PO.054

IEA Wind Task 31: Initial results of a new comparison metrics simulation challenge for wind resource assessment in complex terrain

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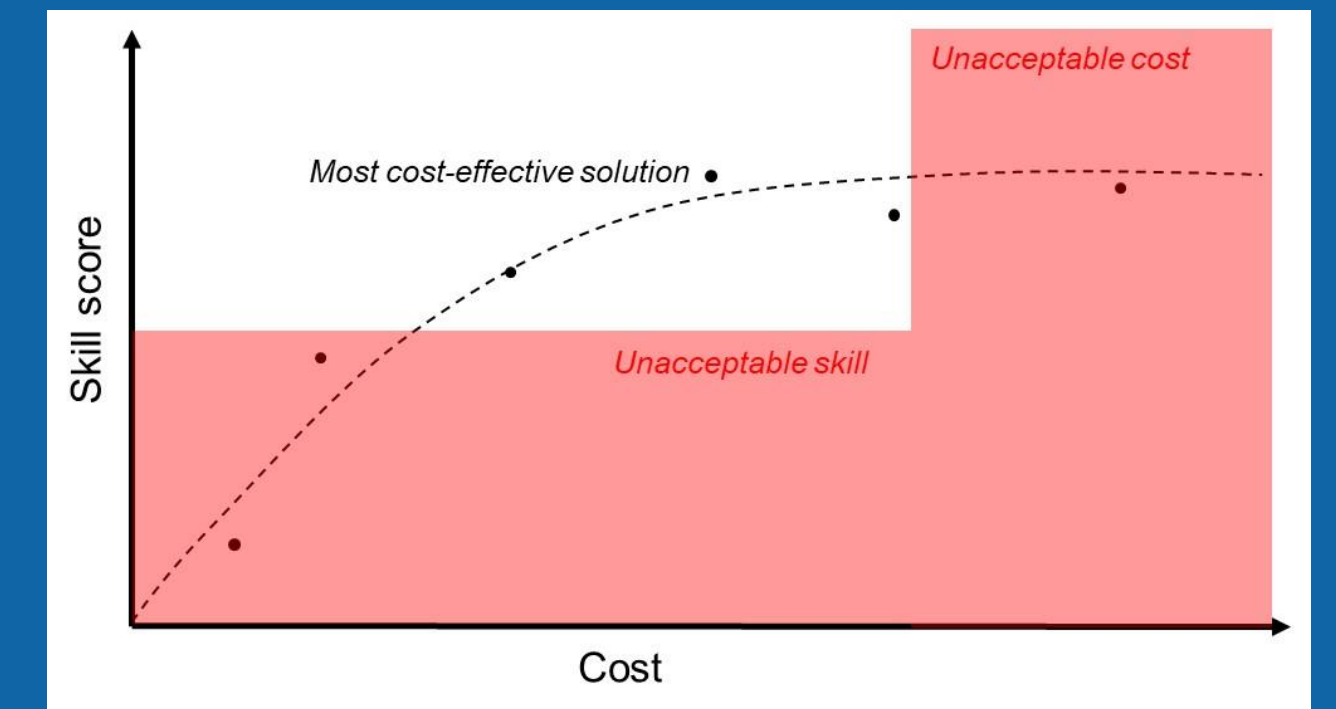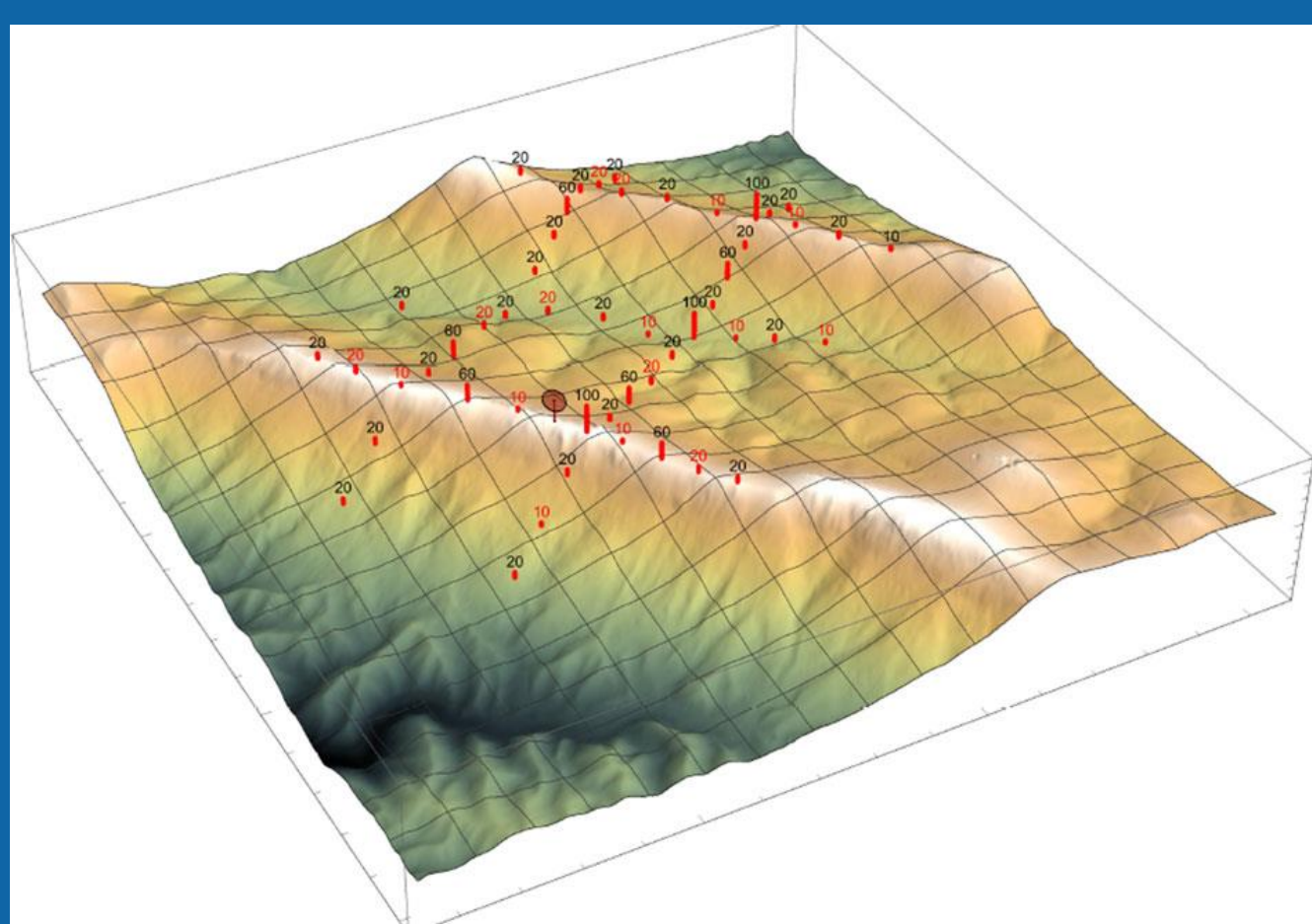### University of Applied Sciences Rapperswil

