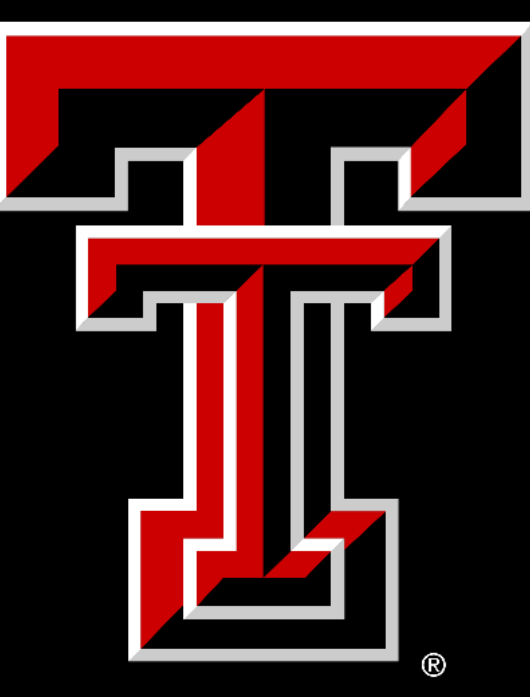


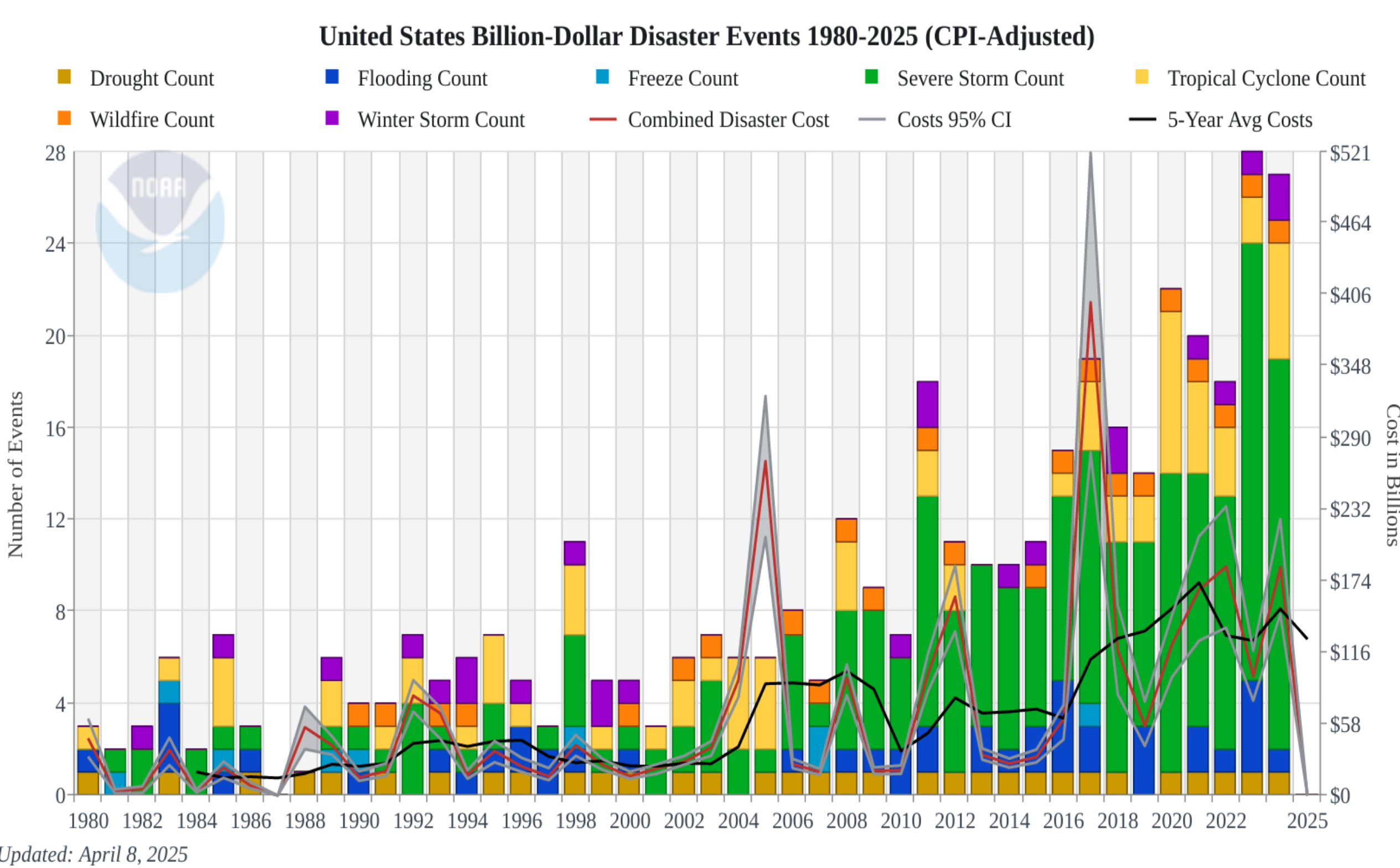
Advancing Vortex (TLV) Generation in Wind Tunnels using CFD

