

# Strategic focus areas

## Research and innovations within

- Wind and ocean conditions
- Innovative concepts
- Offshore deployment and operation
- Wind farm optimisation
- Common themes
  - Education
  - Environment monitoring
  - Test facilities and infrastructure



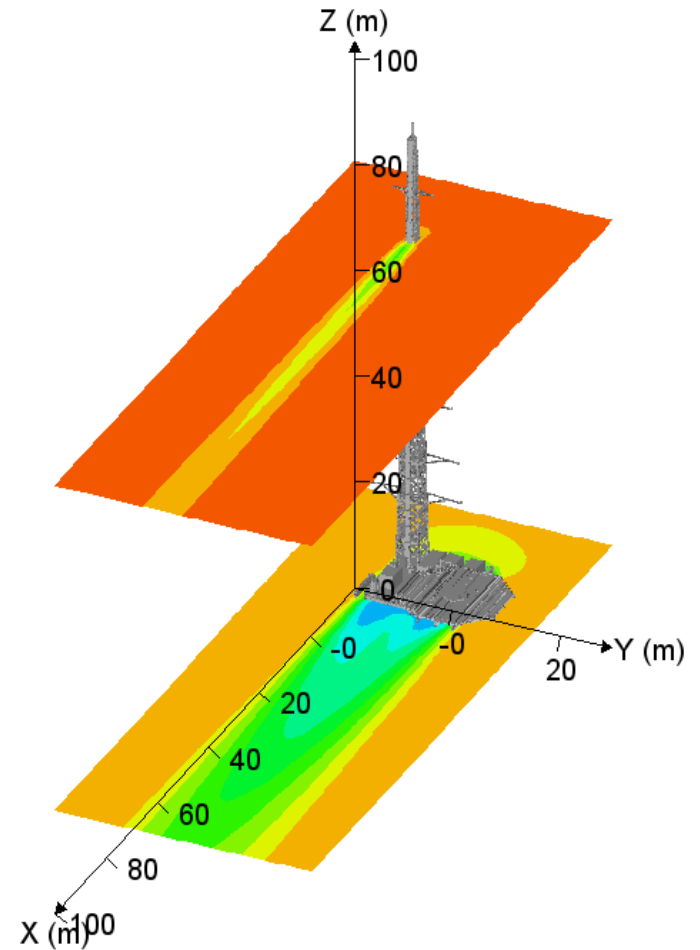
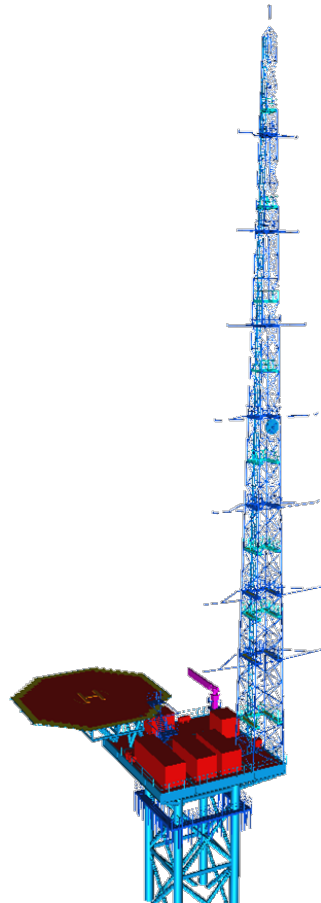
# Wind farm optimization

- WP4-1: Nowcasting (2-120 seconds)
  - Approach based on artificial intelligence
- WP4-3: Wind farm modelling
  - Strong focus on CFD modelling
  - Optimization approach based on model reduction supported by CFD
  - Ongoing initiative for joint wake seminar with NOWITECH dedicated to the modelling of wakes behind wind turbines



# Example: FINO platforms

- Influence of mast on wind measurements (study with FLACS-Wind)

