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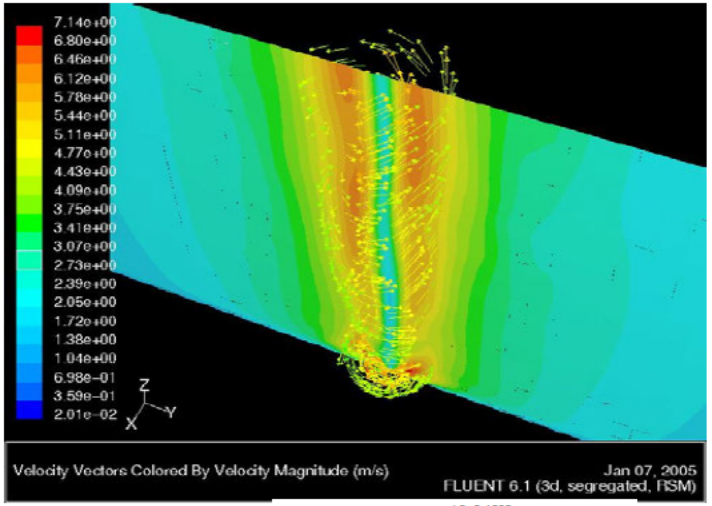
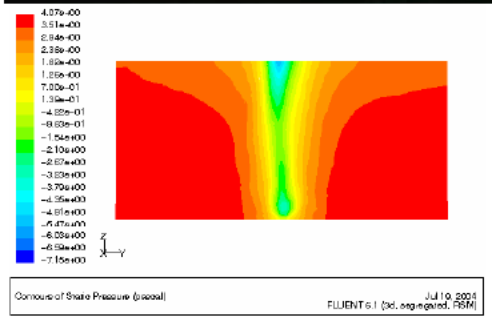
The Boundary Layer Wind Tunnel Laboratory

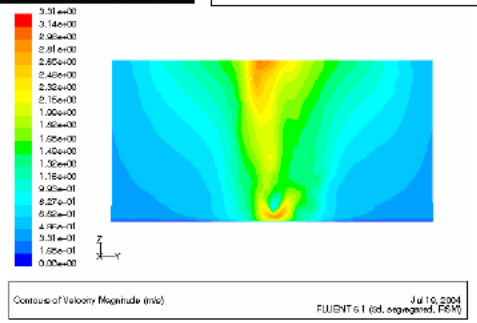
Tornado Simulations

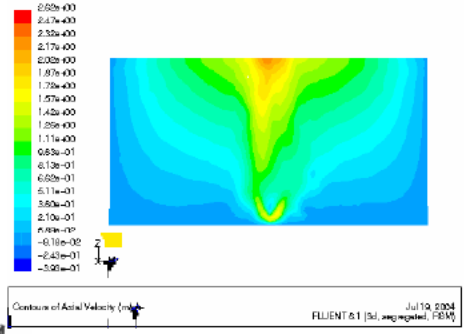
Summary

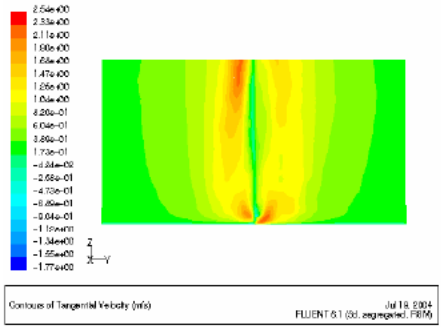
Tornados are surface vortex flows originated from thunderstorms and generating very localized, short duration surface high intensity winds.
Numerical, laboratory and analytical modeling of surface vortex flows are conducted to determine the generic macro-flow dynamics of such winds.
The flow is primarily dependent on swirl ratio, the ratio between initial swirl and axial velocities. For low swirl the flow separates and forms a laminar vortex. With increasing swirl the laminar vortex breaks down into a turbulent one aloft which gradually descends to the surface. The touch down of this vortex is associated with the critical phase in a tornado-genesis.



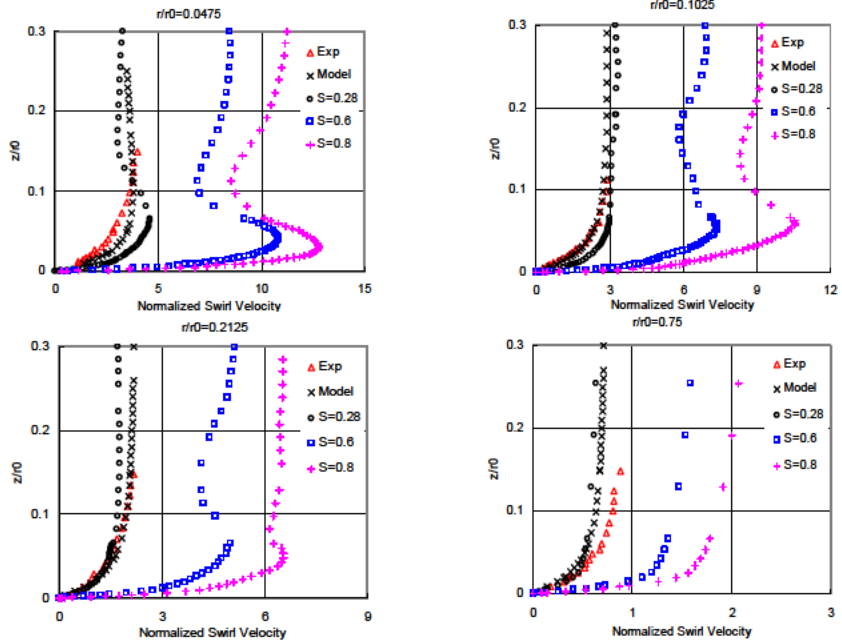








Pressure, Velocity Magnitude, Axial Velocity ans Swirl Velocity Contours; S=0.4



Swirl Velocity Profiles: CFD, Experiments, Model; various Swirl Ratios

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