FABRE

CONVEGNO FABRE

Ponti, viadotti, e gallerie esistenti: ricerca, innovazione e applicazioni

Recent Findings from IABSE Task Group 3.1 on the Wind Response of Monitored Long-Span Bridges under Extreme Events

IABSE TG 3.1 – Super-long span bridge aerodynamics

Tommaso Argentini (presenting author)

POLITECNICO MILANO 1863

IABSE

ROMA, 16-19 FEBRUARY 2026

International Association For Bridge And Structural Engineering

Scientific / technical Association comprising members in 100 countries and counting 58 National Groups worldwide

IABSE Task Group 3.1: Super Long Span Bridge Aerodynamics

~30 Members from 11 Companies and 10 Universities

chair G. Diana (Polimi), vice-Chair S. Stoyanoff (RWDI)

https://iabse.org/TG3.1

Mission of Task Group 3.1

Definition of **benchmark cases** for the **validation** of software programs for the computation of the **bridge response** to the **turbulent wind**.

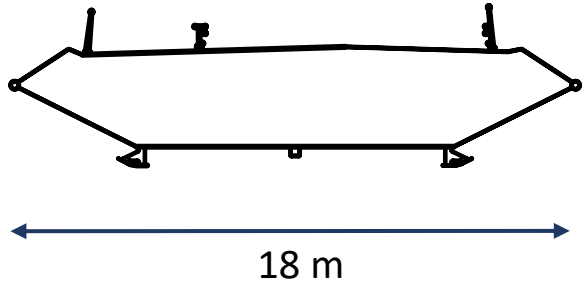
Benchmark completed and published:

- **comparison of numerical simulations** performed with **different codes** with same input data
- **3 papers** published on **SEI** (Structural Engineering International)

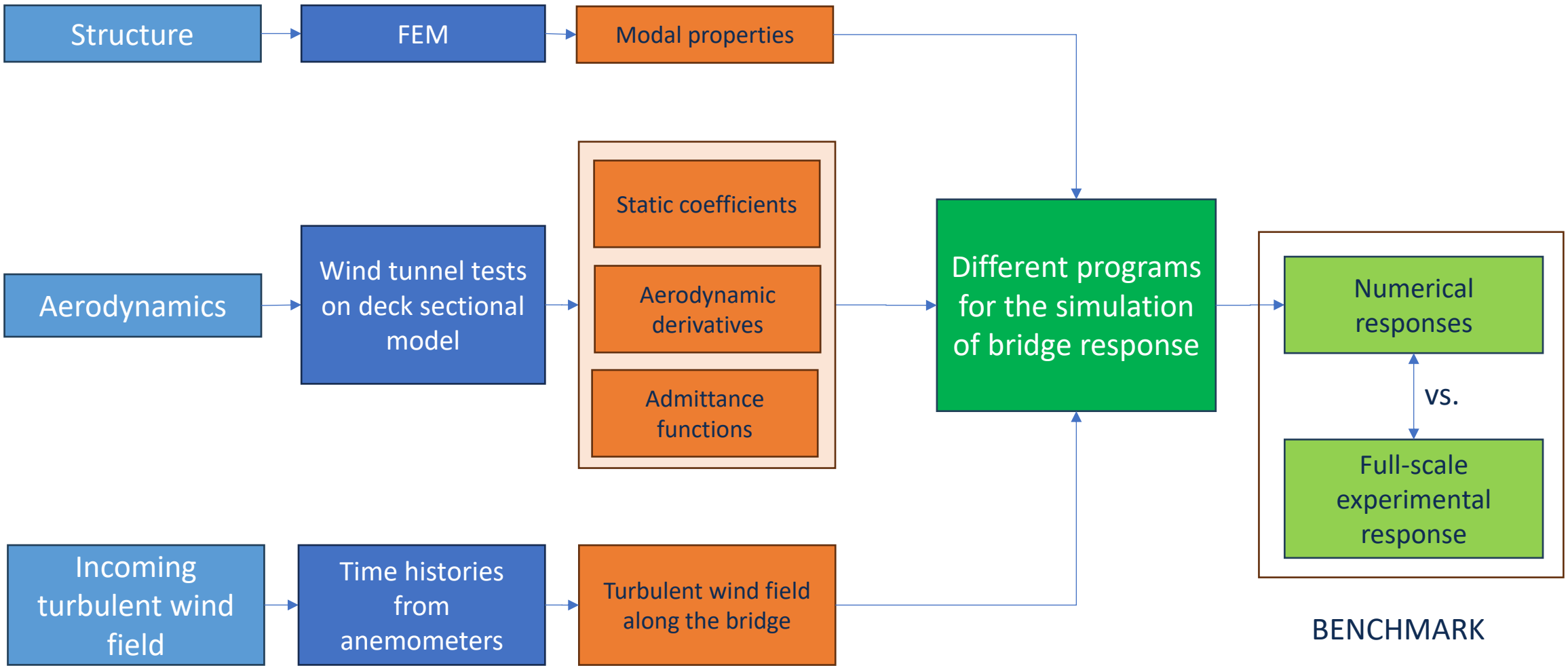
Completed (in publication):

