1b.nc
  - Sphere1
    - TextureMaptoSphere1
  - land_dom1.nc
  - phy_dom1.nc
  - prog_dom1.nc
    - Threshold1
  - publ_dom1.nc

Properties

Cell Array Status

- ☒ tqc_dia
- ☒ tqi_dia
- ☒ rain_gsp
- ☒ snow_gsp
- ☒ rain_con
- ☒ snow_con
- ☒ graupel_gsp
- ☒ ice_gsp
- ☒ hail_gsp
- ☒ tot_prec

Domain Array Status

- ☒ total
- ☒ integrate_nh
- ☒ nh_solve
- ☒ nh_hdiff
- ☒ transport
- ☒ prep_tracer
- ☒ nesting
- ☒ exch_data
- ☒ global_sum
- ☒ ordglb_sum

☐ Project Lat/ Lon

☐ Project Cassini

☐ Use Topography (wet_c)

☐ Use Land/Sea for Masking (Off = Sea; On = Land)

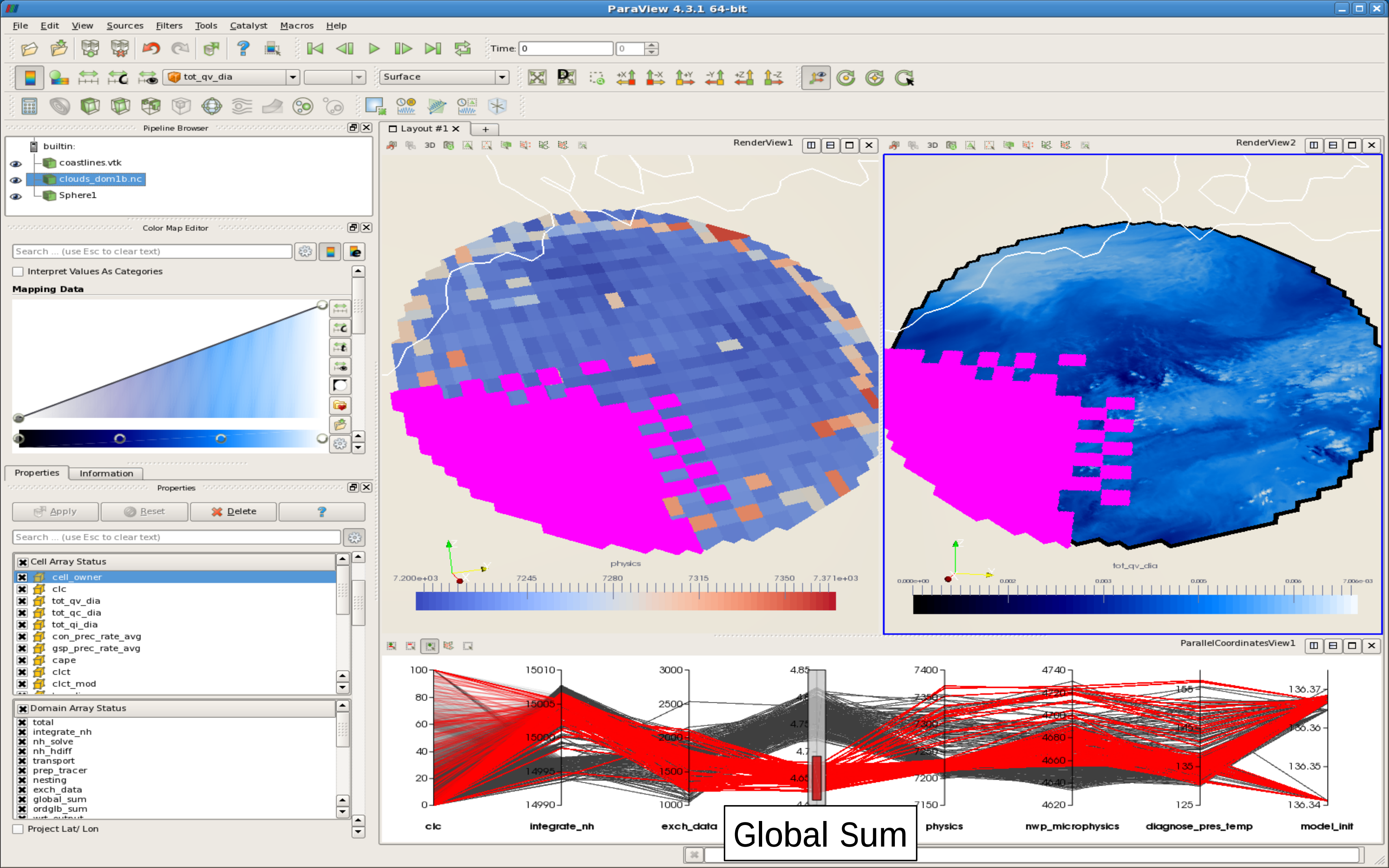
☐ Invert Z-Axis

☐ Show 3D Surface

3D Surface Thickness: 50

Vertical Level: 38

Display (ParallelCoordinatesRepresentation)


ParaView 4.3.1 64-bit
File Edit View Sources Filters Tools Catalyst Macros Help
Time: 0
tot_qv_dia
Surface
Pipeline Browser
builtin:
coastlines.vtk
clouds_dom1b.nc
Sphere1
Color Map Editor
Search ... (use Esc to clear text)
Interpret Values As Categories
Mapping Data
Properties
Information
Apply
Reset
Delete
Cell Array Status
cell_owner
clc
tot_qv_dia
tot_qc_dia
tot_qi_dia
con_prec_rate_avg
gsp_prec_rate_avg
cape
clct
clct_mod
Domain Array Status
total
integrate_nh
nh_solve
nh_hdiff
transport
prep_tracer
nesting
exch_data
global_sum
ordglb_sum
Project Lat/ Lon
Layout #1
RenderView1
RenderView2
physics
7.200e+03
7245
7280
7315
7350
7.371e+03
tot_qv_dia
0.000e+00
0.002
0.003
0.005
0.006
7.006e-03
ParallelCoordinatesView1
clc
integrate_nh
exch_data
physics
nwp_microphysics
diagnose_pres_temp
model_init
100
80
60
40
20
0
15010
15005
15000
14995
14990
3000
2500
2000
1500
1000
4.85
4.75
4.7
4.65
7400
7350
7300
7250
7200
7150
4740
4720
4700
4680
4660
4640
4620
155
145
135
125
136.37
136.36
136.35
136.34