Problem statement

◈ Choice of best wind modelling tool for given project difficult: accuracy and costs?

◈ New method developed for predicting skill and cost scores of different tool → choice of best model [1].

◈ New public challenge designed → transfer function between predicted and actual skill and cost scores [2].
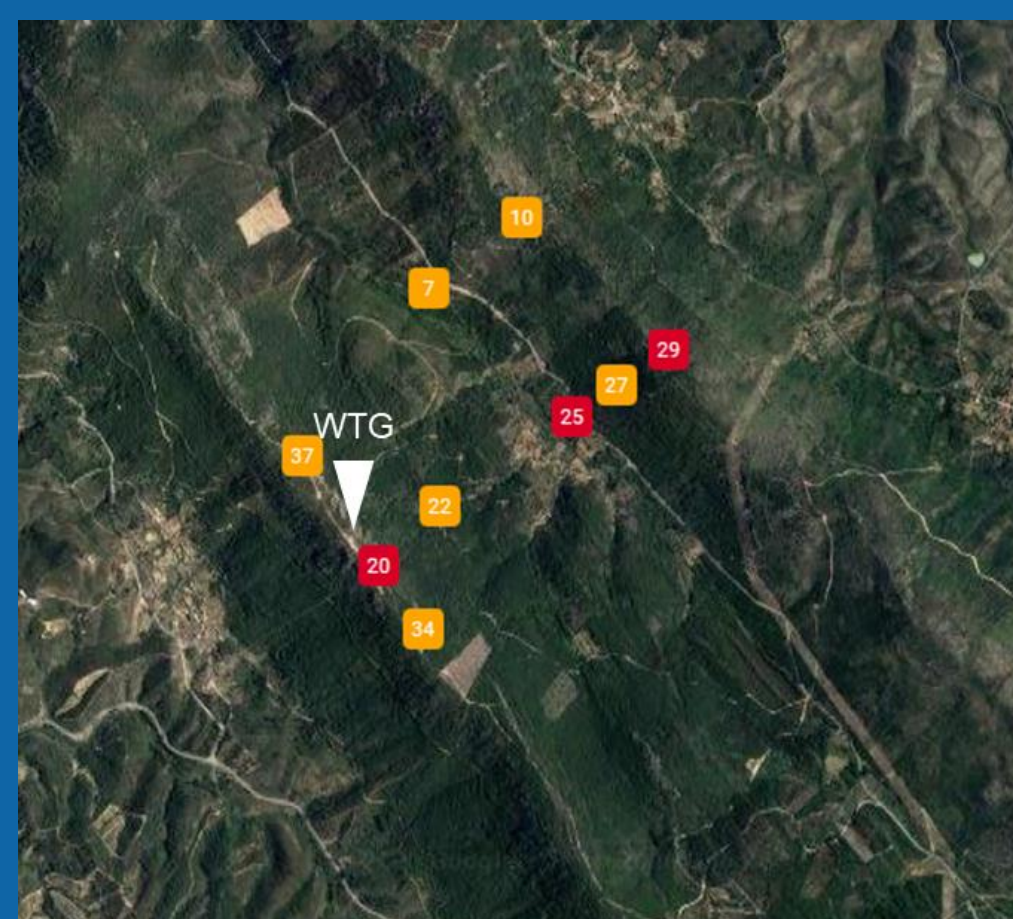

Challenge description

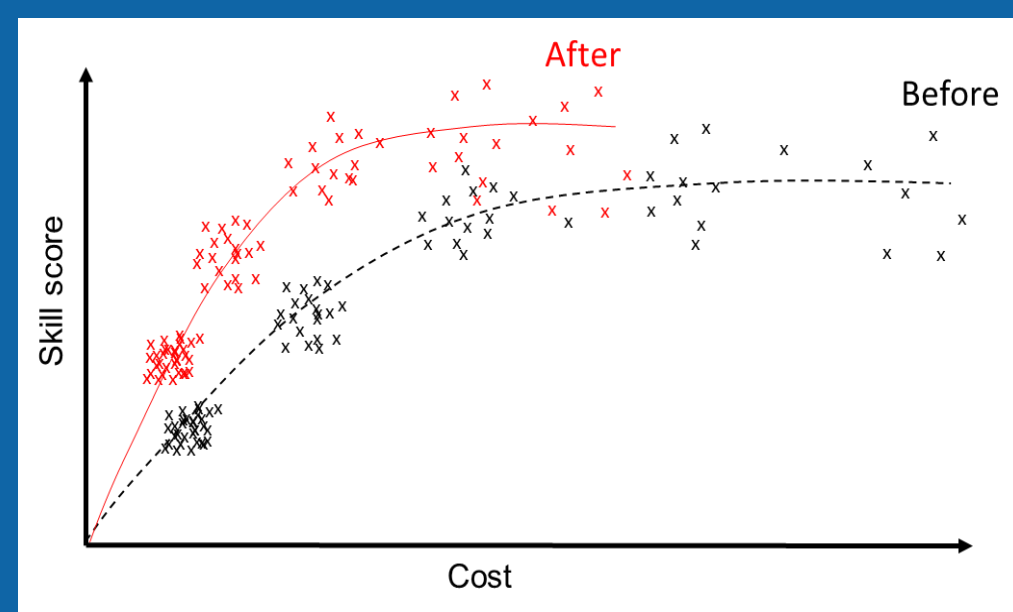◈ Complex terrain site: Perdigao [3]:

◈ Challenge goal:

Collect comparison metrics data regarding the skill and cost scores of a range of different simulation tools for a complex terrain site, both before and after carrying out new simulations.
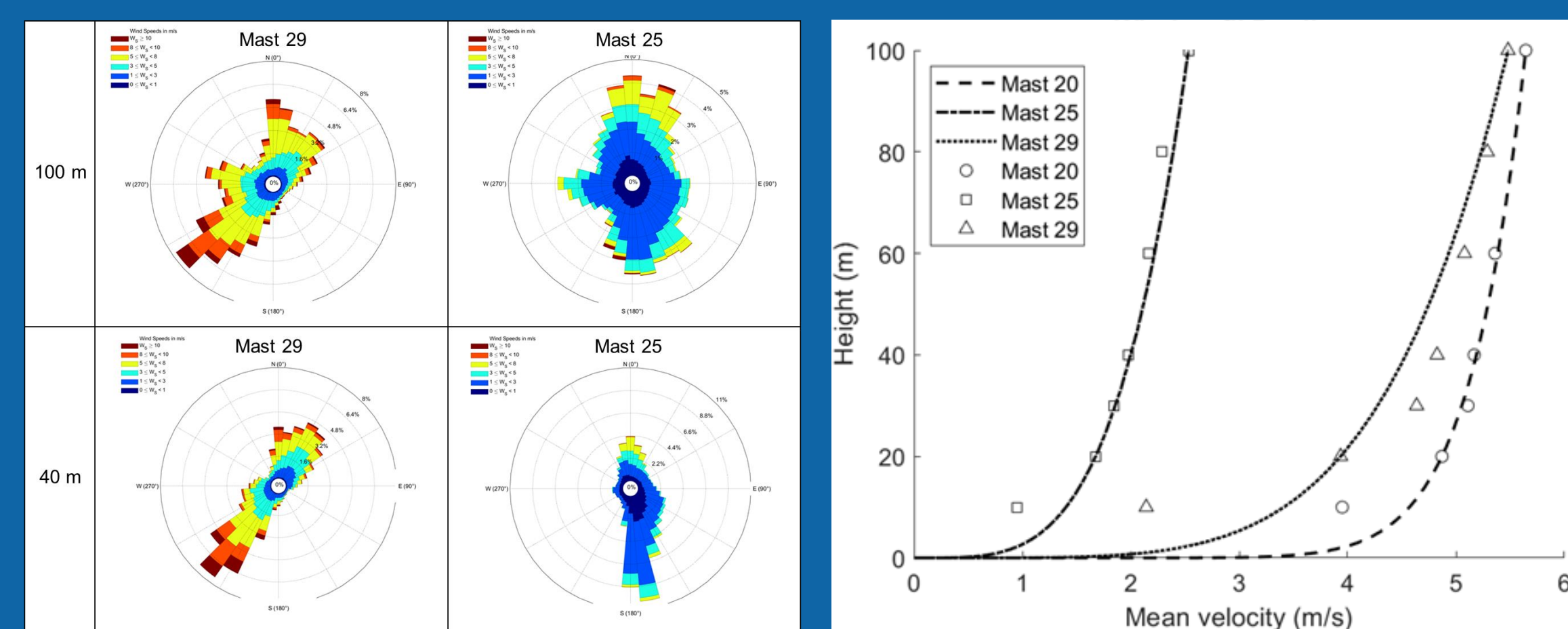
◈ Chosen met masts:

◈ Expected results:

◈ Measurement data:

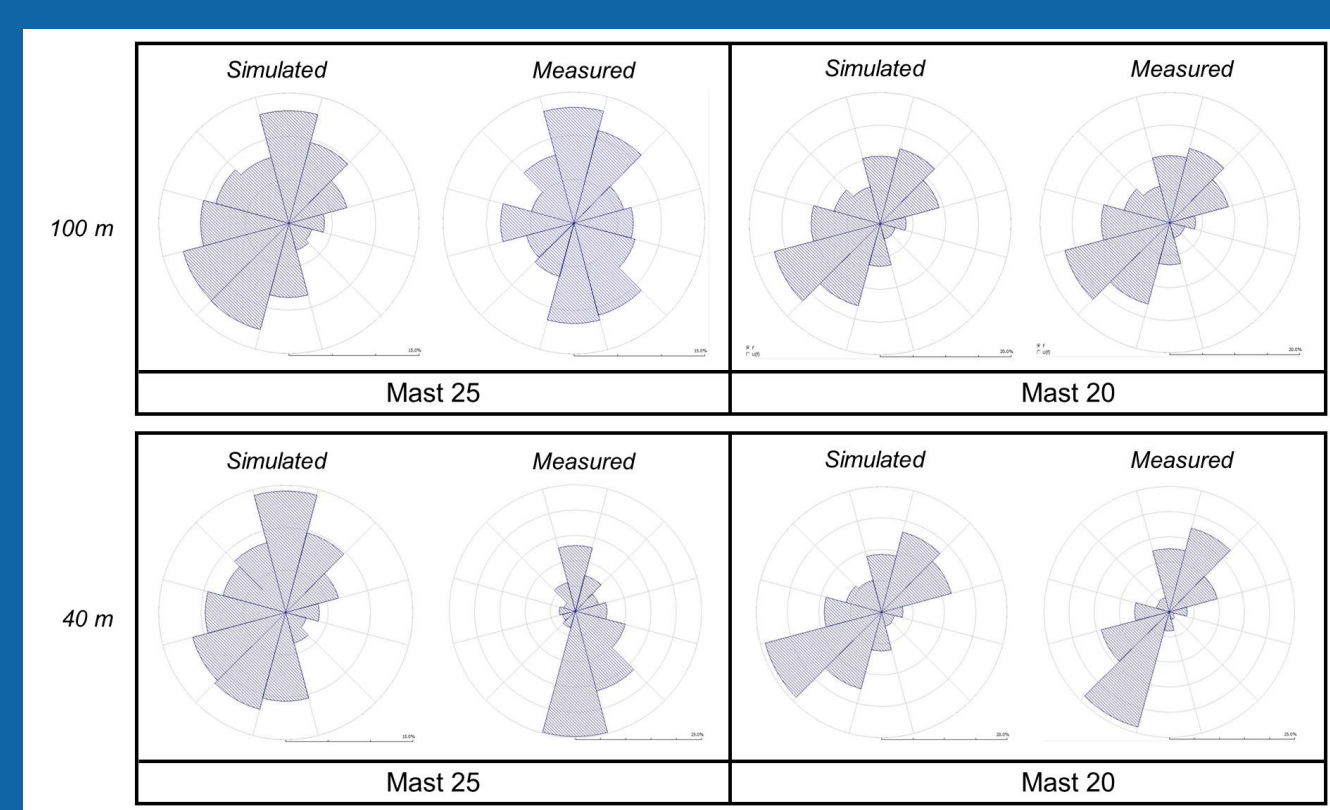◈ How to predict cost and skill scores?

