

Validation of Turbulence Enable Modeled Time Series and Mapping Inner & Outer Range

PCWG March 16 Meeting

Alex Montornès

Pau Casso & Gil Lizcano

gil.lizcano@vortex.es

VORTEX



VORTEX

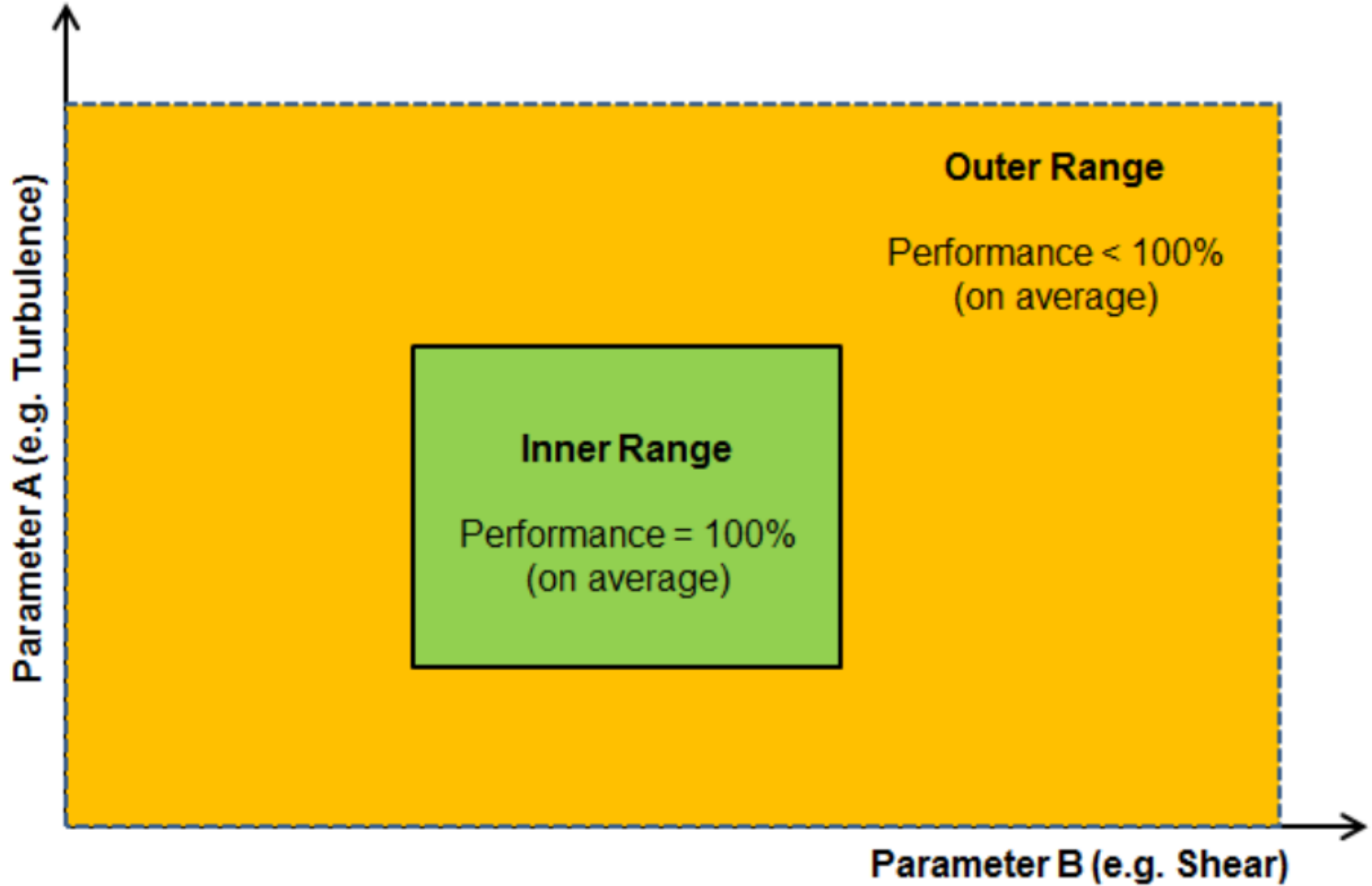
Wind Conditions Modeling Cloud Computing Service