- **Numerical vs. full-scale measurements** during an **extreme wind event**

- Case study: **Hardanger Bridge** (Norway), open access monitoring system

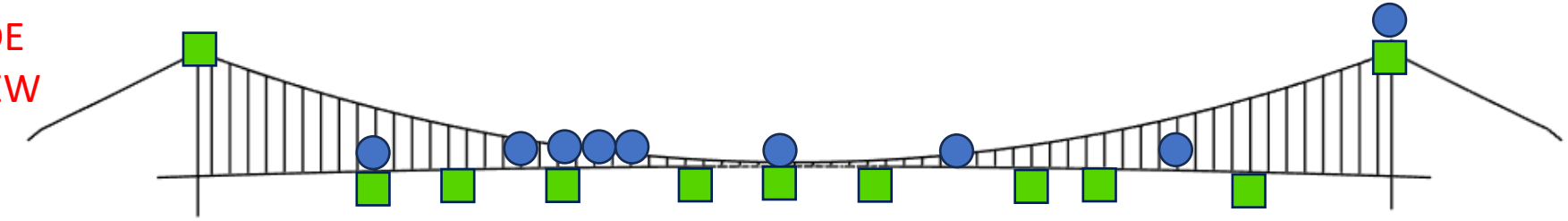


Benchmark flowchart



Issues encountered during numerical-experimental comparison

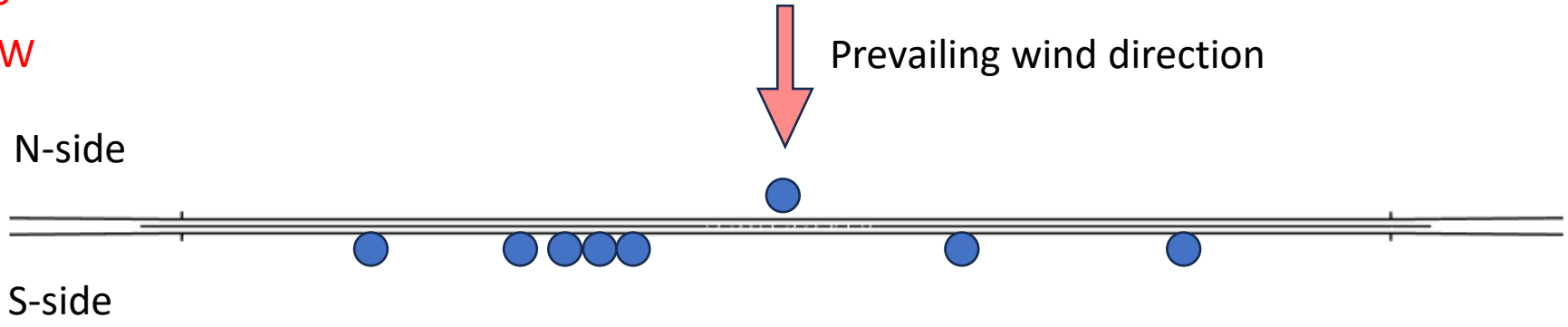
SIDE VIEW



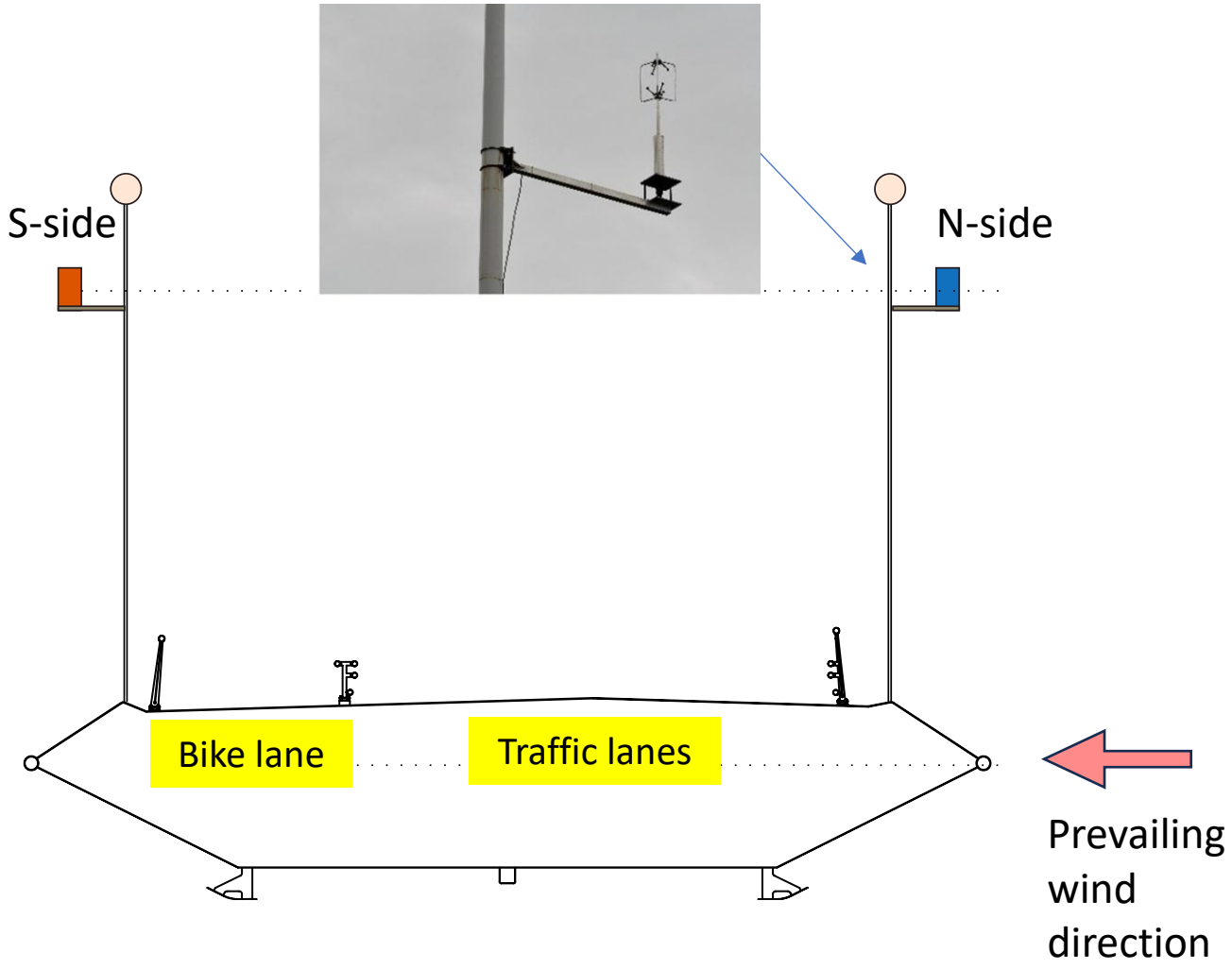
