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Memo: Accuracy of RASP - Regional Atlas of Siting Parameters

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Introduction

How accurate are your site and resource assessments based on calibrated RASP data in windPRO or windPROSPECTING compared to the baseline GASP data? This note gives a first hint.

Approach

A regional atlas of siting parameters (RASP) has been calibrated for Sweden using more than 50 long-term corrected measurement campaigns scattered across the country together with selected geospatial predictors. The following data has been considered:

- Only traditional masts (no remote sensing devices)
- ERA5 as the long-term reference data – the reference period used is 15 years (2003-2017)
- Geospatial predictors such as amount of forest or water body in a circular area around the mast

RASP employs a heteroscedastic Gaussian Process Regression (GPR) machine learning method which explicitly accounts for the varying quality of measured data. The accuracy the calibrated dataset is evaluated by a leave-one-out validation study using the 30 masts with the highest quality. Loads estimated directly on these data are considered "ground truth". The procedure is:

- A RASP dataset is calibrated using all available sites except one
- The RASP data is used to calculate the resource and fatigue loads at the left-out site
- The resource and fatigue loads are calculated directly using data from the left-out site
- This process is repeated for 30 sites of very high quality with each individually left out
- The accuracy of RASP is assessed as summary statistics of the predictions

Results

The table below summarizes the statistics of the predicted wind speeds and fatigue loads and compares RASP predictions to the GASP predictions. Note that the results are normalized by those obtained by data directly.

Accuracy of siting parameters	RASP		GASP	
	Mean	Stddev.	Mean	Stddev.
Resource assessment	**1.01**	**0.06**	**1.06**	**0.09**
Mean wind speed	1.00	0.04	1.03	0.05
Annual energy production	1.01	0.08	1.09	0.12
Site assessment	**1.01**	**0.06**	**1.15**	**0.11**
Blades	1.01	0.05	1.15	0.11
Tower bottom	1.01	0.07	1.20	0.15
Tower top	1.02	0.08	1.21	0.16
Drivetrain	1.00	0.03	1.05	0.04

As seen in the table above, RASP removes the significant bias present in the GASP dataset. For the loads, this is mainly due to overestimated turbulence. The spread (standard deviation) of the predictions across sites is reduced with almost 50%.

Endnotes

The findings are to be considered preliminary as RASP is a work in progress and only Sweden is considered.

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