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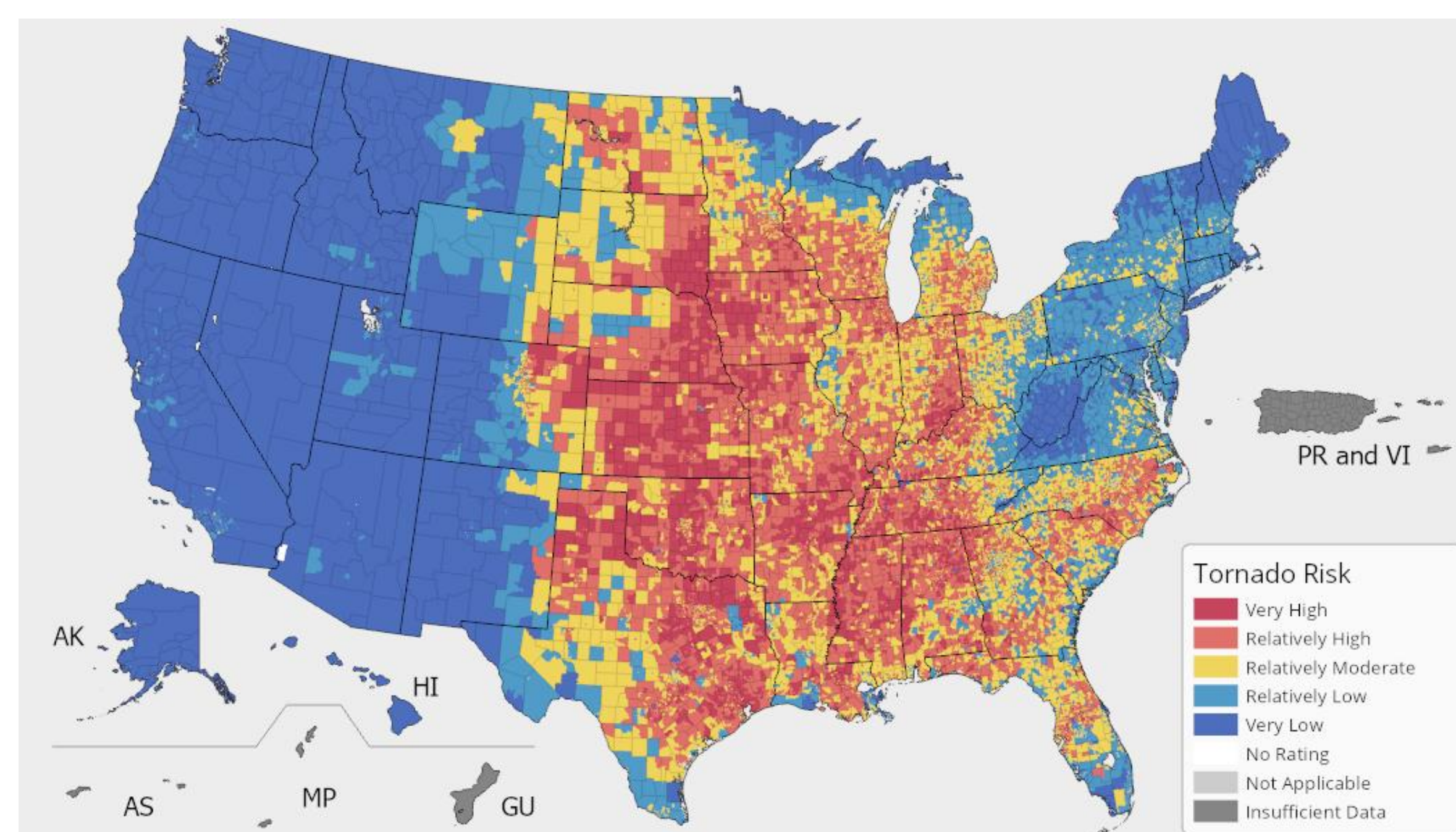


Background

- Between 1980 and 2023, **severe storms** and **hurricanes** caused 70% (**\$41.4 billion**) of average annual property damage.
- Tornadoes** were responsible for approximately \$1.5 billion annually between 2018 and 2022.
- Focusing on simulating tornado-like vortices (TLVs) to understand tornado-induced loading.



Credit: NOAA, 2025



Credit: National Tornado Risk Index (FEMA)