Anemometers

Accelerometers

TOP VIEW



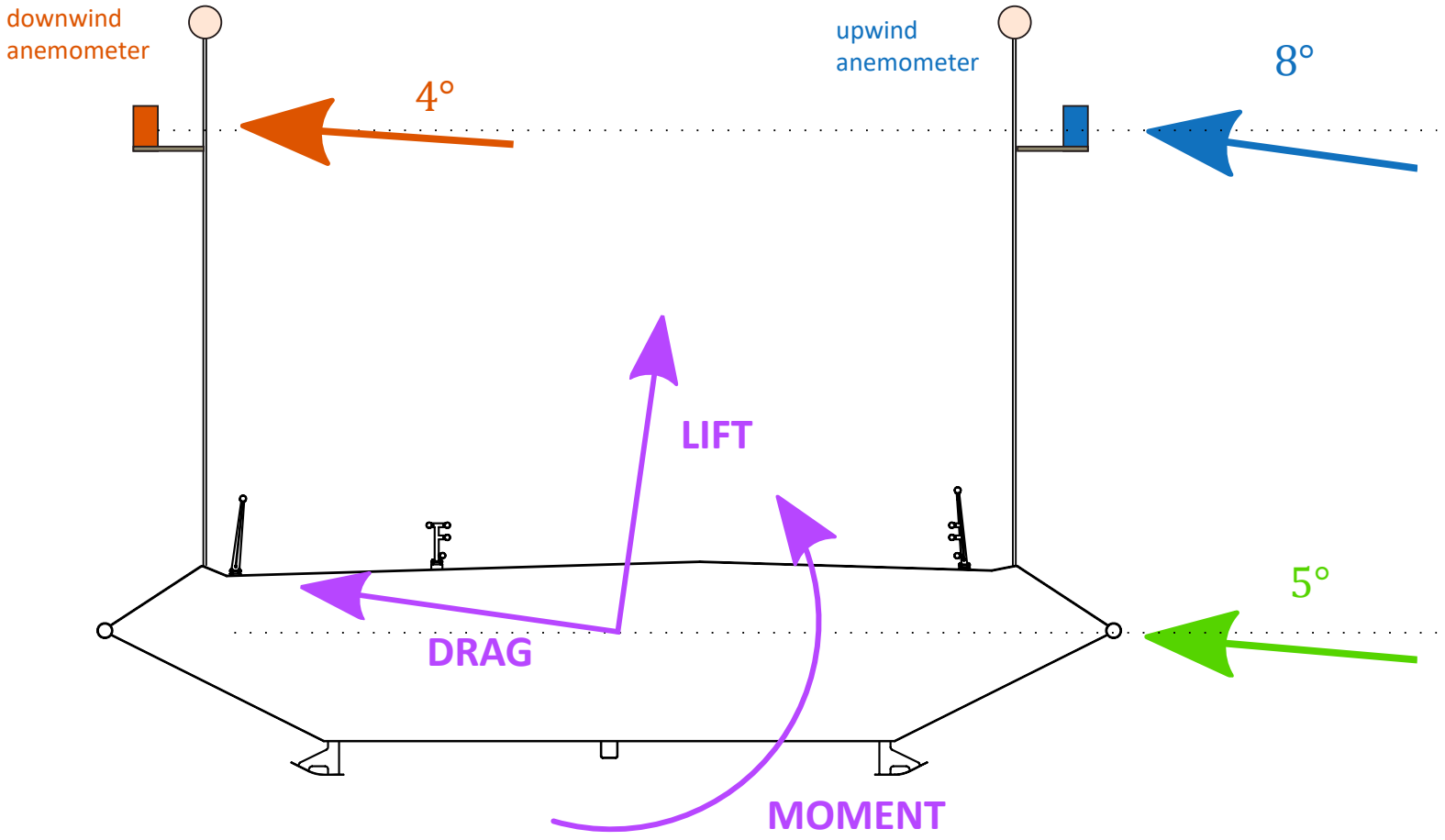
Issues encountered during numerical-experimental comparison



Main issues about anemometric measurements:

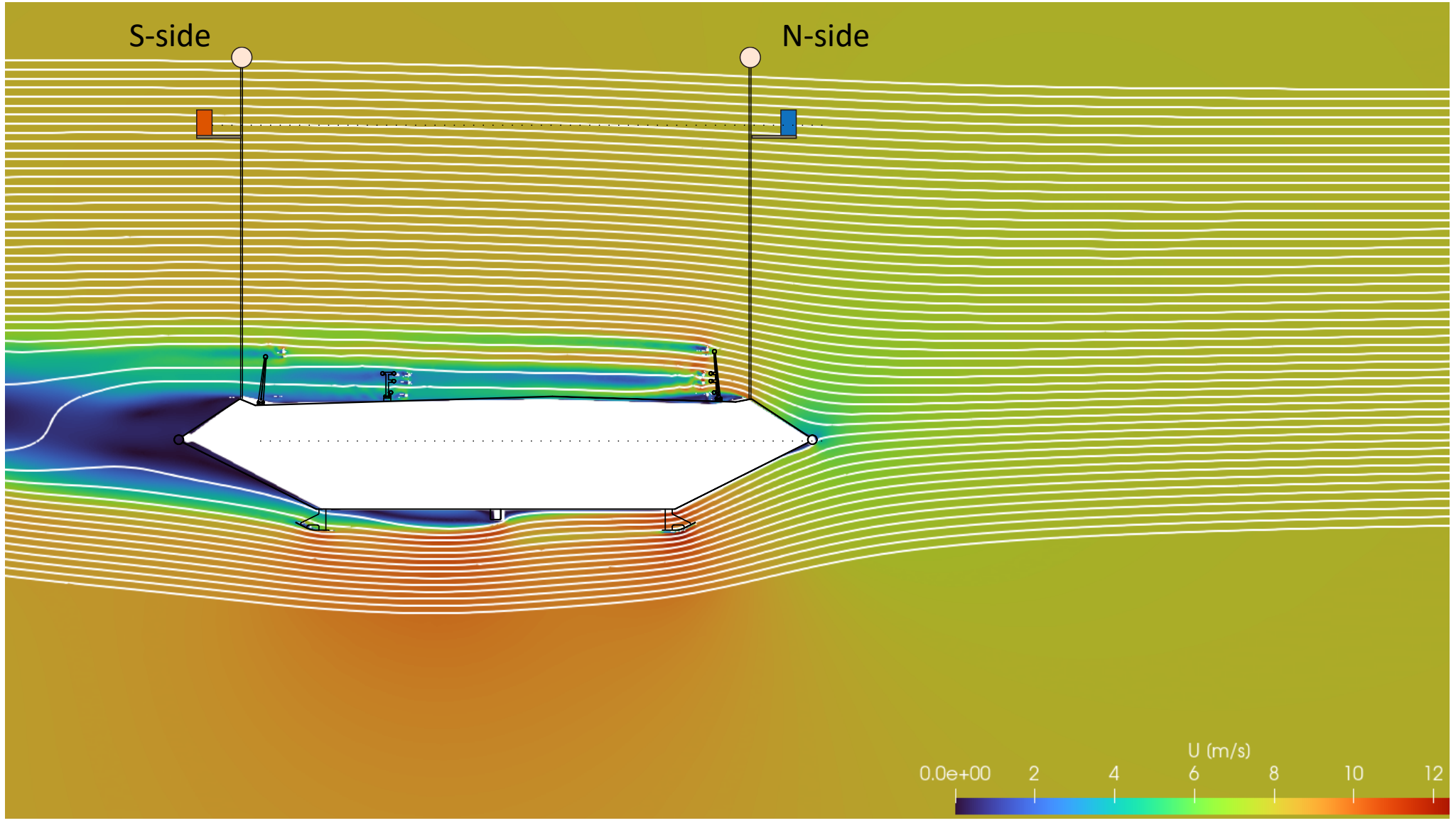
1. Angle of attack (wind inclination)
2. Incoming turbulence intensity
3. Relative wind speed
4. Extrapolation of wind along all the bridge

