

# GRASS 3D Workshop – 3D data visualization with VTK

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Institute of Applied Geosciences

FOSS4G2006 Workshop



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- 1 VTK and ParaView
  - What is VTK
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  - How to export with r.out.vtk
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- 4 Volume map export and visualization
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# The Visualization ToolKit (VTK)

- software system for 3D computer graphics, image processing and visualization



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- software system for 3D computer graphics, image processing and visualization
- multi-platform and supports Windows, several Unix's and MacOS X
- written in C++ and bindings for Python, Tcl/Tk and Java available
- open source and freely available from <http://www.vtk.org>



# Why do visualization with VTK

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# Why do visualization with VTK

- the most sophisticated visualization toolkit available on the market
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- supports all types of raster, vector and volume data implemented in GRASS
- is actively developed and has an advanced software design
- easy to implement visualization applications with VTK (supports rapid prototype development)



# ParaView

- multi-platform visualization application based on VTK



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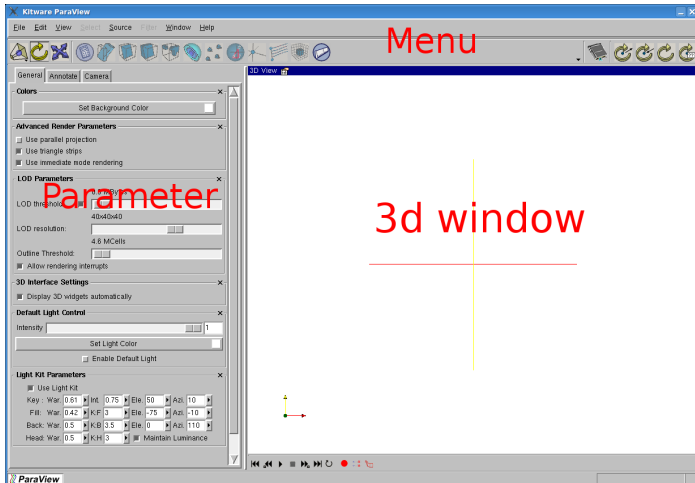
# ParaView

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<http://www.paraview.org>

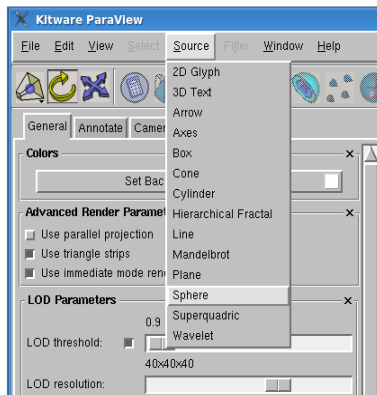
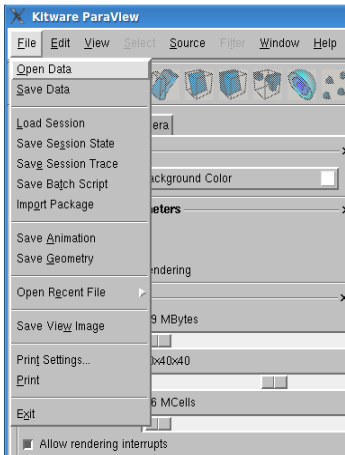
Please start ParaView by typing: `paraview`



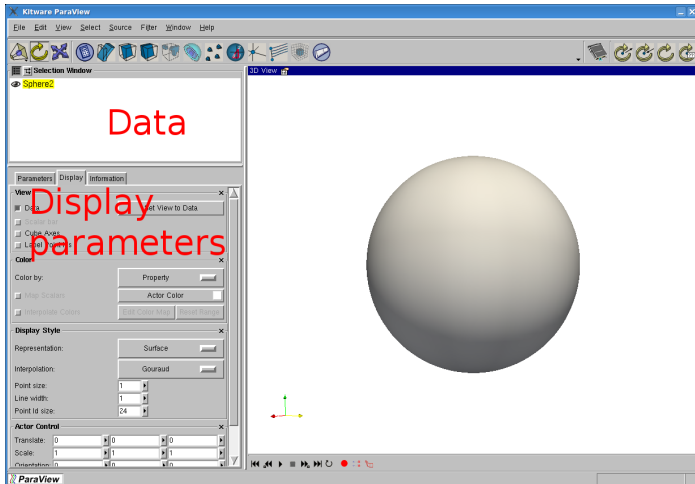
# ParaView



# Data import and creation



# Display



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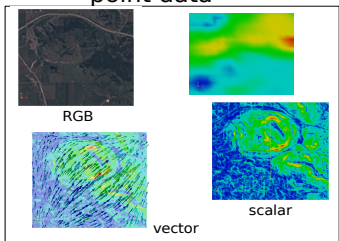
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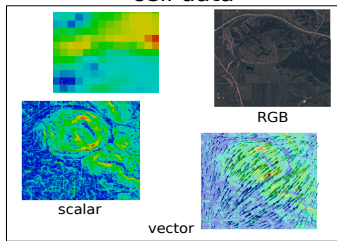
# Features of r.out.vtk