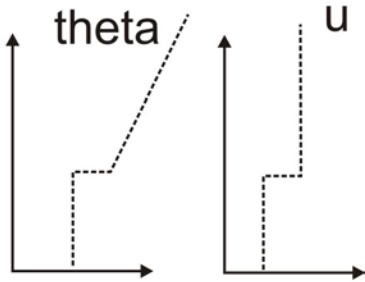
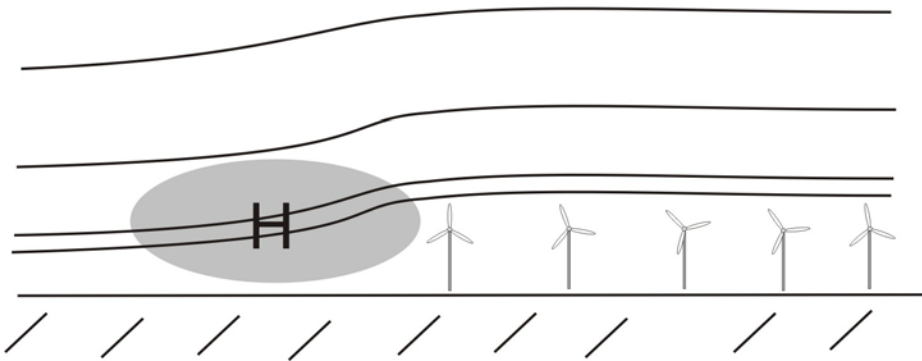


# Generation of pressure gradients by wind farm:

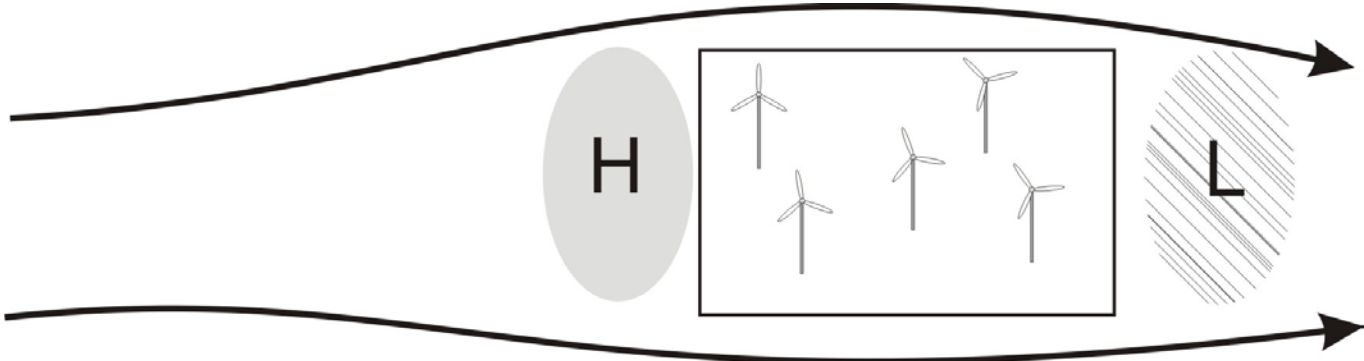
- $\theta$  increases with height under typical stable conditions
- As air lifted over farm, lower  $\theta$  air brought up from below
- This creates cold anomaly aloft and thus high pressure anomaly below (from hydrostatic law) – pressure gradients deflect wind.



side view



top view



# Self-induced effects

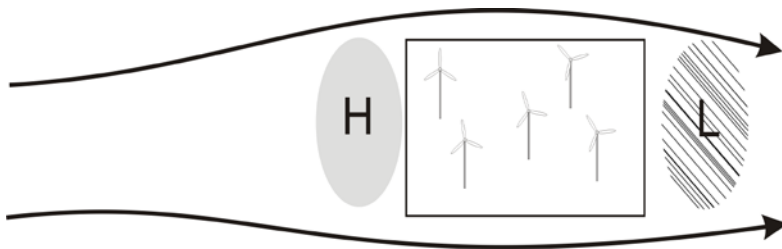
$$U_b \frac{d}{d} \frac{u}{x} = \frac{u}{x} \frac{d}{d} - \frac{p}{x} u_b + C_t u_b + F_x$$