1. Angle of attack correction



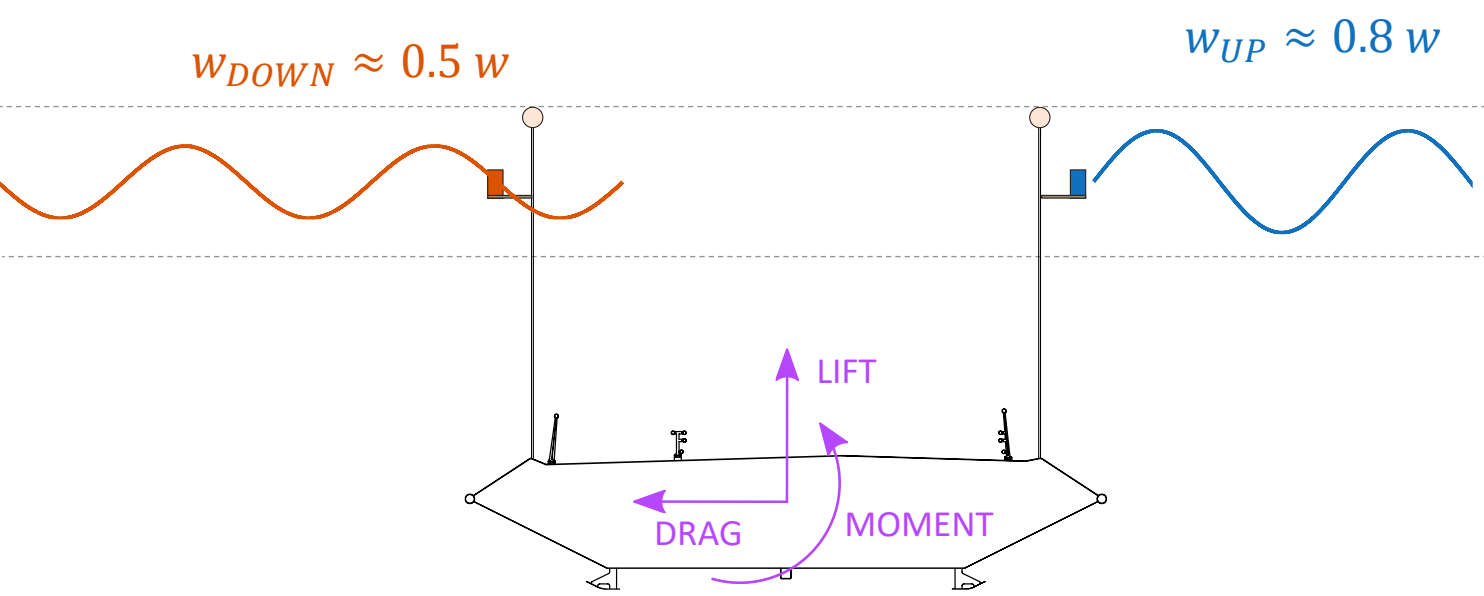
- Deck geometry influence the mean flow field at anemometer location, in particular flow direction!
- Aerodynamic forces (static and dynamic) strongly depend on the angle of attack