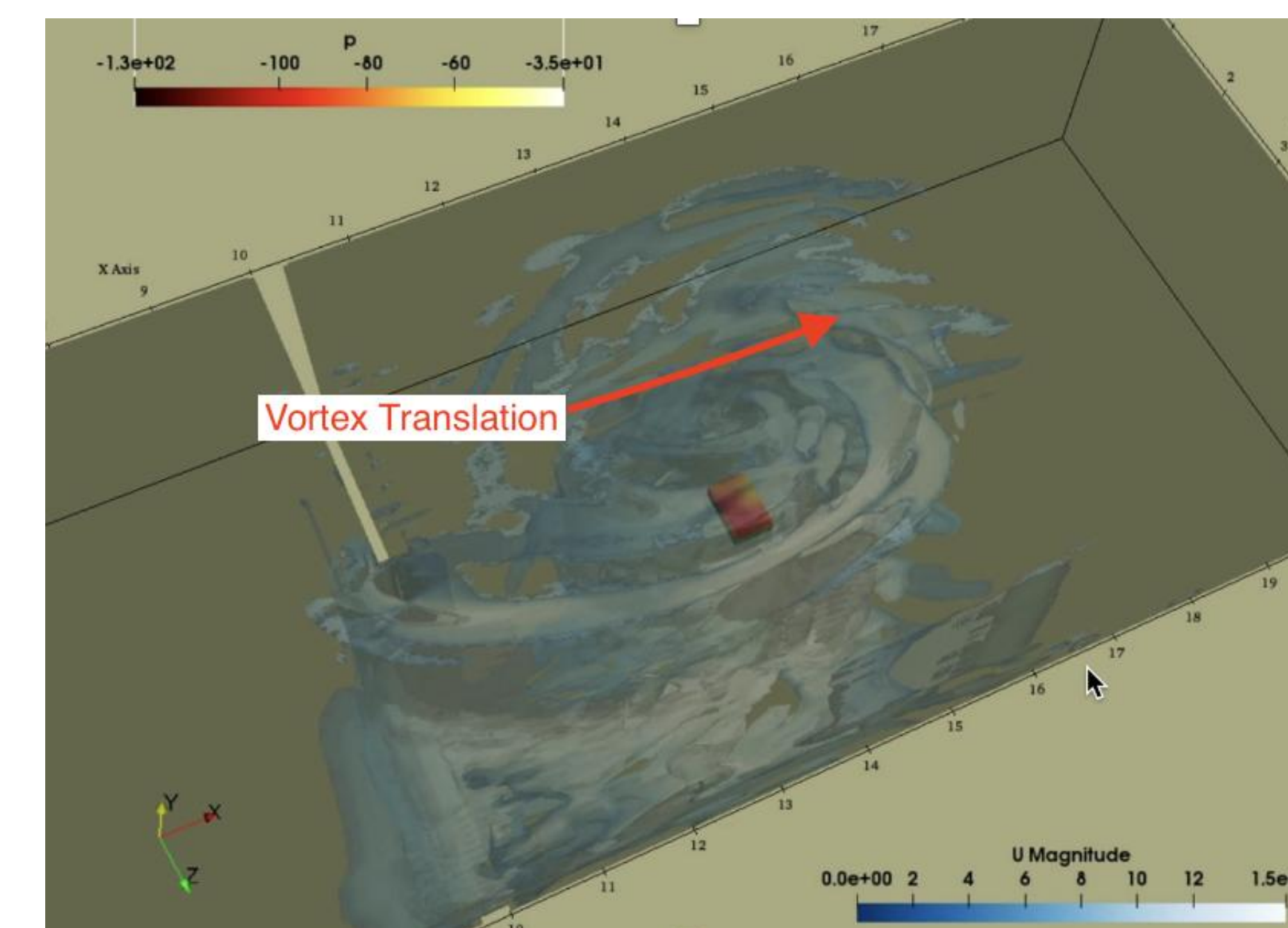
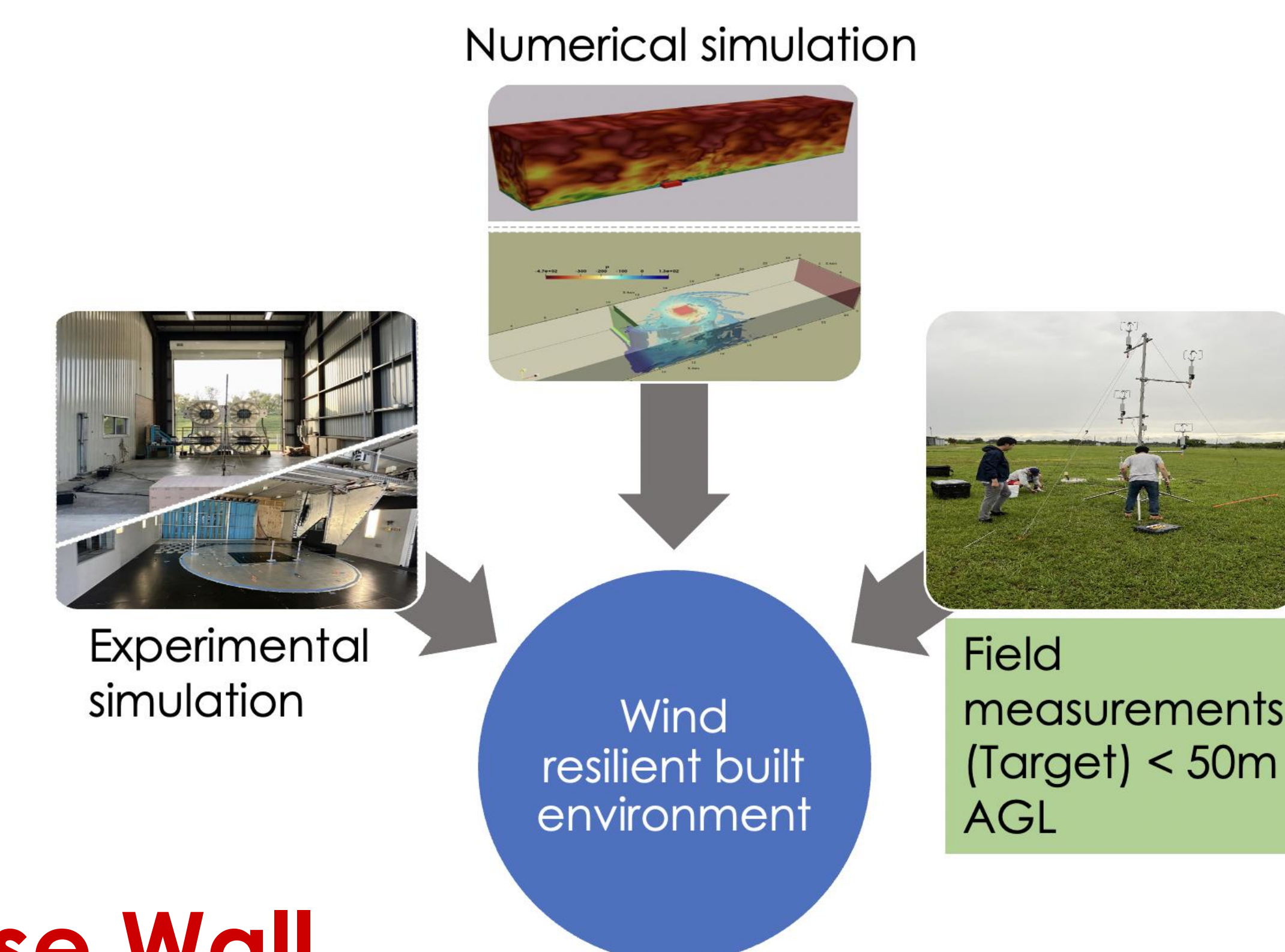