## r.out.vtk

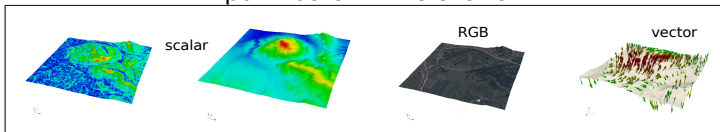
point data



cell data



point data with elevation



# How to use r.out.vtk

- Exporting cell data: `r.out.vtk in=slope out=celldata.vtk`





# How to use r.out.vtk

- **Exporting cell data:** `r.out.vtk in=slope out=celldata.vtk`
- **Exporting point data:** `r.out.vtk -p in=slope out=pointdata.vtk`

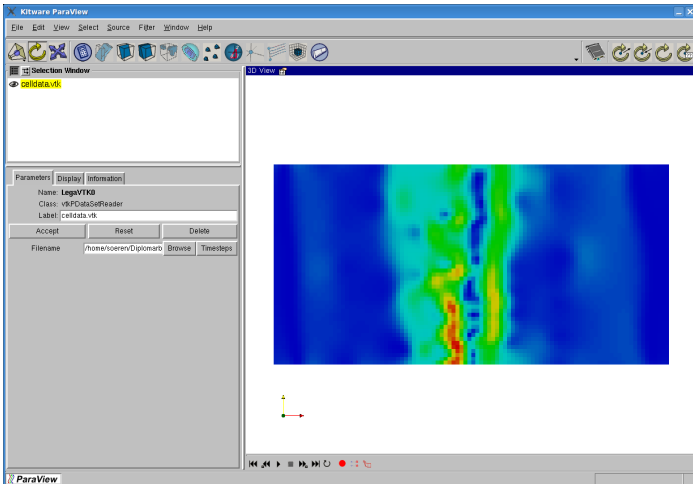


# How to use r.out.vtk

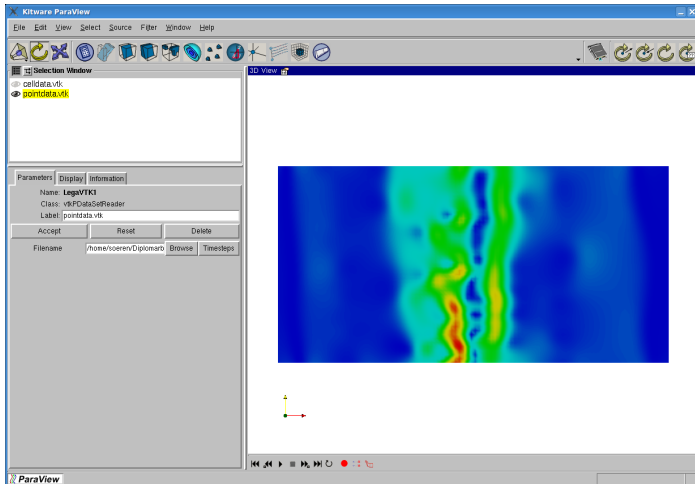
- **Exporting cell data:** `r.out.vtk in=slope out=celldata.vtk`
- **Exporting point data:** `r.out.vtk -p in=slope out=pointdata.vtk`
- **Exporting several data with elevation:** `r.out.vtk in=slope,aspect,elevation elevation=elevation out=elev.vtk`