1. Angle of attack correction – CFD & wind tunnel tests

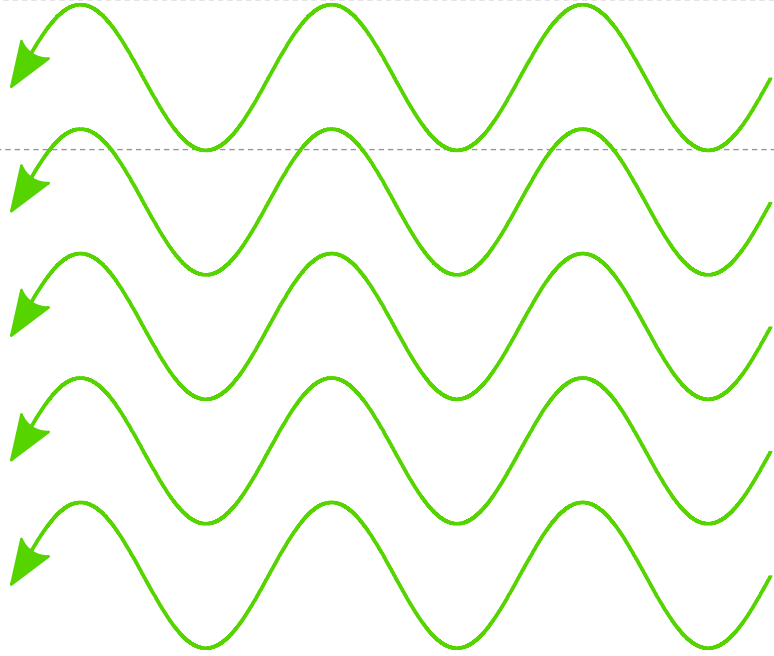


Undisturbed wind

2. Turbulence reduction correction



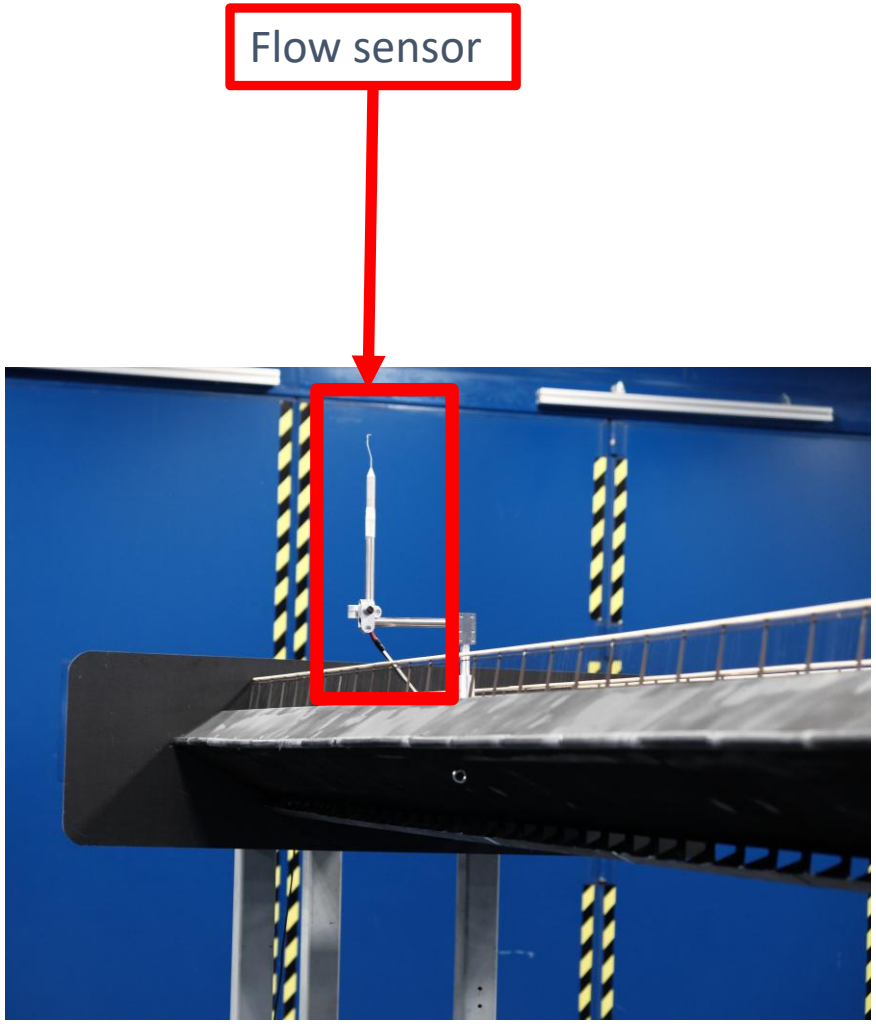
Vertical component of incoming turbulence, w
(mono-harmonic representation)



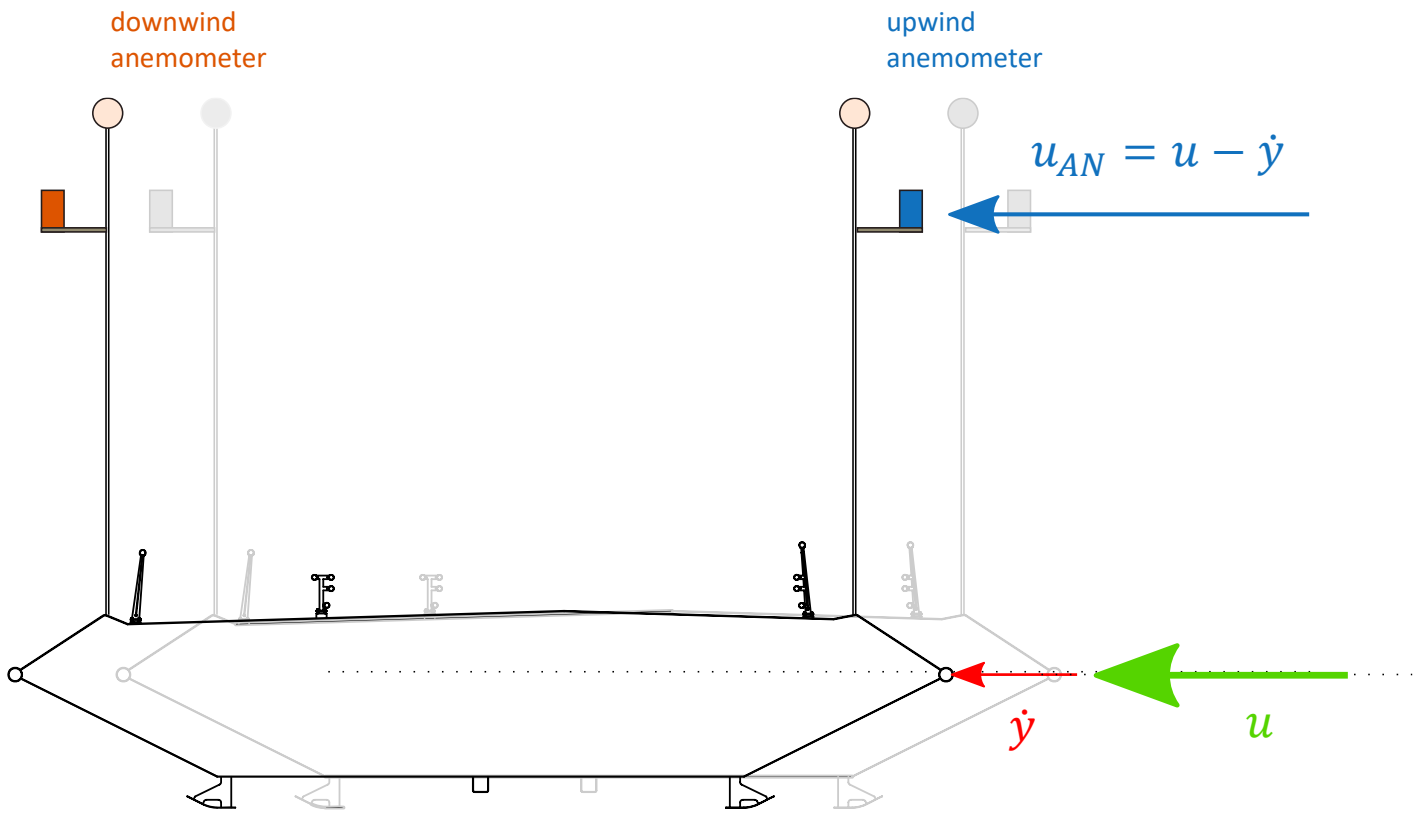
- Anemometers measure smaller fluctuations (function of frequency and angle of attack)
- Aerodynamic buffeting forces are underestimated