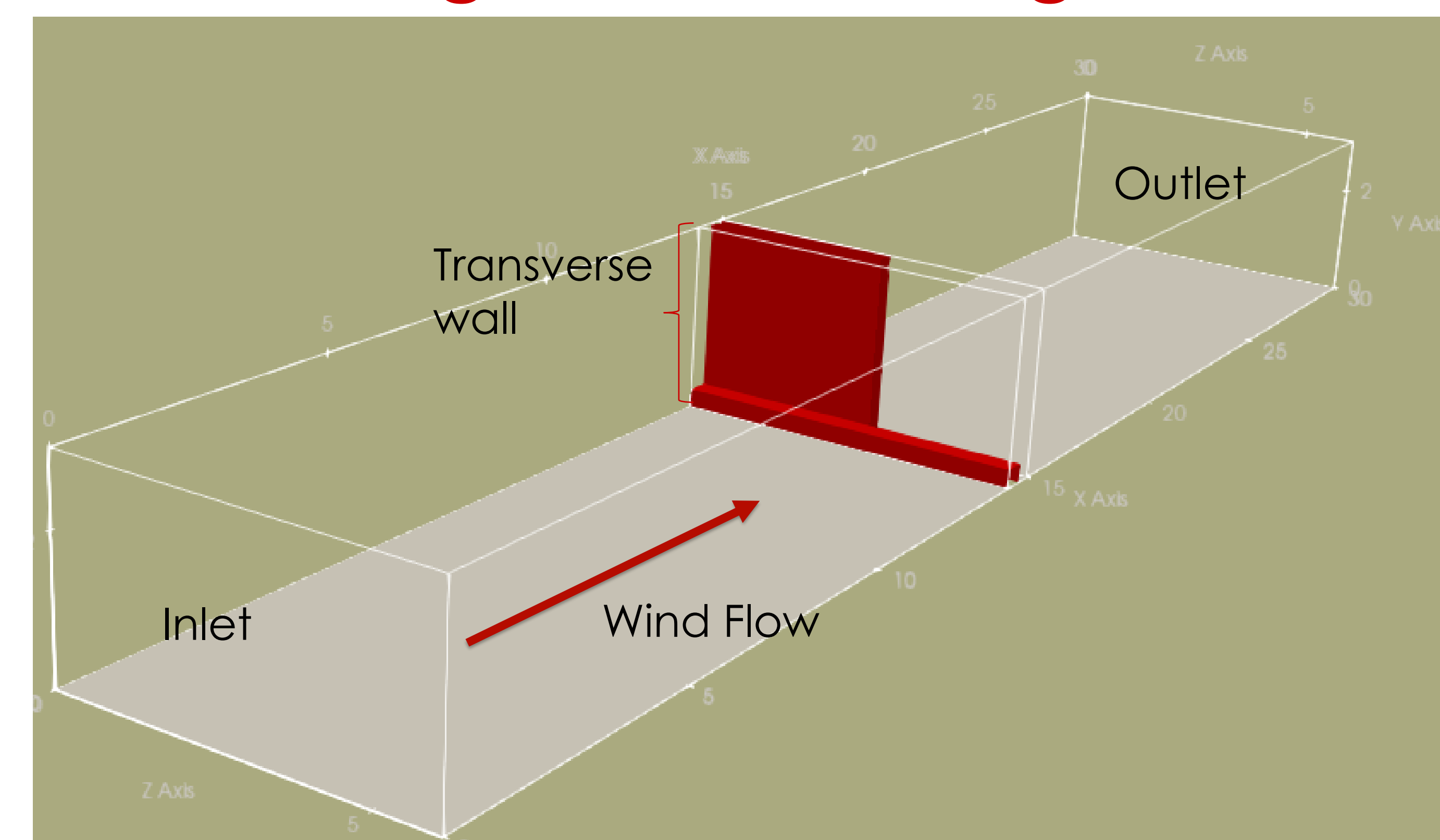
Kentucky Tornado (Drone image: UIUC WERL)