Global Sum

InSitu with ParaView/Catalyst

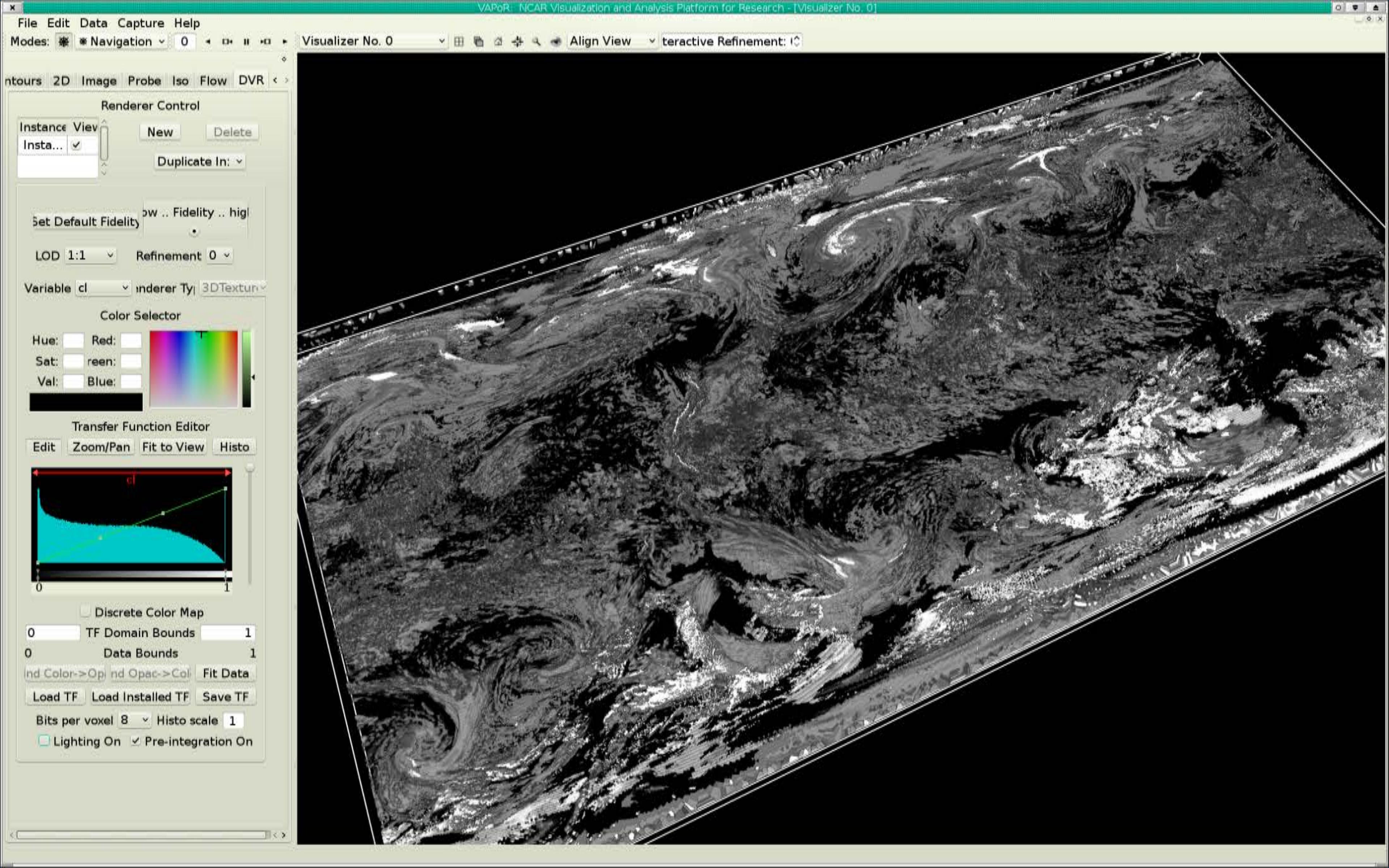
- In-situ (co)processing/visualization using Catalyst extension
- Adaptor required that connects ICON (model) and Catalyst
- Two possibilities for co-processing:
  - Batch-visualization using pre-defined Python scripts
  - Live visualization within a client/server setting
- In development (very simple demo using ICON ocean model)

ICON extension for Vapor

- Vapor developed at NCAR (open source)
- Supports wavelet compression and LoD rendering for very large (regular) data sets
- Extension for ICON/MPAS data available
  - Currently only with fast on-the-fly resampling to regular grid
  - Next year:
    - Visualization on native ICON/MPAS grid
    - Wavelet compression for ICON/MPAS data

Next Slides:

- ICON HDCP2 (1.3 million cells, CL)
- ICON HDCP2 (350 million cells, CLW)


VAPoR: NCAR Visualization and Analysis Platform for Research - [Visualizer No. 0]

Modes: Navigation 0

Visualizer No. 0

teractive Refinement: 0

Instance	View
Insta...	✓

LOD 1:1 Refinement 0

Variable cl Renderer Ty| 3DTextur

Hue: Red:

Sat: reen:

Val: Blue:

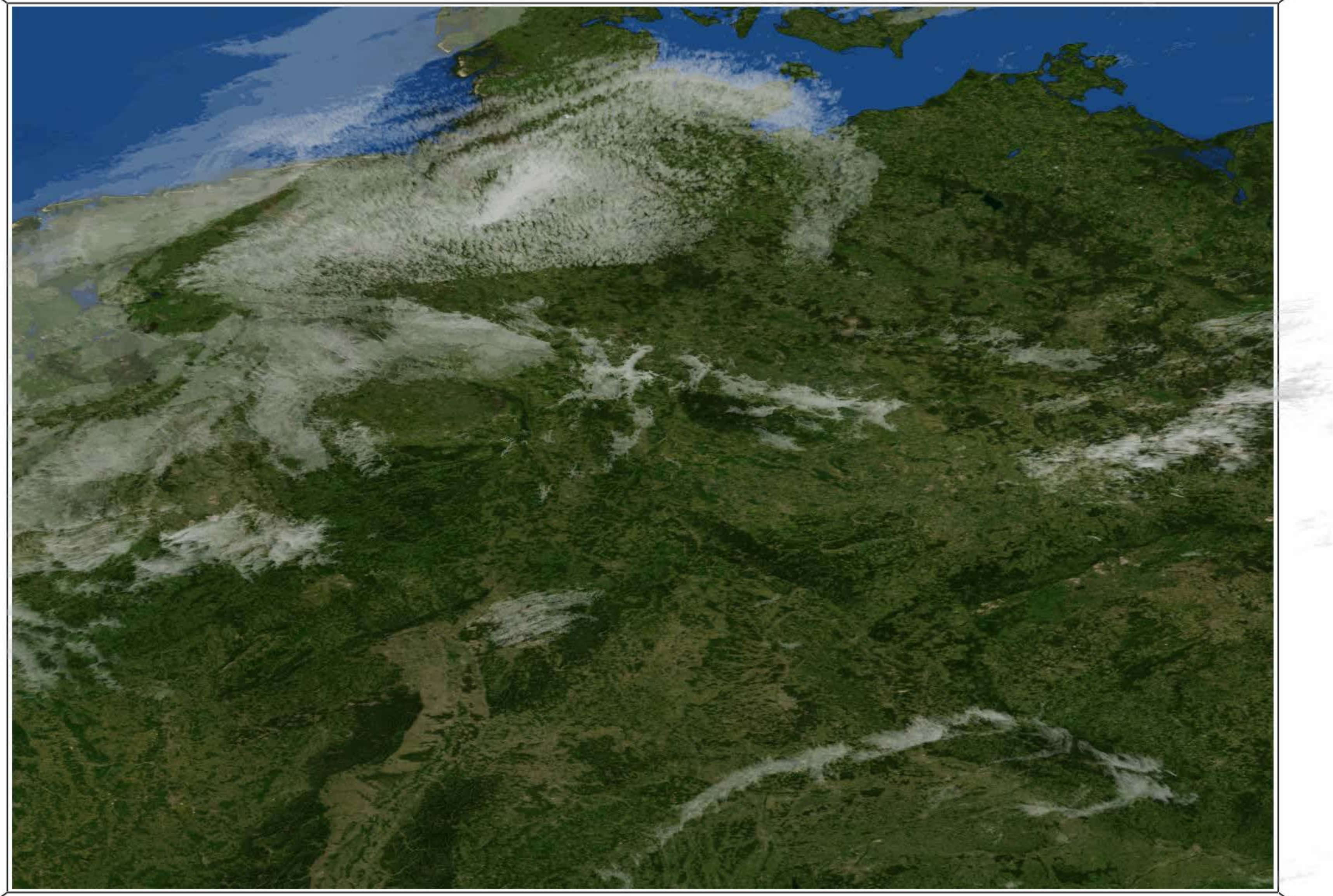
□ Discrete Color Map

0 TF Domain Bounds 1

0 Data Bounds 1

Bits per voxel 8 Histo scale 1

□ Lighting On ☑ Pre-integration On



Help and Assistance

- DKRZ Website (www.dkrz.de/Nutzerportal-en/doku/vis)
- Tutorials & lectures (Avizo, NCL, ParaView, Vapor)