GRASS 3D Workshop – 3D data visualization with VTK

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FOSS4G2006 Workshop
Table of Contents

1 VTK and ParaView
   - What is VTK
   - How to use ParaView

2 Raster map export and visualization
   - How to export with r.out.vtk
   - Raster maps in ParaView

3 Vector map export and visualization
   - How to export with v.out.vtk
   - Vector maps in ParaView

4 Volume map export and visualization
   - How to export with r3.out.vtk
   - Volume maps in ParaView

Sören Gebbert  GRASS 3D Workshop – 3D data visualization with VTK
# Table of Contents

1. **VTK and ParaView**
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   - Raster maps in ParaView

3. **Vector map export and visualization**
   - How to export with v.out.vtk
   - Vector maps in ParaView

4. **Volume map export and visualization**
   - How to export with r3.out.vtk
   - Volume maps in ParaView
The Visualization ToolKit (VTK)

- software system for 3D computer graphics, image processing and visualization
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- open source and freely available from http://www.vtk.org
ParaView

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Please start ParaView by typing: paraview
ParaView

Menu

Parameter

3d window
Data import and creation
Display

Data Display Parameters

VTK and ParaView
Raster map export and visualization
Vector map export and visualization
Volume map export and visualization

What is VTK
How to use ParaView

Grass 3D Workshop – 3D data visualization with VTK

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Table of Contents

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Features of r.out.vtk

- **r.out.vtk**
- **point data**
  - RGB
  - vector
  - scalar
- **cell data**
  - RGB
  - vector
  - scalar
- **point data with elevation**
  - RGB
  - vector
  - scalar

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How to use r.out.vtk

- **Exporting cell data:** `r.out.vtk in=slope out=celldata.vtk`
How to use \texttt{r.out.vtk}

- **Exporting cell data:** \texttt{r.out.vtk in=slope out=celldata.vtk}
- **Exporting point data:** \texttt{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 data with elevation:** `r.out.vtk in=elevation elevation=elevation out=elev.vtk`
Cell data
Point data
Elevation and data

VTK and ParaView
Raster map export and visualization
Vector map export and visualization
Volume map export and visualization

How to export with r.out.vtk
Raster maps in ParaView

Elevation and data
Elevation color table
VTK and ParaView
Raster map export and visualization
Vector map export and visualization
Volume map export and visualization

Contouring

1. Open the ParaView application.
2. Import the data file.
3. Define the contour values.
4. Generate the contour lines.

How to export with r.out.vtk
Raster maps in ParaView
Table of Contents

1. VTK and ParaView
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2. Raster map export and visualization
   • How to export with r.out.vtk
   • Raster maps in ParaView

3. Vector map export and visualization
   • How to export with v.out.vtk
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Features of v.out.vtk

- Points
- Lines
- Boundaries
- Areas
- Mixed
- Faces

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Export data with `v.out.vtk`.

- **Exporting vector lines**: `v.out.vtk input=roads3d output=roads3d.vtk type=line`
Export data with v.out.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 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 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 lines
Using the *Tube* filter
Trees
Buildings and \textit{Triangulate} filter
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1. VTK and ParaView
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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 elevation data

How to export with r3.out.vtk

Volume maps in ParaView

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Export scalar data

- Exporting elevation data
  - reduce the z-resolution `g.region tbres=150`
Export scalar data

- Exporting elevation data
  - reduce the z-resolution `g.region tbres=150`
  - `r3.out.vtk -sp top=elevation bottom=border_sand_clay out=clay3d.vtk`

- Exporting point data:
  - `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`
Export scalar data

- 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 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`
Export scalar data

- 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`

- default region: `g.region -dp3`
Export scalar data

- 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`

- default region: `g.region -dp3`

- Exporting point data: `r3.out.vtk -p in=Boundaries,ResultStream out=gw3d.vtk`
Elevation data
Point data
Data extraction

1. Open ParaView and navigate to the file "stream3d.vtk".
2. Select "Threshold" in the Parameters panel.
3. Specify the Threshold values: Lower Threshold = 0.1, Upper Threshold = 2.
4. Click "Accept" to apply the threshold filter.
Data extraction

1. Select "Scalar bar" and set the data to "Result Stream"
2. Edit the color map and reset the range
3. Set the display style to "Surface"
Isosurfaces

1. **Input Scalars**: Threshold 1
2. **Input Scalars**: Result Stream
3. **Generate Range Of Values**: Number of Values 16, Range 257.25 to 340
4. **Contour Values**: Threshold 1, Scalar Range: 257.25 to 340
Clipping

1. Click on the Threshold filter.
2. Adjust the threshold value as needed.
3. Set the clip function to Plane.
4. Adjust the center and normal values.

How to export with r3.out.vtk
Volume maps in ParaView
The End
The End

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