(Smith, 2009)

Pressure perturb. of inversion:

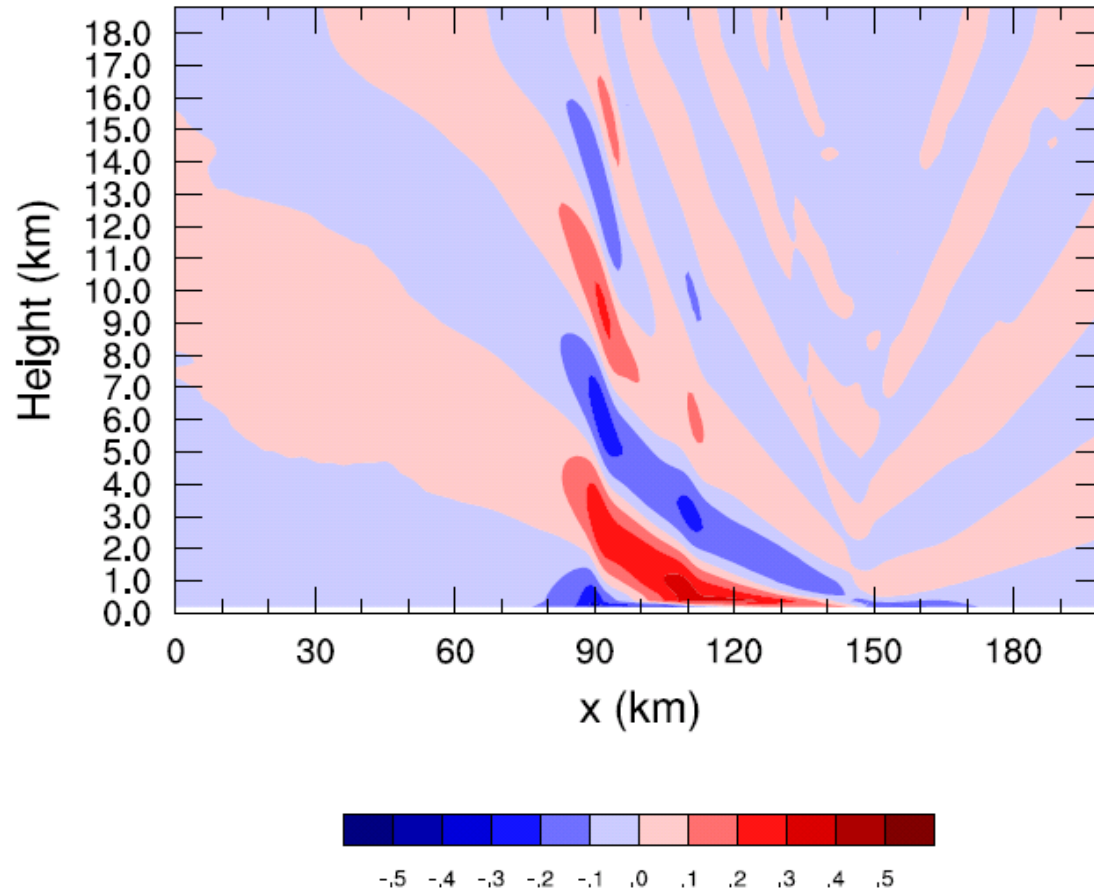
$$\hat{p} = -\frac{i|U|g}{N} \frac{\Delta\theta}{\theta_0}$$

Idealised set-up:



# Self-induced effects

Gravity waves are being produced due to convergence/lifting of air



# Self-induced effects

- Idealised tests show:
  - up to 30% reduction in the farm
  - gravity wave signal in the lee