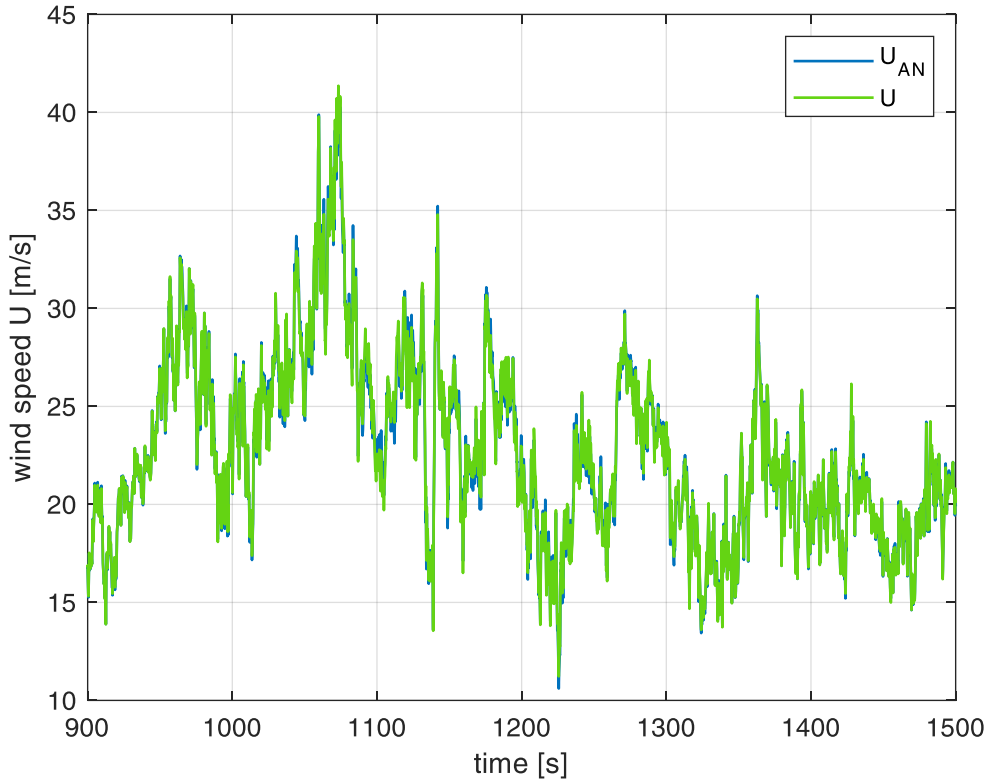
3. Turbulence reduction correction: wind tunnel tests