Modeling from Climate to Blade

Global interface to model wind data

Our downscaling engine is the model WRF

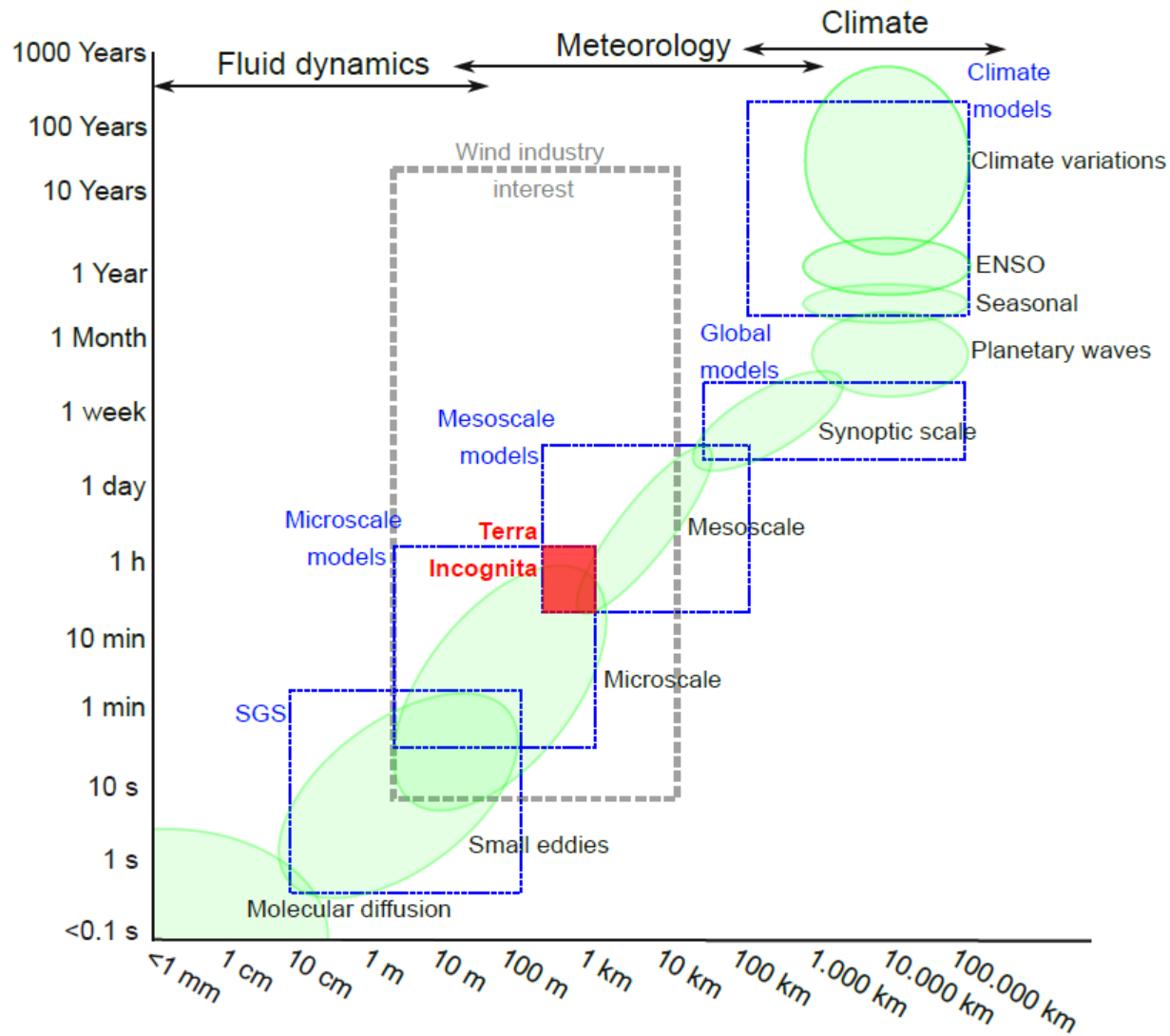
More than 23K registered users, more than 65K runs



Appendix C: Draft Hypothesis Power Deviation Matrix

The **draft** hypothesis power deviation matrix for use in PCWG-Share-01 is shown below. The Power Deviation Matrix will be finalised prior to the commencement of PCWG-Share-01.