Current Research Focus

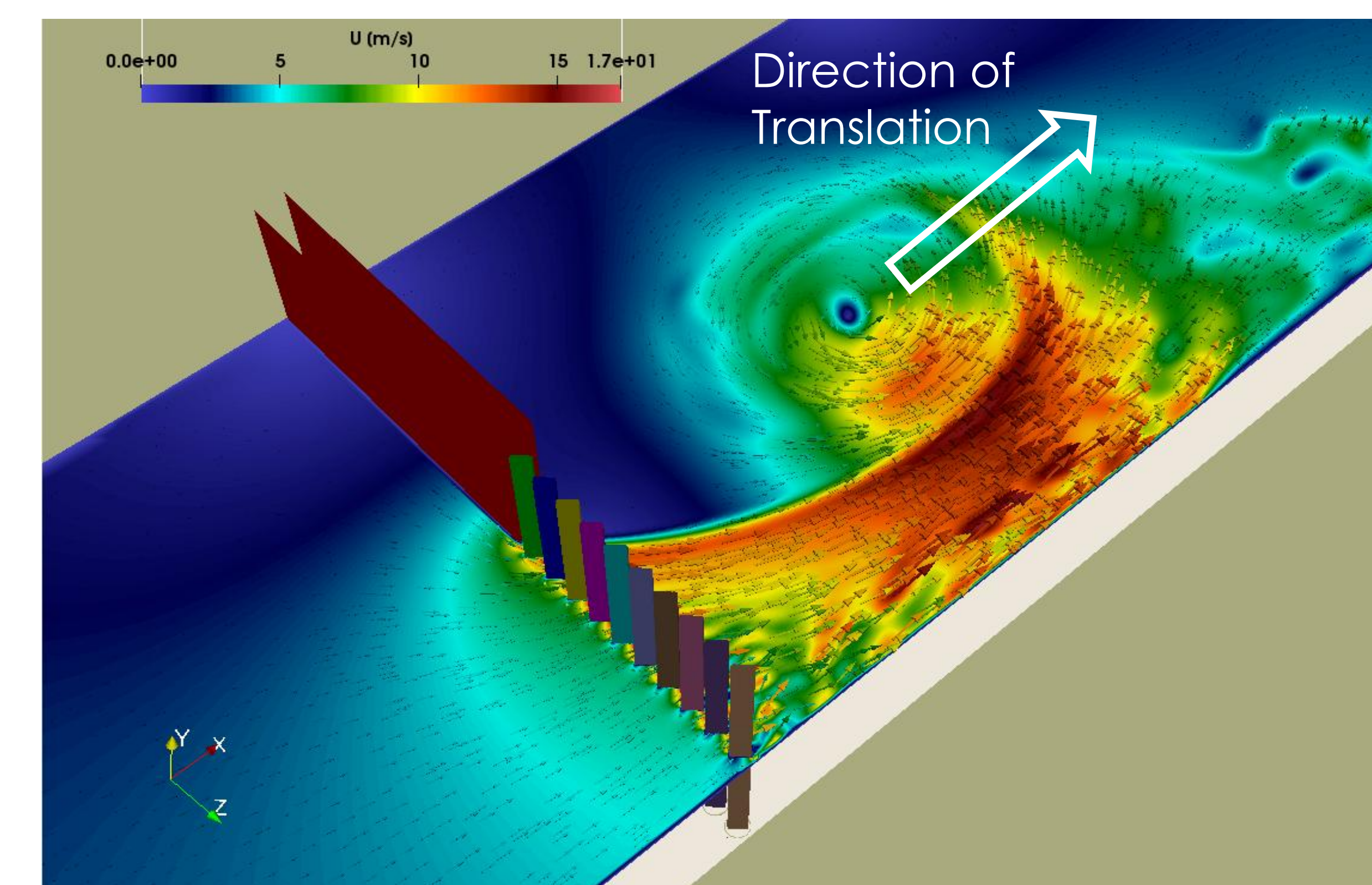
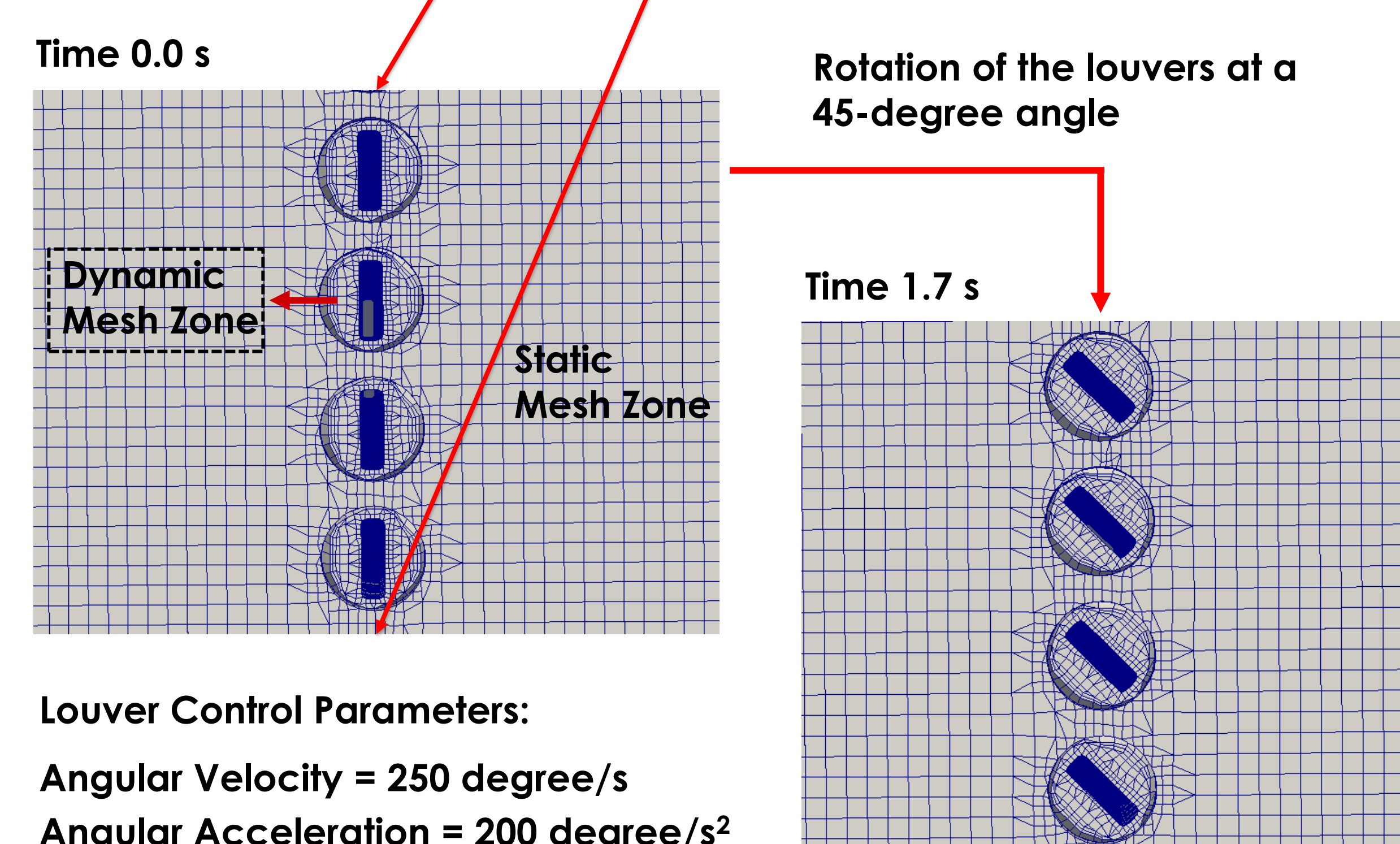
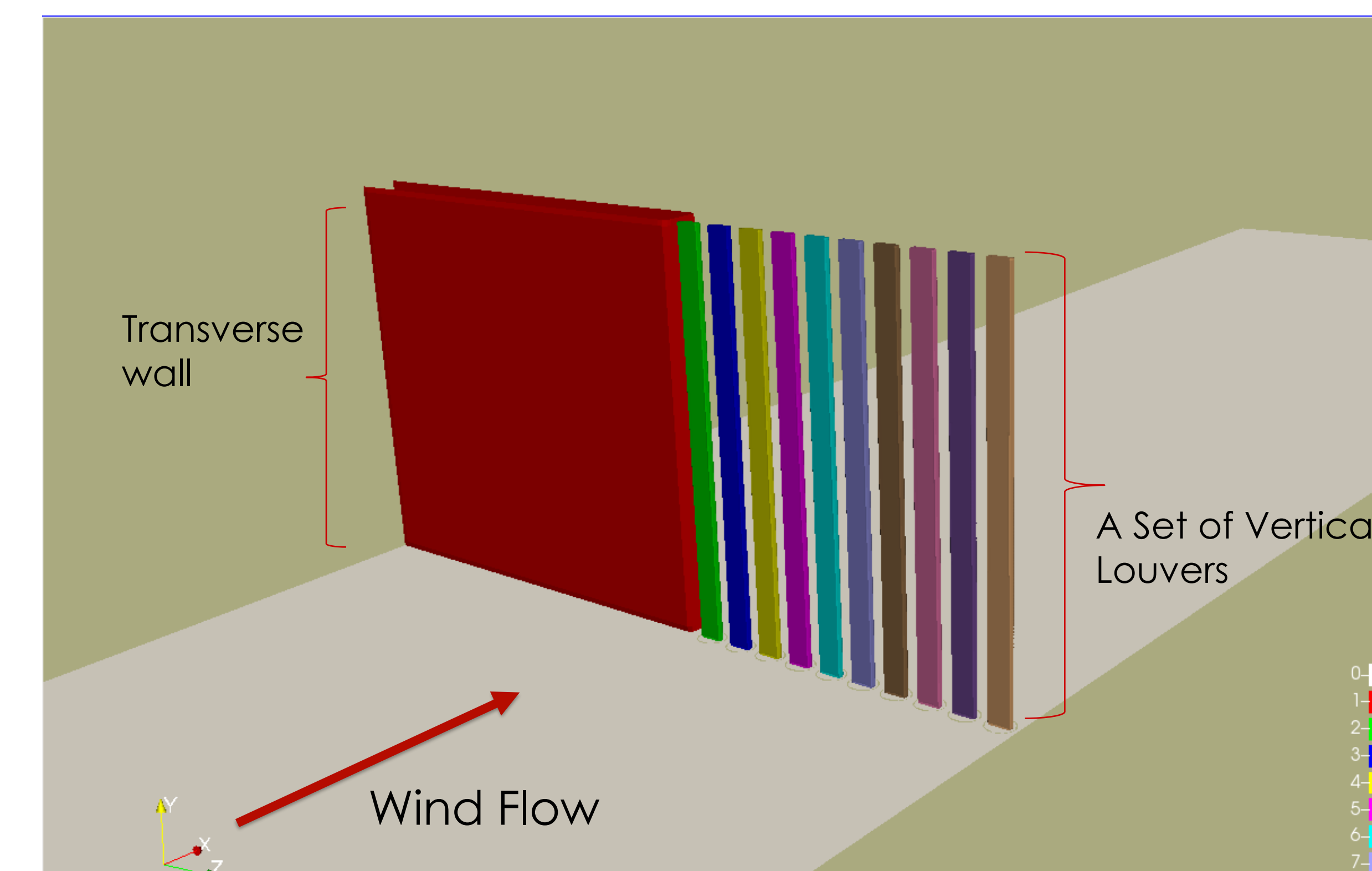