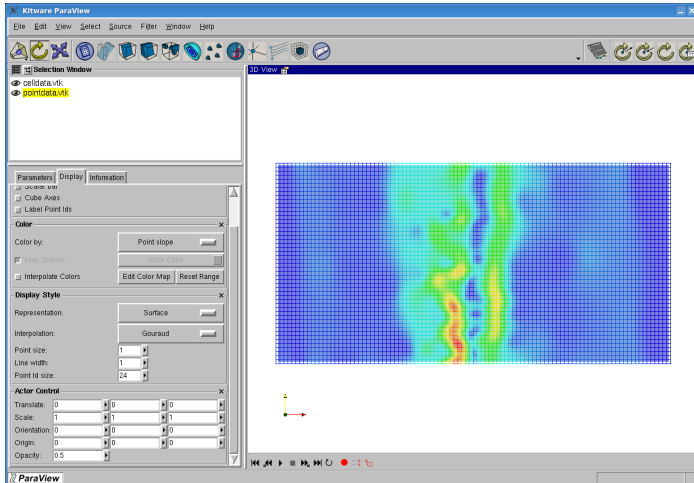
# Cell data



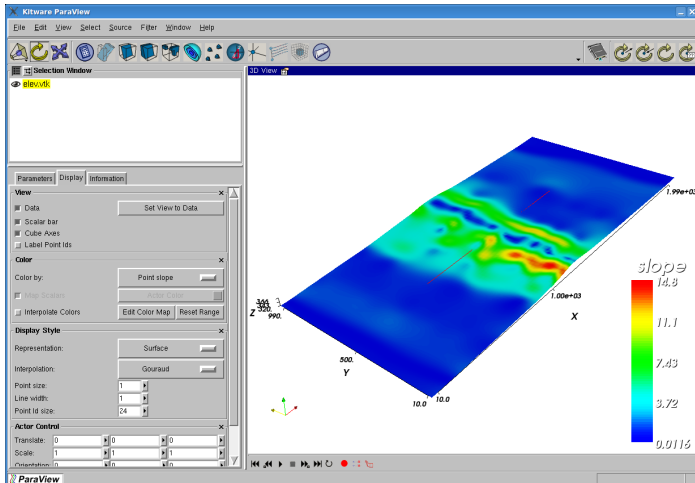
# Point data



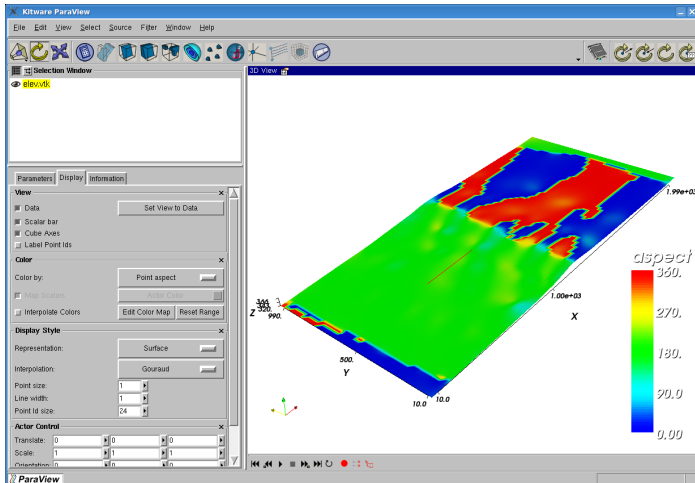
# Point and Cell data together



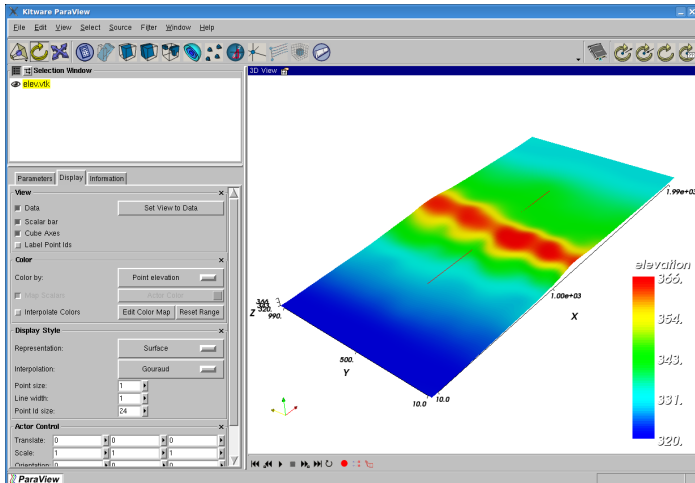
# Elevation and data



# Elevation and data

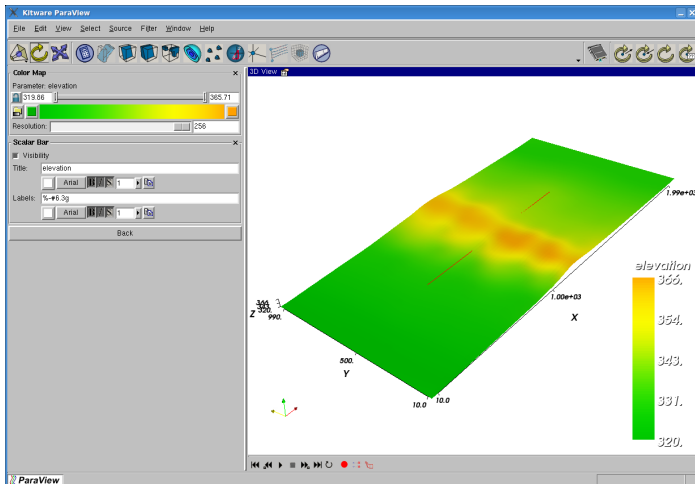


# Elevation and data

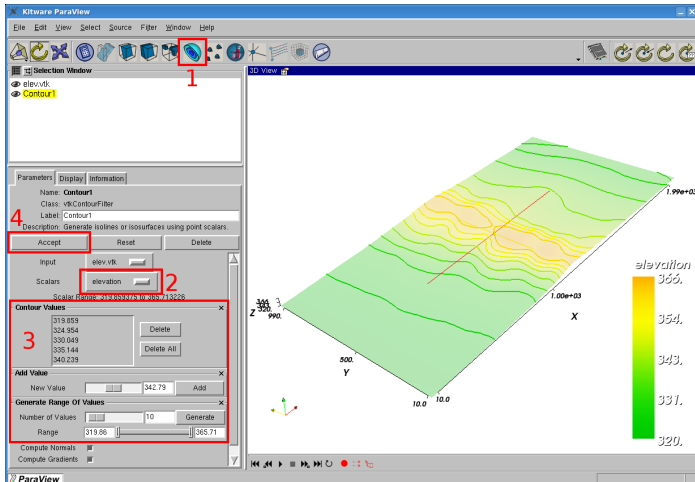




# Elevation color table



# Contouring

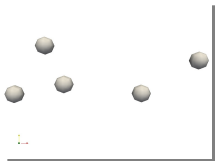


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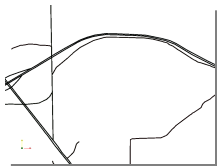
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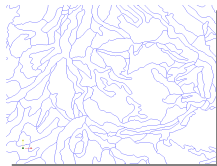
# Features of v.out.vtk



Points



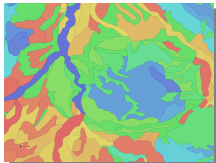
Lines



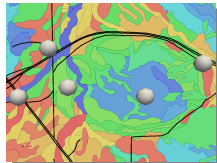
Boundaries

## v.out.vtk

Areas



Mixed



Faces



# Export data with v.out.vtk

- Exporting vector points: `v.out.vtk input=Sources3d output=Sources3d.vtk`



# Export data with v.out.vtk

- **Exporting vector points:** `v.out.vtk input=Sources3d output=Sources3d.vtk`