		Power Deviation Matrix																				
Turbulence Intensity [%]	29%	10%	20%	25%	23%	15%	11%	6%	0%	-3%	-6%	-7%	-6%	-2%	0%	0%	0%	0%	0%	0%	0%	0%
	27%	10%	20%	25%	20%	14%	10%	5%	0%	-3%	-5%	-6%	-5%	-2%	0%	0%	0%	0%	0%	0%	0%	0%
	25%	10%	20%	24%	18%	12%	9%	5%	0%	-2%	-5%	-5%	-5%	-2%	0%	0%	0%	0%	0%	0%	0%	0%
	23%	10%	18%	21%	16%	10%	8%	4%	0%	-2%	-4%	-5%	-4%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	21%	10%	15%	18%	13%	9%	7%	3%	0%	-2%	-3%	-4%	-3%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	19%	8%	11%	14%	11%	7%	5%	3%	0%	-1%	-3%	-3%	-3%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	17%	4%	8%	11%	8%	6%	4%	2%	0%	-1%	-2%	-2%	-2%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	15%	0%	4%	8%	6%	4%	3%	2%	0%	-1%	-2%	-2%	-2%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	13%	-4%	0%	5%	4%	2%	2%	1%	0%	0%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	11%	-8%	-3%	2%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	9%	-12%	-7%	-2%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	7%	-16%	-10%	-5%	-4%	-2%	-2%	-1%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5%	-20%	-14%	-8%	-6%	-4%	-3%	-2%	0%	1%	2%	2%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	
3%	-24%	-18%	-11%	-8%	-6%	-4%	-2%	0%	1%	2%	2%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	
1%	-28%	-21%	-14%	-11%	-7%	-5%	-3%	0%	1%	3%	3%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
		Normalised Wind Speed [m/s]																				



Mesoscale (*Multiscale*) Modeling:

- ❑ Can Mesoscale model **help** to map the inner/outer region ?
- ❑ Is **feasible** for an **industry** approach ?
- ❑ How **reliable**? How **consistent** ? How **efficient** ? How **accurate** ?

Large Scale Drivers
(Reanalysis)