Active turbulence generation at Politecnico di Milano Wind tunnel



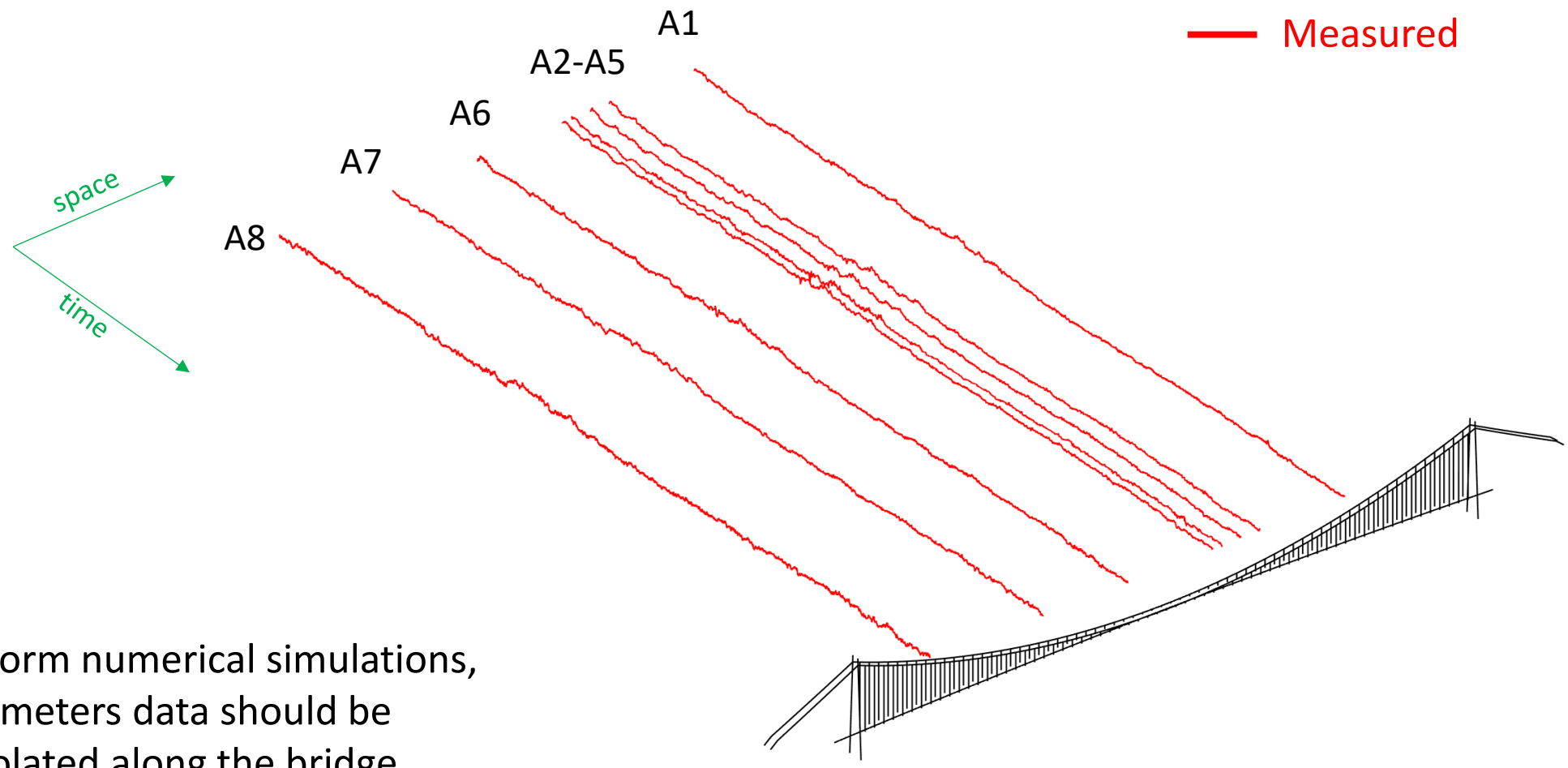
3. Relative motion correction





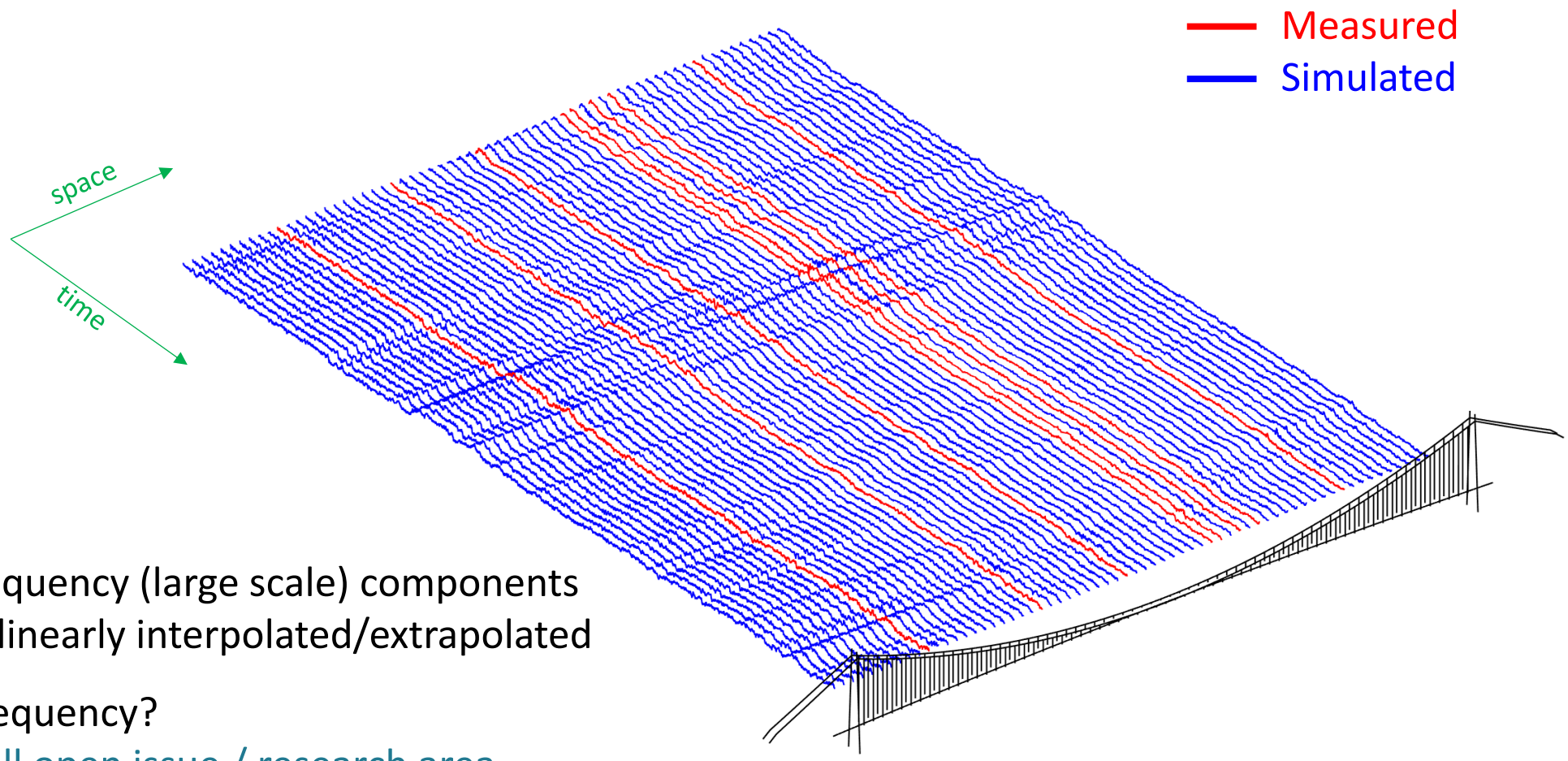
- Difference appears to be small
- It can lead to large errors in aeroelastic damping, because it is proportional to the deck velocity

4. Extrapolation of wind along all the deck



To perform numerical simulations, anemometers data should be extrapolated along the bridge

4. Extrapolation of wind along all the deck



- Low frequency (large scale) components can be linearly interpolated/extrapolated
- High frequency?
  - Still open issue / research area

Final remarks (1 of 2)

- The **IABSE Task Group 3.1** has developed a **benchmark** case aimed at comparing the **full-scale experimental response** of a long-span bridge during a storm event with numerical **simulation results**.

