ParaView in 2018: Features Quick Peek

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1. Introduction

ParaView is an OpenSource Application and Architecture for display and analysis of massive scientific dataset. It is used all over the world by researched and academic and private sector within all kinds of scientific domains. It is ever evolving and improving, thanks to collaboration between Kitware and other companies, EDF, TOTAL or DRKZ comes to mind.

Some new exciting features have been added in 2017, and since ParaView 5.5 has just been released, they are now available for everyone to use.

2. OpenTURNS : Stats and Uncertainty tools

ParaView is always been great for 3D Analysis, but is was not the de-facto choice for statistical analysis. Thanks to EDF funding, new capabilities for data analysis is making its debut in ParaView and VTK based on OpenTURNS. OpenTURNS is an open source initiative for the Treatment of Uncertainties, Risks'N Statistics, and is now an optional dependency of VTK. It takes the form of an optional VTK module that can be requested to be built in ParaView by turning ON the CMake option PARAVIEW_USE_OPENTURNS.

Two new filters, "*OT Kernel Smoothing*" and "*OT Density Map*" are now available, and the "OT Density Map" is even integrated into the Plot Matrix View in order to show the density map of the first and last decile as well as the median, which results can be seen on Fig. 1 and on our blog [1].

3. Major Improvements on the Point Gaussian Representation

One feature introduced in ParaView 4.4 that was quite used was the *Point Sprite Representation* available through a built-in plugin. The feature was lost when we transitioned to the new OpenGL2 backend rendering engine.

The new *Point Gaussian Representation* was supposed to take its place partially and be supported for a long time as an official representation and not "just a plugin" as before. However Point Sprite users were not very happy with it: the new feature was not easy to use and lot slower when rendering big number of points. This issue comes to an end with some new features and bug fixes which are now merged into ParaView, as show on Fig. 2 and on our blog [2]:

- Possibility to write Custom Shader from within ParaView UI;
- Possibility to use Opacity and Scaling not only with a Scalar Array but also with a Vector Array by selecting the component to use or the magnitude;
- Opacity and Scale transfer functions are now dynamic and automatically adjusted;
- Enable Point Gaussian Representation for every DataSet type;
- Just Merged : Support for point selection and point picking with "Hover Point".

4. Separate Color Map and Multi Component volume rendering

By default, ParaView share color map by the name of the colored array. We have now introduced a way to "*separate*" a color map, insuring it is not shared. This enabled the implementation of a new feature, Multi Component Volume Rendering.

When this new feature is enabled:
- for a two-components array, the first component is mapped to the color, the second component is mapped to the opacity;
- for a four-components array, the first, second and third components are used as RGB values and the fourth component is mapped to the opacity.

5. A new Embossing Representations Plugin for ParaView

Besides being large, climate simulations are usually comprised of many different variables and quantities that often need to be visualized side by side. The two new representations included in a new plugin have been explicitly developed with this idea in mind, and as climate simulations tend to be based on all kind of different grids, special attention was paid that all major ones are supported. Both representations have been tested with rectilinear grids, tri-polar curvilinear grids, as well as semi-irregular grids such as ICON and MPAS.

The new *"Bump Mapped Surface"* representation works only with point data and does not modify at all the current geometry. The GPU uses the gradient of the data to alter surface normals and creates a shade effect. When selected, the data array and a scaling factor can be chosen by the user.

The new *"Extrusion surface"* is mainly designed to work with cell data and behaves like an extruded "city map". The cells are extruded based on their value in the selected array and a user defined factor. Optionally, it is possible to normalize values with an auto-scaling based on the range of the data or a manual range. See Fig. 3 and on our blog [3]. Applied to a point data array, this filter will warp the points in their normal direction according array values. For instance it can be used to produce an elevation model from a 2D map.

6. Conclusion

We have introduced a few of the new features, but these are only a quick peek into what is new in the ParaView 5.5.0 release. In the context of a demonstration, other very nice features could be demonstrated as well as letting potential users try it for themselves (e.g.: efficient rendering of large number of 3D glyphs, new StreamLines Representation, new Cluster Analysis filters from the DRP plugin, GPU-computed isocontours).

References

[1] : https://blog.kitware.com/openturns-integration-in-paraview-stats-and-uncertainty-tools/
[2] : https://blog.kitware.com/major-improvements-on-the-point-gaussian-representation/
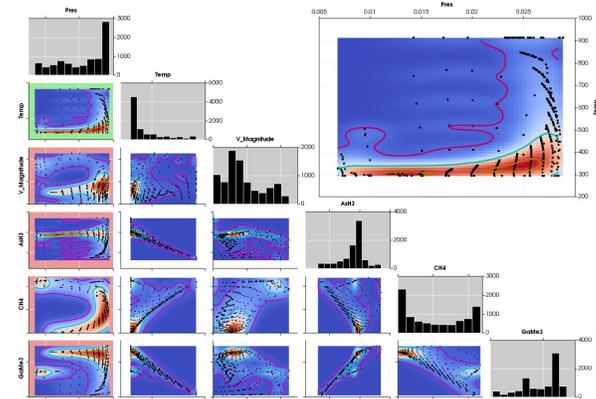[3] : https://blog.kitware.com/a-new-embossing-representations-plugin-for-paraview/

Figure 1: Improvement of the Plot Matrix view to display density map computed with OpenTURNS within ParaView.
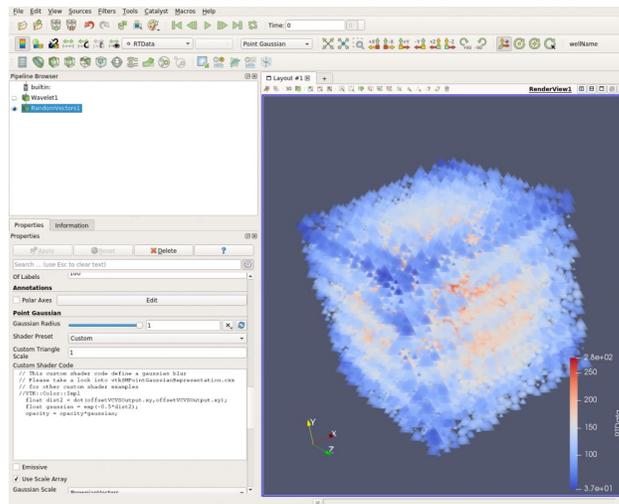
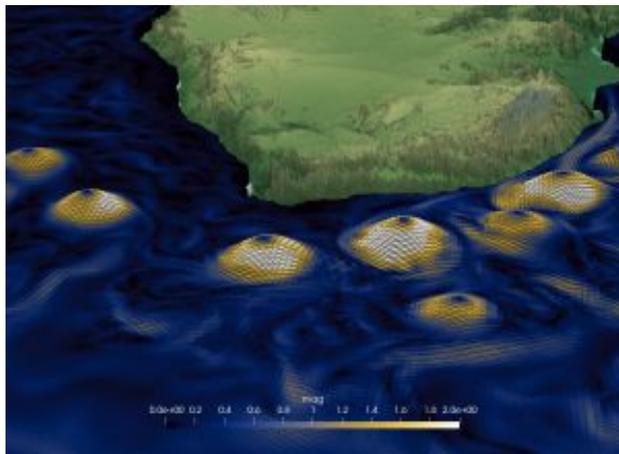

Figure 2: Custom Shader for Point Gaussian Representation in ParaView.

Figure 3: Results of using embossing plugin in ParaView.