- **Exporting vector lines:** `v.out.vtk input=roads3d output=roads3d.vtk type=line`



# Export data with v.out.vtk

- Exporting vector points: `v.out.vtk input=Sources3d output=Sources3d.vtk`
- Exporting vector lines: `v.out.vtk input=roads3d output=roads3d.vtk type=line`
- Exporting polygonal data

# Export data with v.out.vtk

- **Exporting vector points:** `v.out.vtk input=Sources3d output=Sources3d.vtk`
- **Exporting vector lines:** `v.out.vtk input=roads3d output=roads3d.vtk type=line`
- **Exporting polygonal data**
  - **trees:** `v.out.vtk input=trees3d output=trees3d.vtk type=line, face`



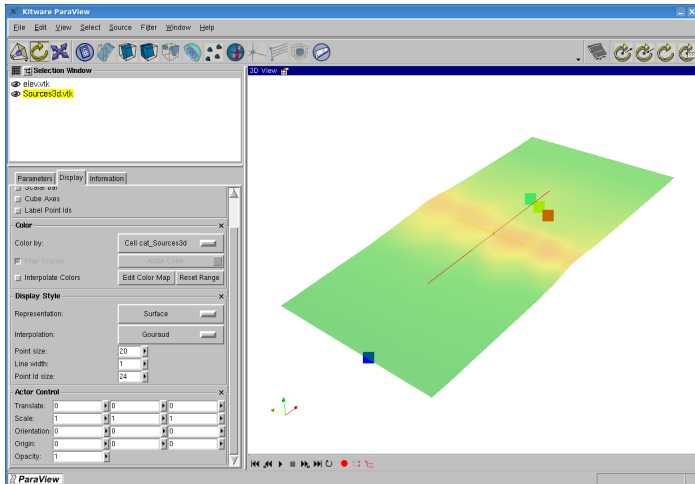


# Export data with v.out.vtk

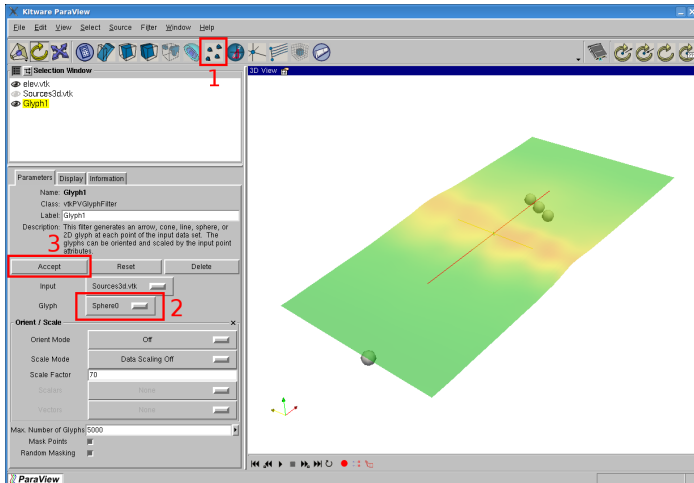
- **Exporting vector points:** `v.out.vtk input=Sources3d output=Sources3d.vtk`
- **Exporting vector lines:** `v.out.vtk input=roads3d output=roads3d.vtk type=line`
- **Exporting polygonal data**
  - **trees:** `v.out.vtk input=trees3d output=trees3d.vtk type=line, face`
  - **buildings:** `v.out.vtk input=industry3d output=industry3d.vtk type=face`