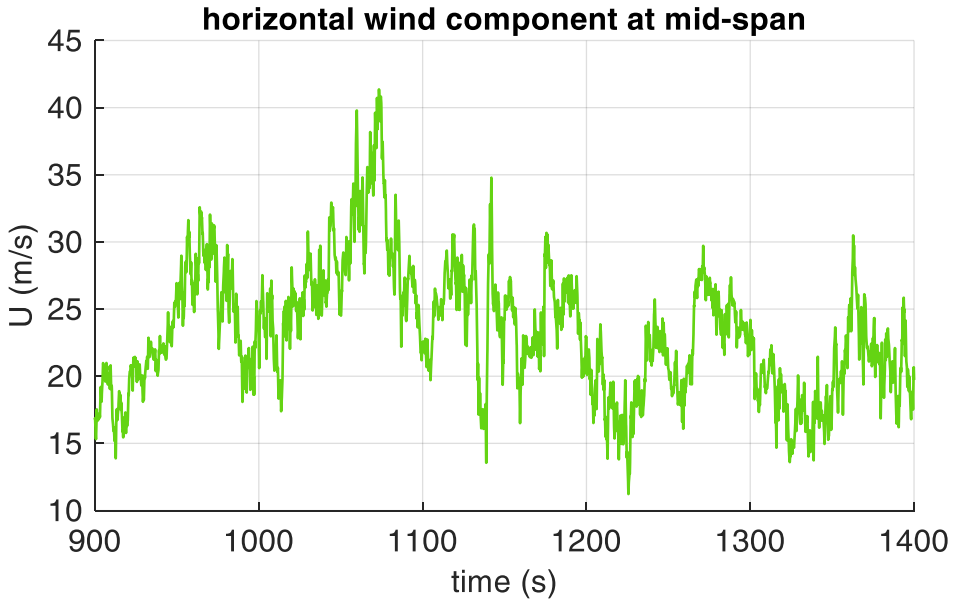
- A complete dataset is available, including **input data** (FEM model, aerodynamic coefficients, wind field) and **output data** (measured accelerations), enabling comprehensive validation of the simulations.

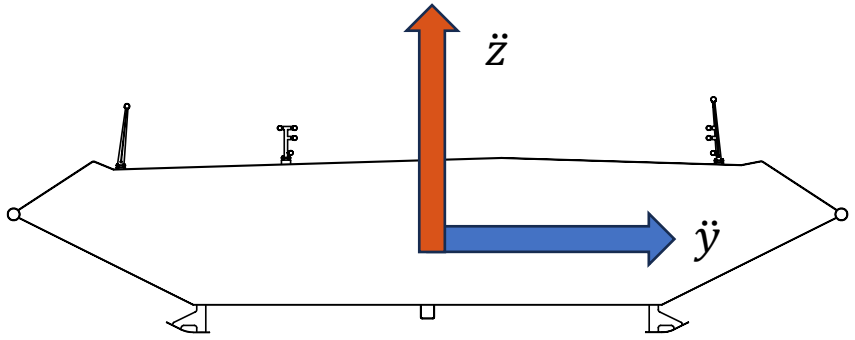
- The analysis and postprocessing of **anemometric input data require attention**: sensor placement relative to the deck can significantly influence the estimation of aerodynamic forces.

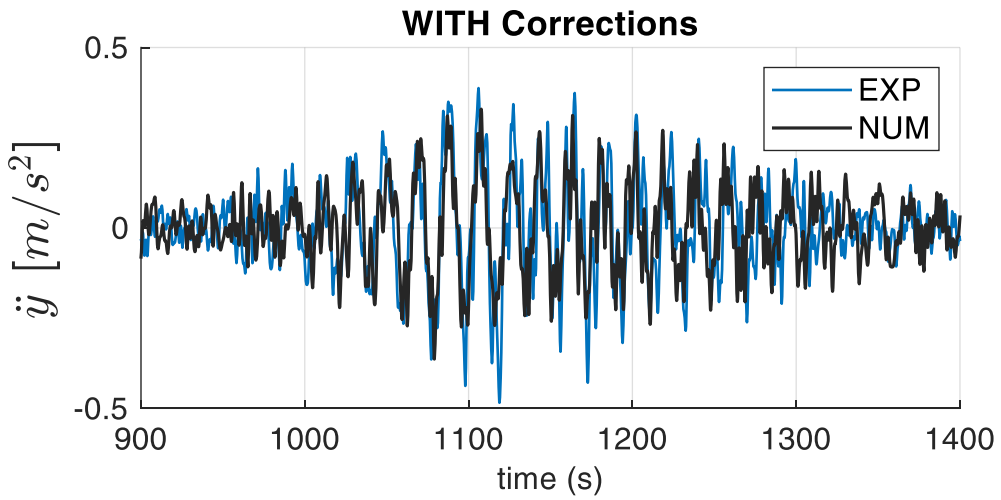
- **Preliminary studies** should be done **when designing the monitoring system** for amenometric measurements, if validation of numerical simulations of wind-induced response are planned.

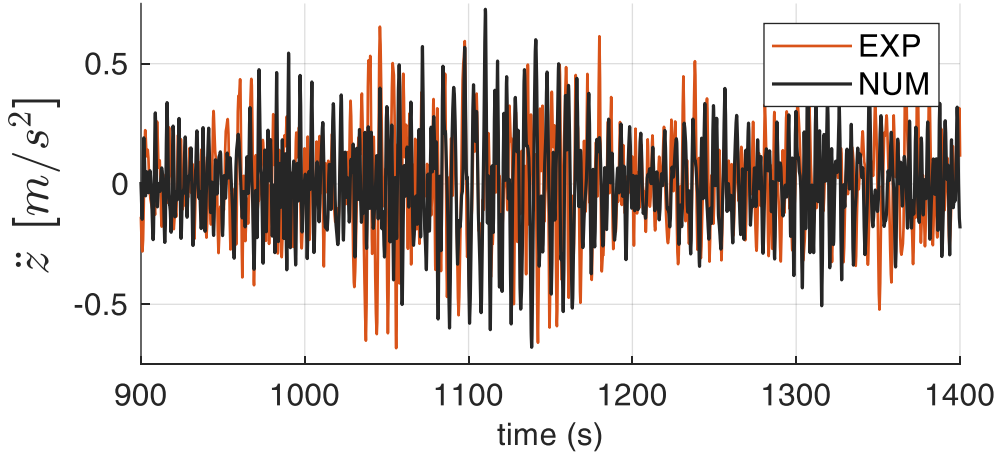
Final remarks (2 of 2)

- Example of experimental-numerical comparison with or without wind correction









THANK YOU FOR YOUR ATTENTION

Recent Findings from IABSE Task Group 3.1 on the Wind Response of Monitored Long-Span Bridges under Extreme Events

T. Argentini (Politecnico di Milano), tommaso.argentini@polimi.it