3D Wind Field Construction with High Performance Computing and VR Visualization

THE PROBLEM

Wind energy, as one of the cleanest renewable energy, is becoming increasingly important. Both the installed wind power and the generated energy are increasing by 30% per year world-wide. Performance of a wind turbine is determined by the efficiency of the blade. If the airflow over wind turbine blades could be controlled fully, the generation efficiency and thus the energy production would increase by 9%. However, the airflow over wind turbine blades is typically a complex stream of unsteady and turbulent wind, due to changes in angle of attack on the blades.

OBJECTIVES

- Finding optimized siting locations for wind turbines to be used in the most efficient manner
- Understanding the turbulent flow over wind turbine blades to better understand the turbulent air
- Visualizing contaminant dispersion help predict flow and traces of airborne contaminants. Such visualization can be useful to emergency responders and homeland security issues.

THE RESULTS

A simulation which allows the user to visualize multiple items. These include accurate airflow models, optimized wind turbine siting and contaminant dispersion in airflow.

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