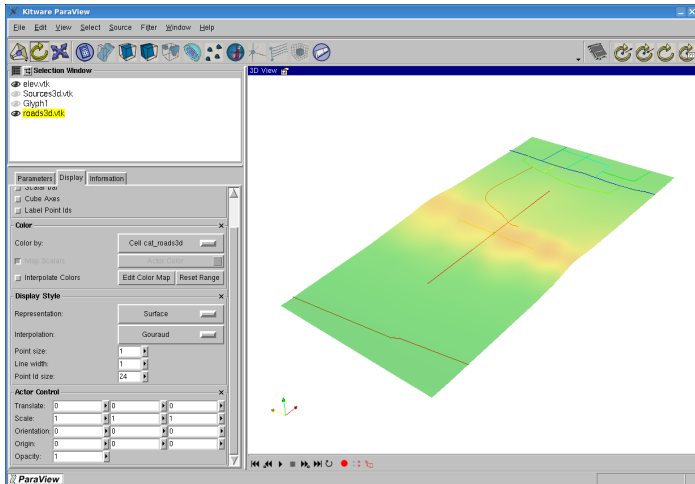
# Vector points



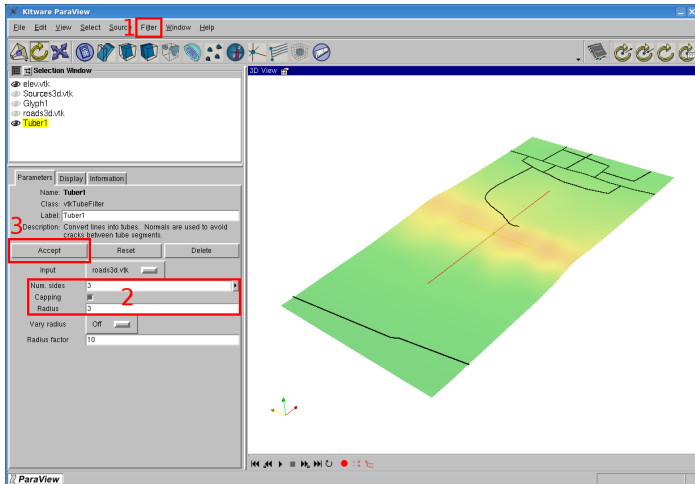
# Using the *Glyph* filter



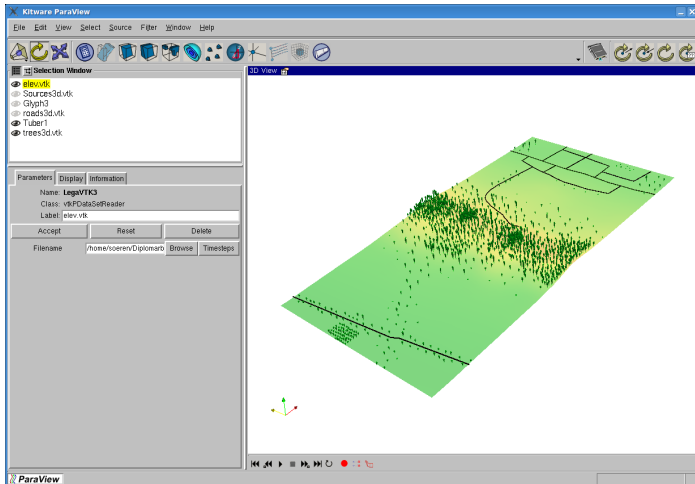
# Vector lines



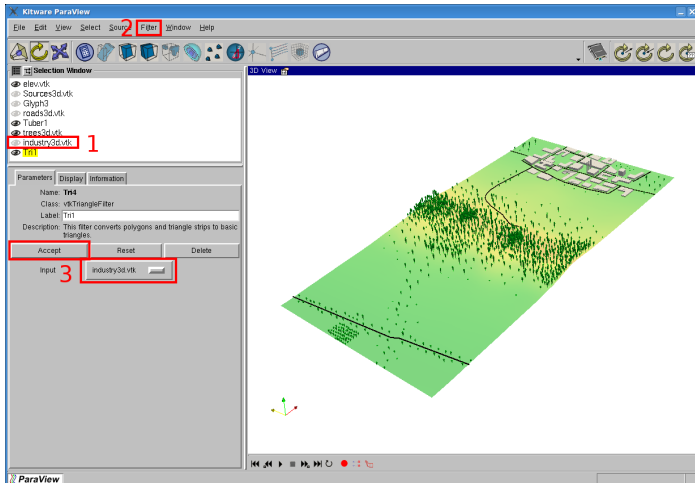
# Using the *Tube* filter



# Trees



# Buildings and *Triangulate* filter



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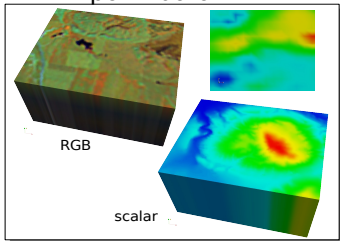




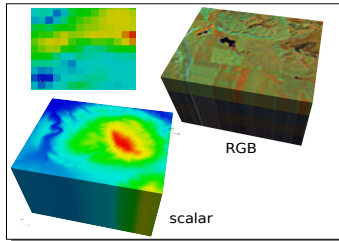
# Features of r3.out.vtk

## r3.out.vtk

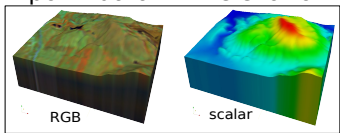
point data



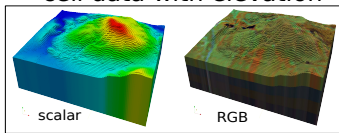
cell data



point data with elevation



cell data with elevation



# Export scalar data

- Exporting cell data: `r3.out.vtk in=geology out=geology3d.vtk`



# Export scalar data

- **Exporting cell data:** `r3.out.vtk in=geology out=geology3d.vtk`
- **Exporting point data:** `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`



## Export scalar data

- **Exporting cell data:** `r3.out.vtk in=geology out=geology3d.vtk`
- **Exporting point data:** `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`
- **Exporting elevation data**



# Export scalar data

- **Exporting cell data:** `r3.out.vtk in=geology out=geology3d.vtk`