Skill parameters include:
- *Model assumptions*
- *Input data quality.*
- *User experience.*

Cost parameters include:
- *License, training and learning costs.*
- *Set-up and post-processing effort.*
- *Simulation run-time costs.*

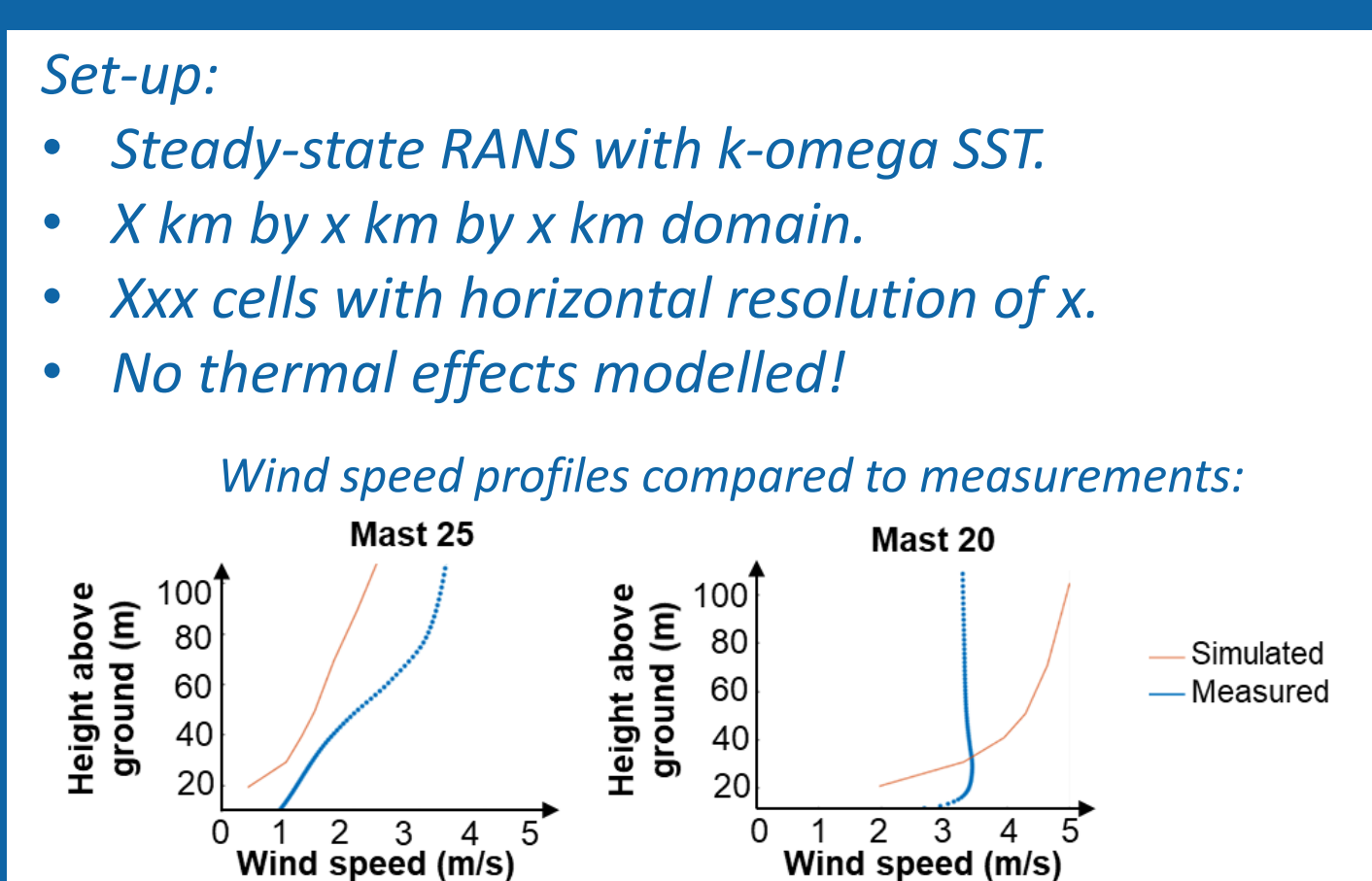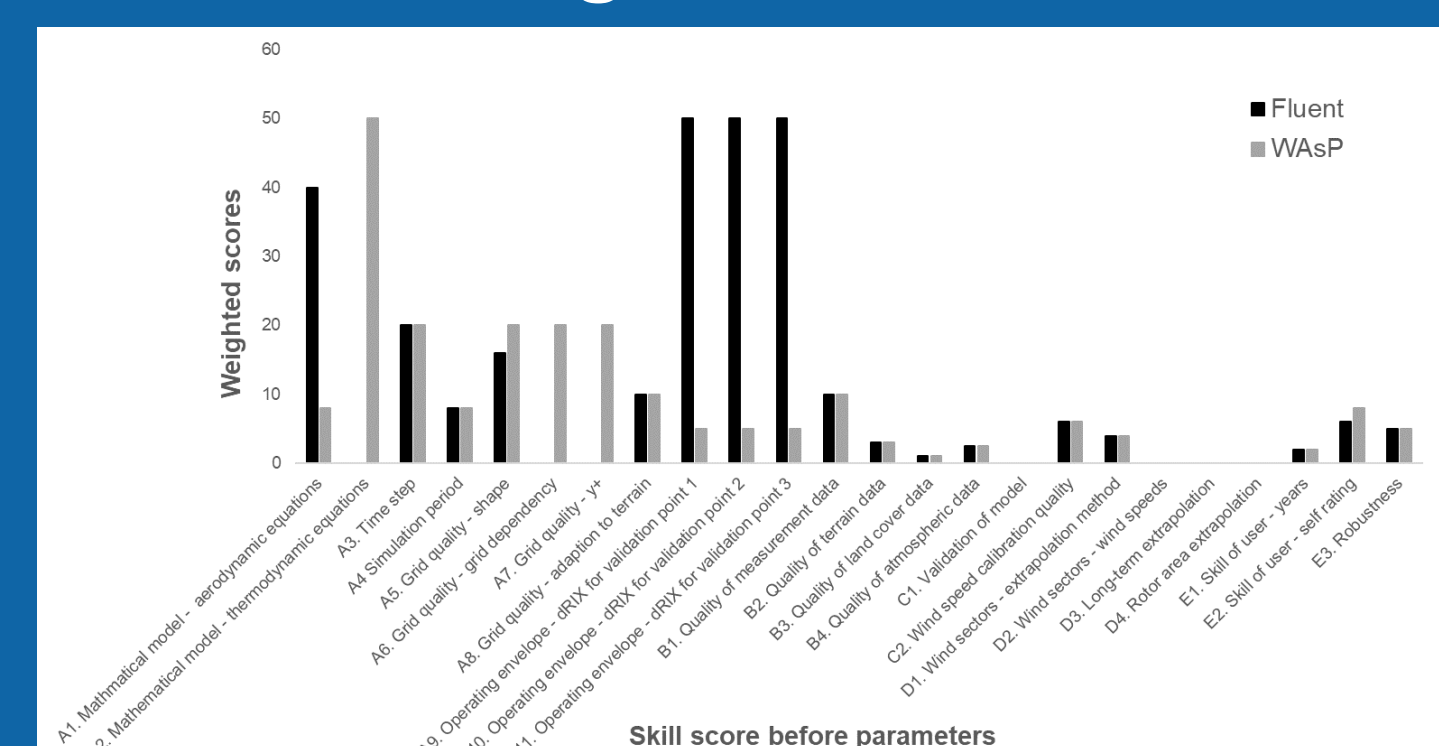## Initial results