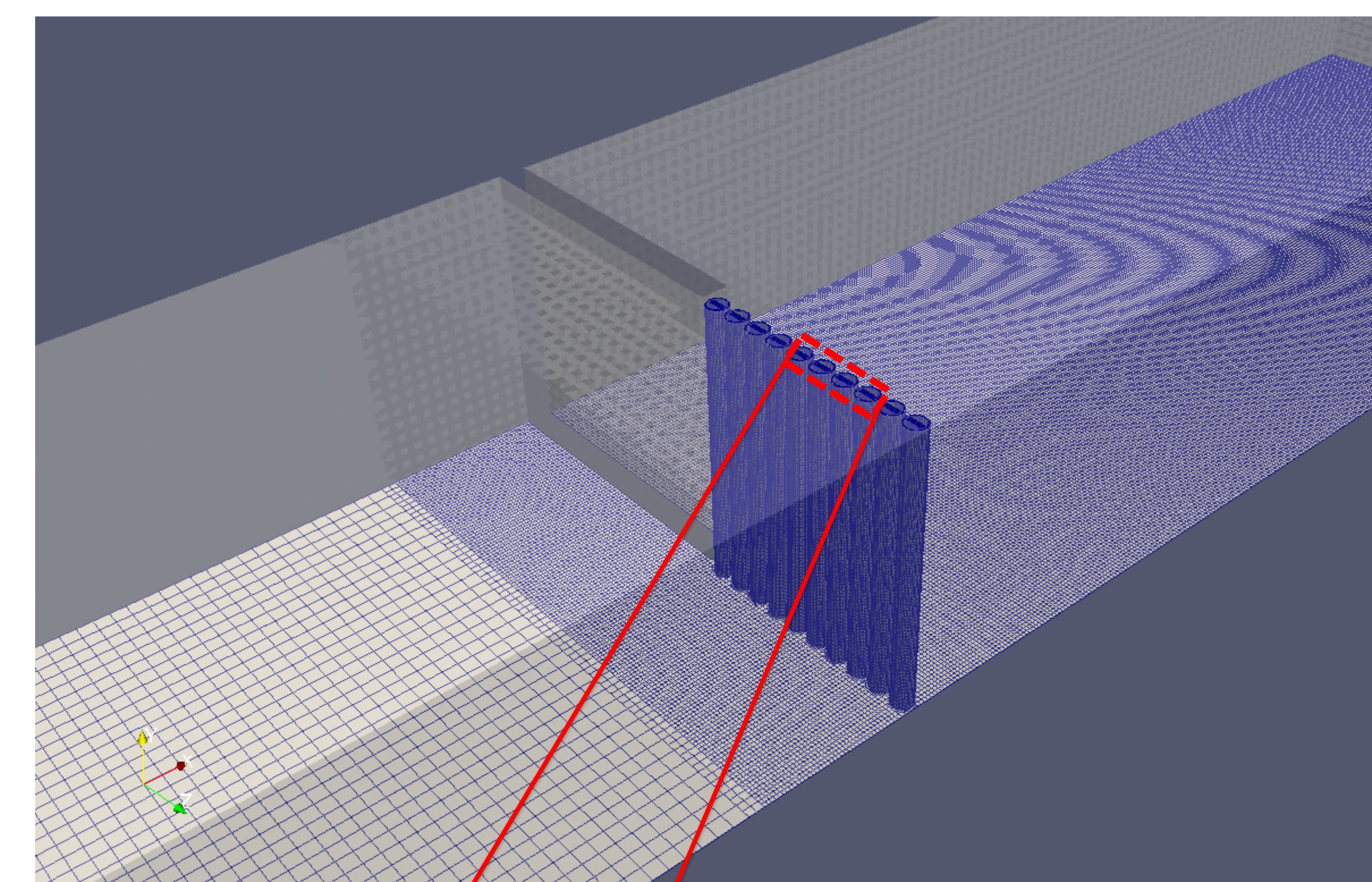
We are simulating the **effect of tornado-like vortices** on low-rise buildings using computational fluid dynamics (CFD) simulations in BLWTs. There are two methods to generate a translating vortex in CFD.