- **Exporting point data:** `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`
- **Exporting elevation data**
  - **reduce the z-resolution** `g.region tbres=150`
  - `r3.out.vtk -sp top=elevation bottom=border_sand_clay out=clay3d.vtk`



# Export scalar data

- **Exporting cell data:** `r3.out.vtk in=geology out=geology3d.vtk`
- **Exporting point data:** `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`
- **Exporting elevation data**
  - **reduce the z-resolution** `g.region tbres=150`
  - `r3.out.vtk -sp top=elevation bottom=border_sand_clay out=clay3d.vtk`
  - `r3.out.vtk -sp top=border_sand_clay bottom=border_bedrock_sand out=sand3d.vtk`

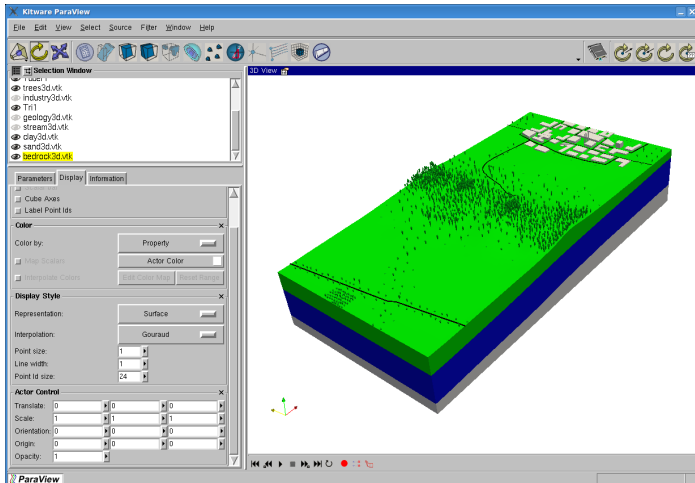


# Export scalar data

- **Exporting cell data:** `r3.out.vtk in=geology out=geology3d.vtk`
- **Exporting point data:** `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`
- **Exporting elevation data**
  - **reduce the z-resolution** `g.region tbres=150`
  - `r3.out.vtk -sp top=elevation bottom=border_sand_clay out=clay3d.vtk`
  - `r3.out.vtk -sp top=border_sand_clay bottom=border_bedrock_sand out=sand3d.vtk`
  - `r3.out.vtk -sp top=border_bedrock_sand bottom=bottom out=bedrock3d.vtk`

