

# Interactive Oceanographic Visualization using spatially-aggregated Parallel Coordinate Plots

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## Introduction

Visual Analytics interfaces allow ocean scientists to interactively investigate and compare different runs and parameterizations.

However, oceanographic models are complex, temporal and the datasets that are generated are huge.

Parallel Coordinate Plots can help explore multivariate data such as ocean-science data.

Common issues with traditional PCPs of clutter and performance inhibit interactive spatial exploration.

We describe techniques that aggregate the PCP based on the spatial nature of the data and we render the polylines as ranges.

## Motivation

Flooding events often occur due to build up of sediment on the coast or estuary. With 50% of the worlds population living within 60kms of the shoreline, there is need to understand sediment transport in more detail.

Hydrodynamic models allow the visualization of changes over time in sandbanks, scour pits and tidal channels.

Multiple runs, 100-year simulations, and complex models create huge datasets.

We also need to look at different resolution scales and understand locations of large deposition, buildup or sediment movement.

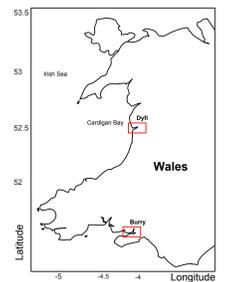


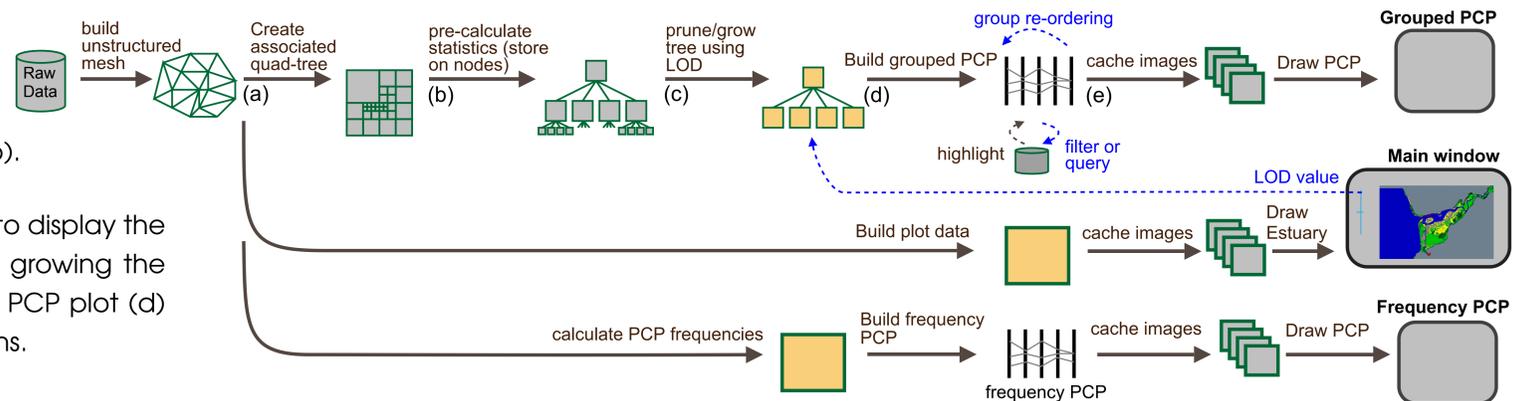
Figure 1: Our case-studies.

## Our Process

The schematic shows our process: we create the PR-quadtrees (a) and calculate the statistical information storing it on the nodes (b).

Then the user can choose the LOD to display the data within the PCP, by pruning or growing the tree (c). We build the aggregated PCP plot (d) that utilizes different transfer functions.

Axis are grouped together such that the user can manipulate them as a unit. Then we render the images onto an offscreen buffer (e) that can then be loaded to create a fast animation of the data over time. The other lines also show that we create other views of the data including a frequency PCP.



## VINCA Integration

We have implemented this process into our multi-view oceanographic visualization system, (Figure 2), which uses Java, OpenGL and Processing.org. Our tool has several coordinated-views, including a main plot window, several PCP variants and line graphs.