◈ WAsP simulations:

→ *Flow in valley (Mast 25) not well captured (no separation modelled in WAsP).*

◈ Fluent CFD simulations:

Set-up:
- *Steady-state RANS with k-omega SST.*
- *X km by x km by x km domain.*
- *Xxx cells with horizontal resolution of x.*
- *No thermal effects modelled!*

Wind speed profiles compared to measurements:
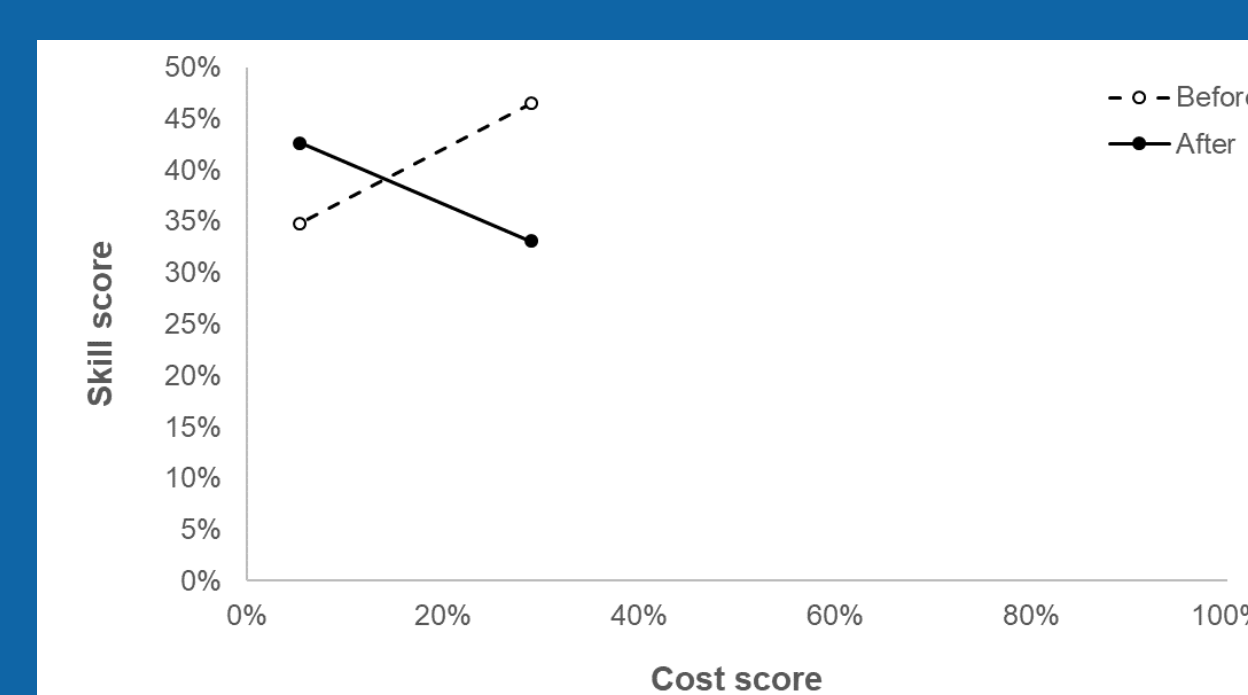

→ *Flow not at all well captured (no thermal effects modelled in this set-up)!!*

◈ Predicted weighted skill scores for Fluent and WAsP:

→ *WAsP: A9-A11 poor because terrain complexity outside operating envelope.*
→ *Fluent: A2, A6 and A7 poor (low grid quality, no thermal effects).*

◈ Resulting skill vs. cost scores:

→ *Costs scaled for 100% = $10,000.*
→ *Skill scaled for maximum actual uncertainty.*
→ *Fluent results worse than predicted → thermal effects need a higher weighting in the predictions!!*

Conclusions

◈ A new comparison metrics simulation challenge for wind resource assessment in complex terrain has been designed.

◈ Initial simulations with the tools WAsP and Fluent show that it is difficult to capture the flow through the valley well.

◈ Initial analysis indicate that the method needs refinement. Further results are expected at the end of 2020.

Sign up for challenge at:

https://www.iet.hsr.ch/index.php?id=19082&L=4

Open from April 1st, 2020 until Sep. 30th, 2020!

[1] S Barber, A Schubiger, N Wagenbrenner, N Fatras, and H Nordborg. A new method for the pragmatic choice of wind models for wind resource assessment in complex terrain. Wind Energy Science, (Discussion paper), 2020.
[2] S Barber, M Buehler and H Nordborg. IEA Wind Task 31: A new comparison metrics simulation challenge for wind resource assessment in complex terrain Stage 1, The Science of Making Torque from Wind Conference (in Review), 2020.
[3] H J S Fernando et al. The Perdigão: Peering into microscale details of mountain winds. Bulletin of the American Meteorological Society, 100(5):799-819, 2019.

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