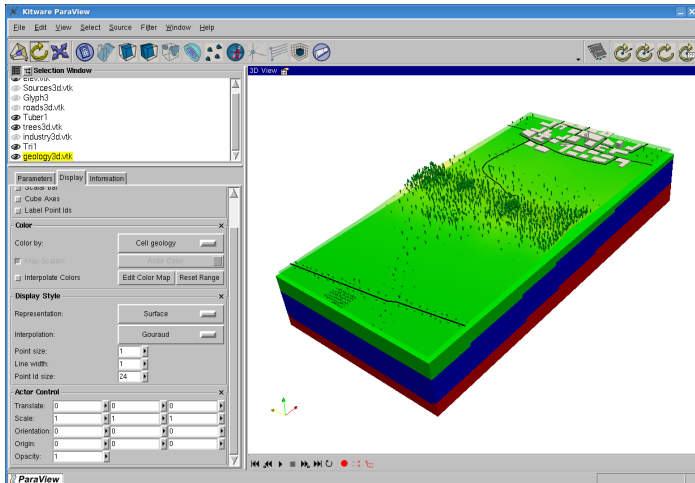


# Elevation data

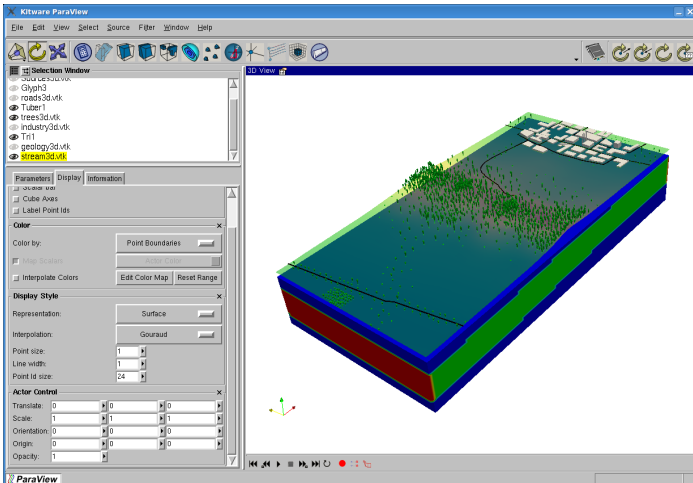




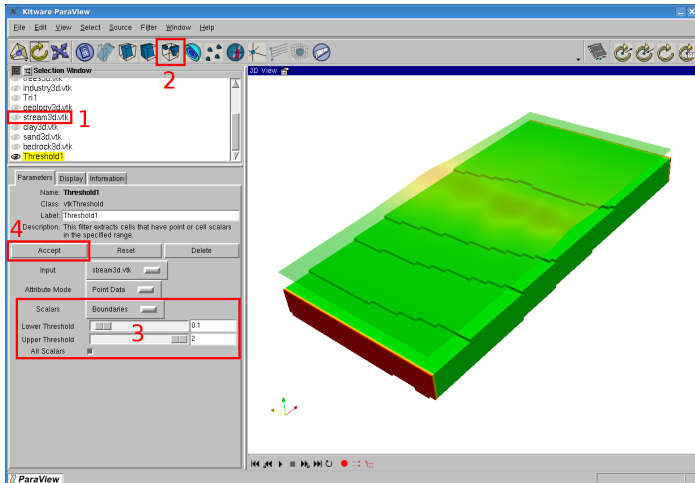
# Cell data



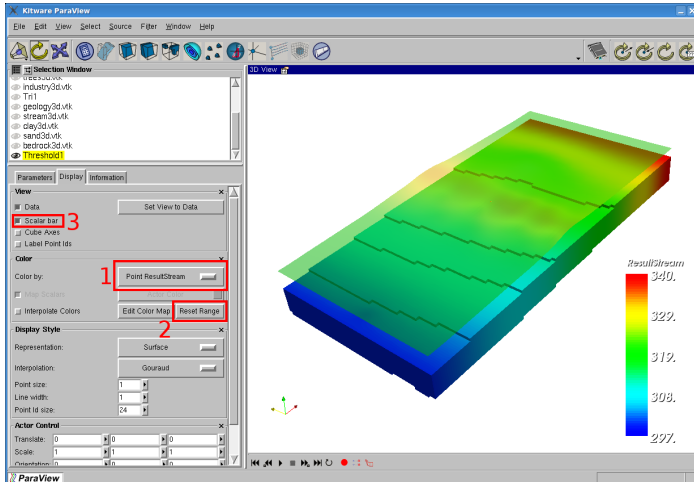
# Point data



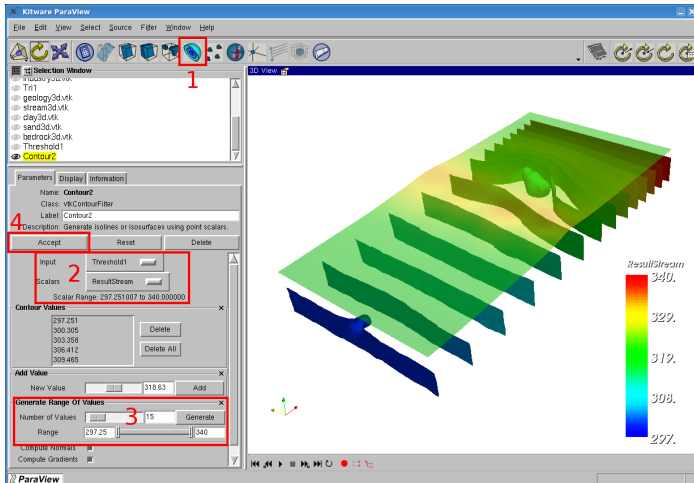
# Data extraction



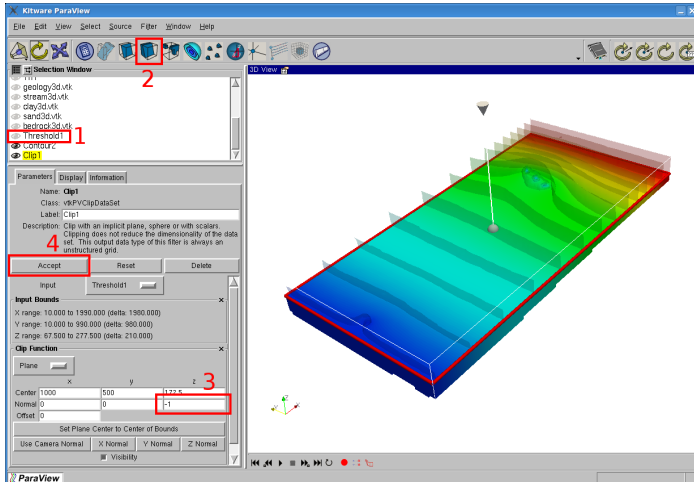
# Data extraction



# Isosurfaces



# Clipping

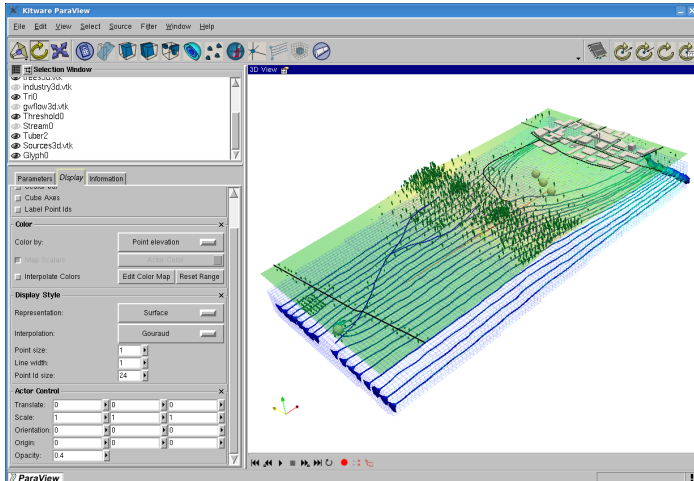


# Export 3d vector data

- Set the default region: `g.region -dp3`