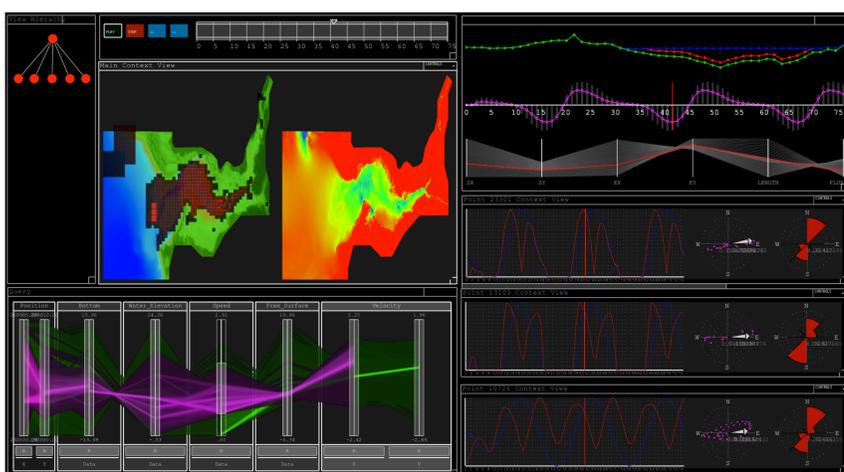


Figure 2: The Vinca oceanographic visualization system

## Example PCPs

We have used a variety of rendering techniques and different transfer functions (shown below in Figure 3).

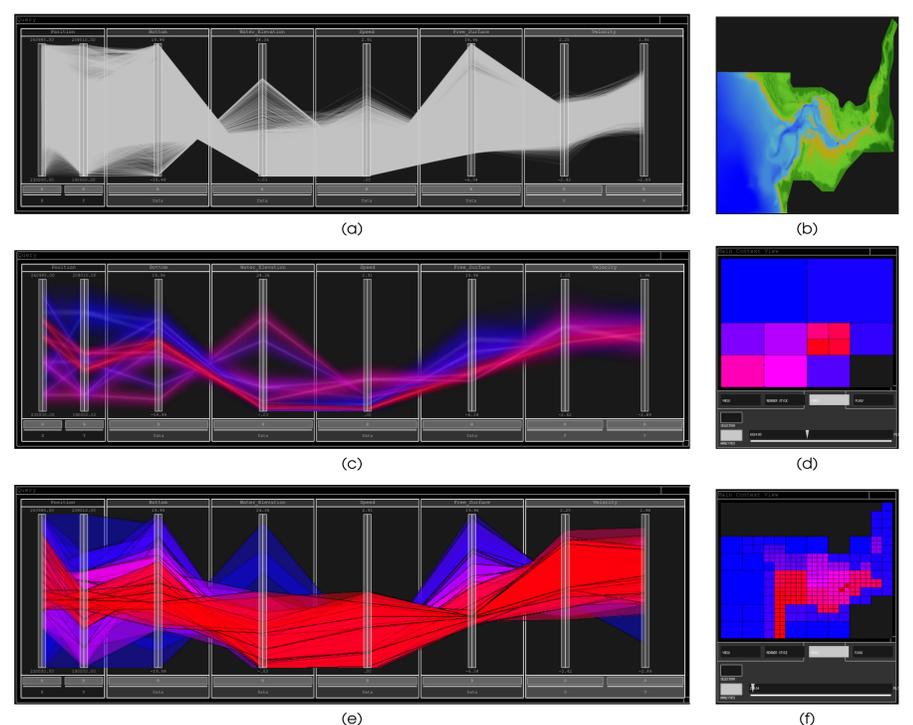


Figure 3: Aggregated PCPs, displaying envelopes using different algorithms.

## Conclusion

We have described a PCP that is aggregated using a spatial PR tree, which we have successfully integrated into our oceanographic visualization environment, VINCA.

We have visualized several different estuaries, to enable users to explore the simulation data. This ongoing work is a collaboration between expert ocean scientists and computer scientists and follows on from previous efforts to investigate big data in oceanography.

## References

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