- Wall Technique
- Moving Louver Technique

Generating Vortices Using a Transverse Wall

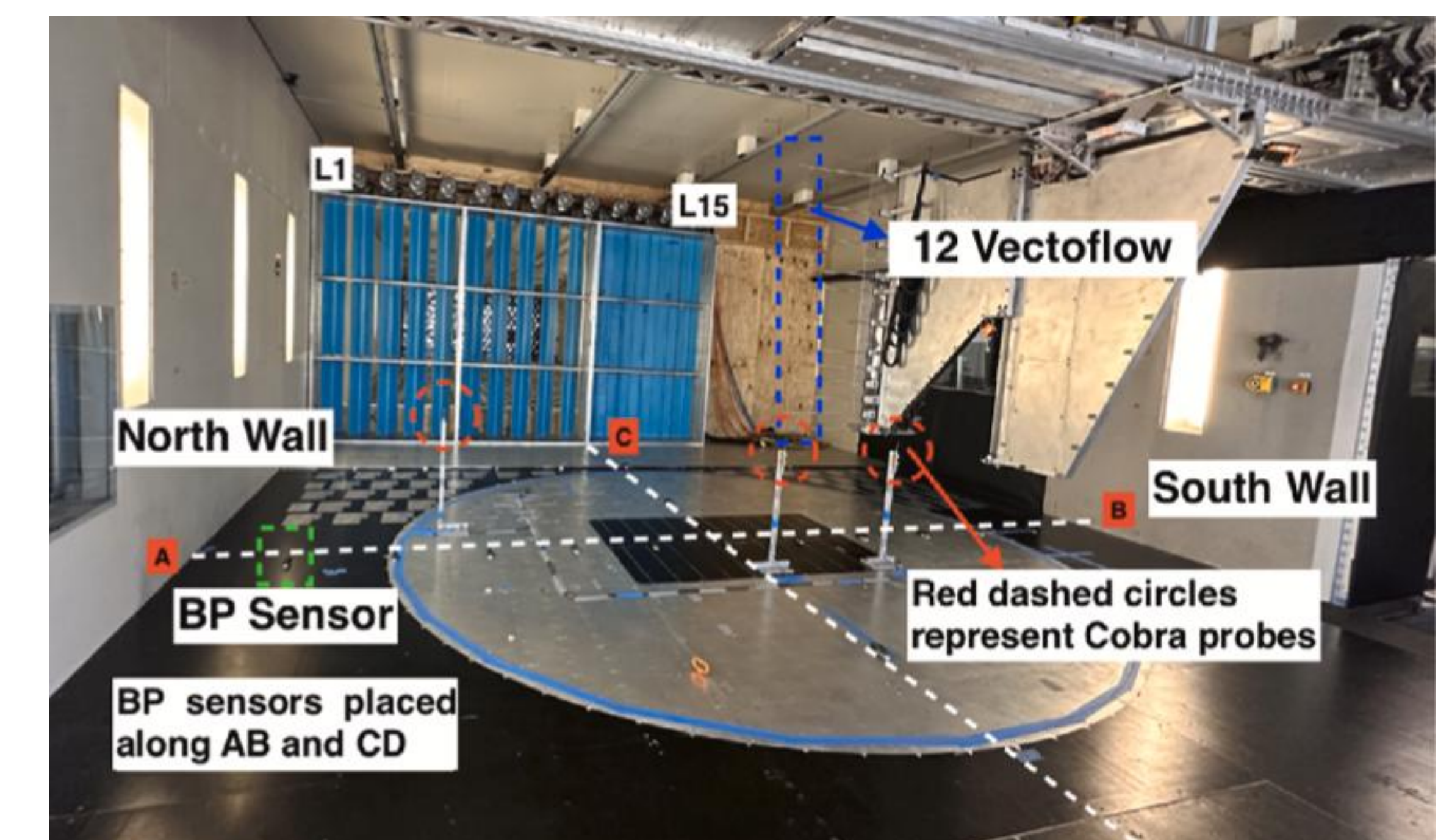


Generating Vortices Using Moving Louvers/blades

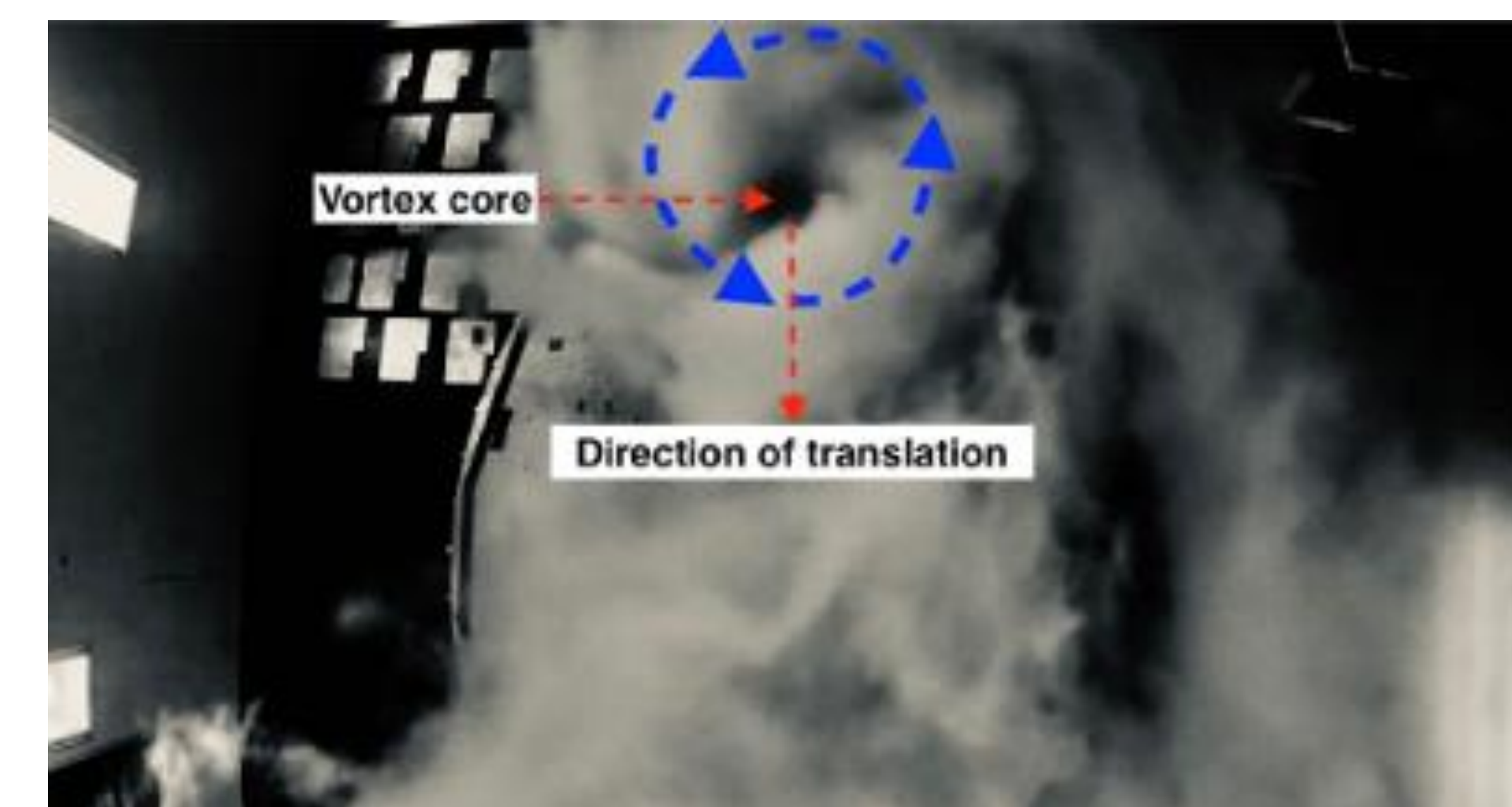


Validation of CFD Simulation

The CFD results will be validated against experimental (UF BLWT, VorTECH at TTU) and real-world data.



Moving-Louver Experiment in the UF BLWT



Translating vortex in the UF BLWT



Tornado Simulation Using VorTECH at TTU

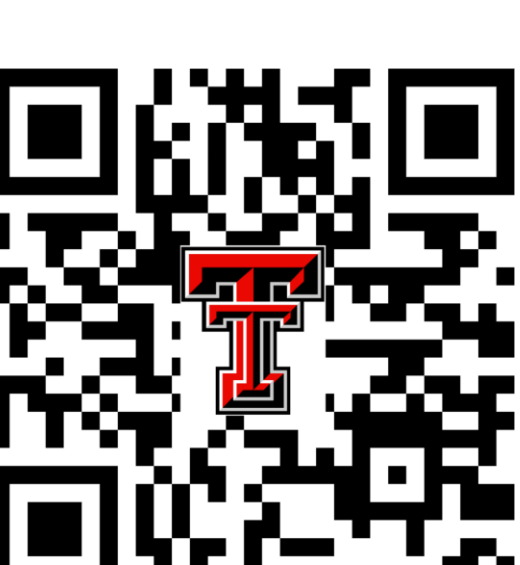
For More Details



CFD
Simulations



Wind Tunnel
Experiment



References