- Exporting vector data: `r3.out.vtk -p`  
`in=Boundaries`  
`vectormaps=ResultStreamVector_x,`  
`ResultStreamVector_y, ResultStreamVector_x`  
`out=gwflow3d.vtk`

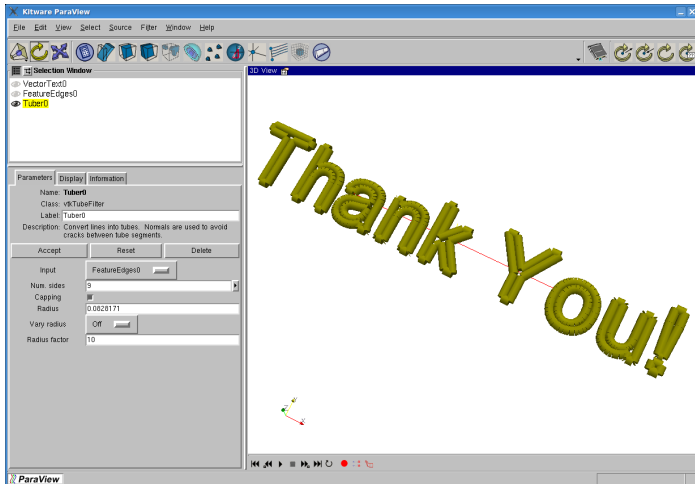


# All together with stream lines





# The End



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[www-pool.math.tu-berlin.de/~soeren/grass/modules](http://www-pool.math.tu-berlin.de/~soeren/grass/modules)

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