Scalable Visual Analysis of Superstructures

The overarching goal of this research project is to develop scalable feature-based visualization techniques to support domain experts in the detection and tracking of superstructures, in the analysis of the momentum fluctuations caused by these structures, and in the exploration of the effect of such structures on fluctuations in the viscous sublayer. This shall be achieved by tightly intertwining computational analytics techniques and interactive visualization of the initial turbulence fields and derived fields. This project will develop visualization techniques for single time-varying fields, as well as sets of fields resulting from measurements and ensemble simulations.

Due to the sheer volume of turbulence fields comprising superstructures, their inherent spatial and temporal aspects, as well as the complex spatio-temporal interrelations between superstructures and other primary turbulence structures, available computational analysis and visualization techniques are vastly limited. It is our plan to develop new and improved techniques which enable an interactive exploration of such fields, and which can, in particular, help analyzing the shape and topology of superstructures in a spatio-temporal context.

The visualization algorithms we develop shall be embedded into the computational infrastructure for turbulence visualization we have developed over the last years. Special emphasis will be put on the development of approaches to enable a visually-guided interactive analysis of superstructures.