WRF
Standard PBL Param

WRF - LES
No PBL Param

50 Km

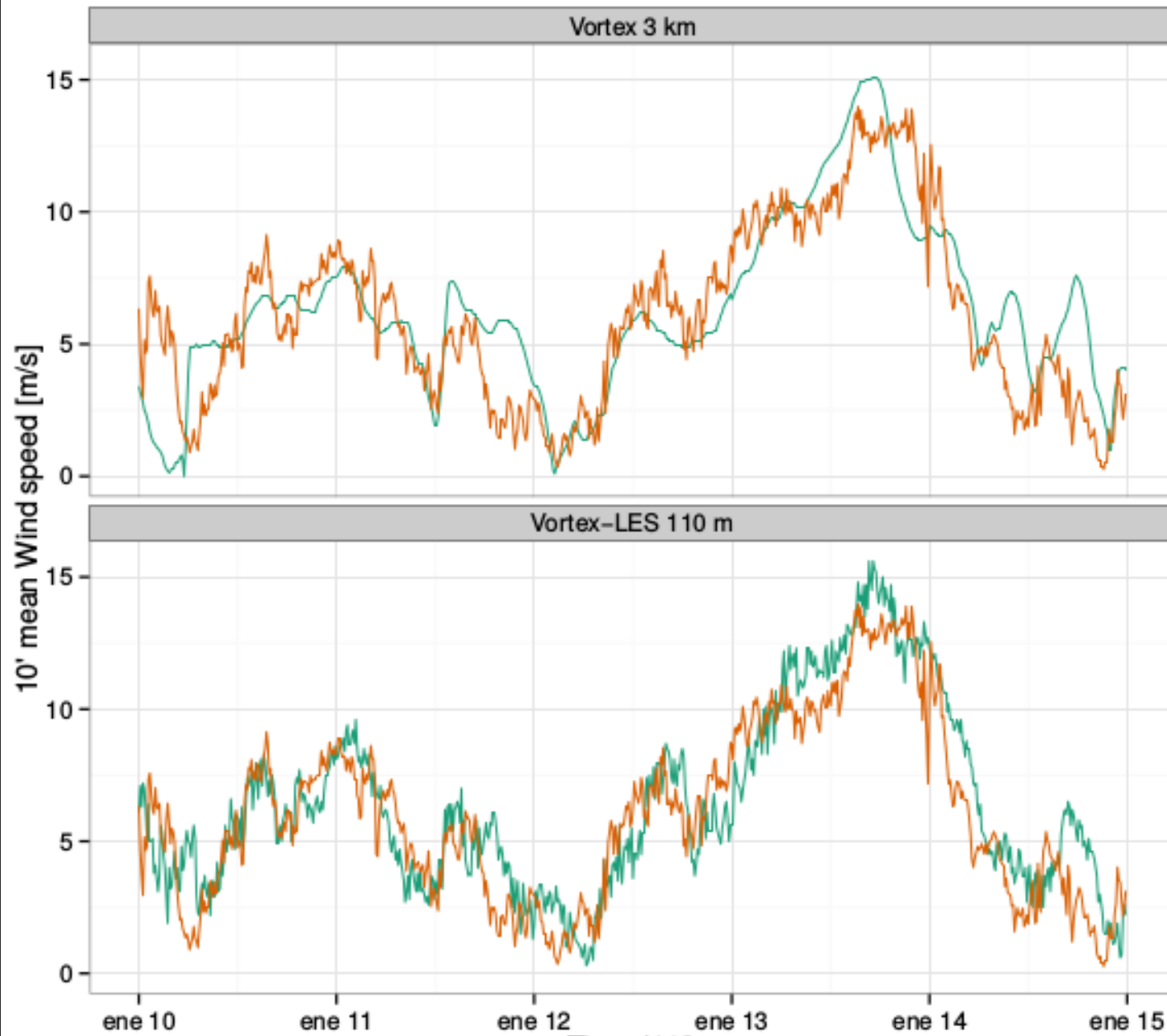
1 km

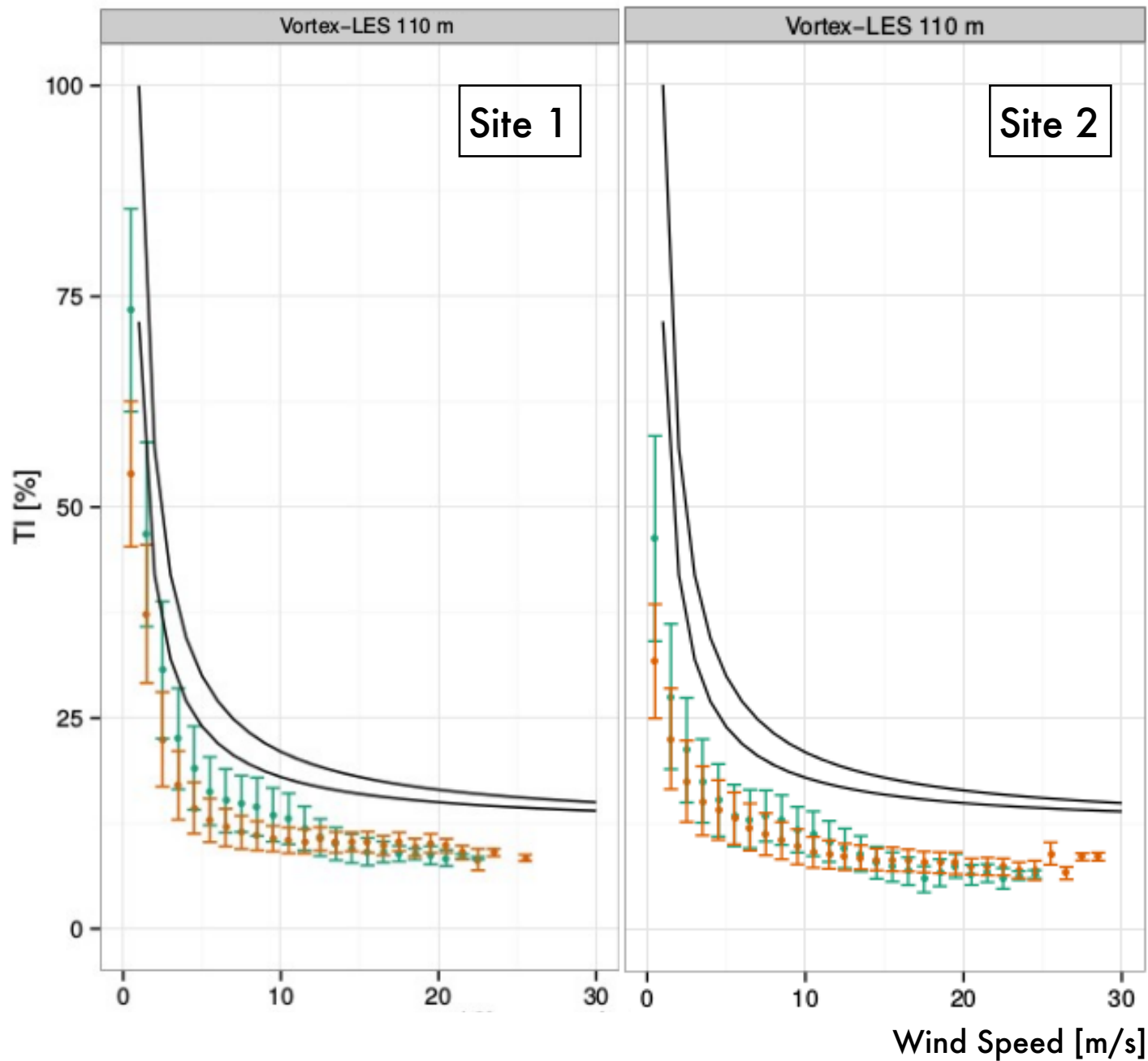
0.1 km

Random sequence of days



Random sequence of
days



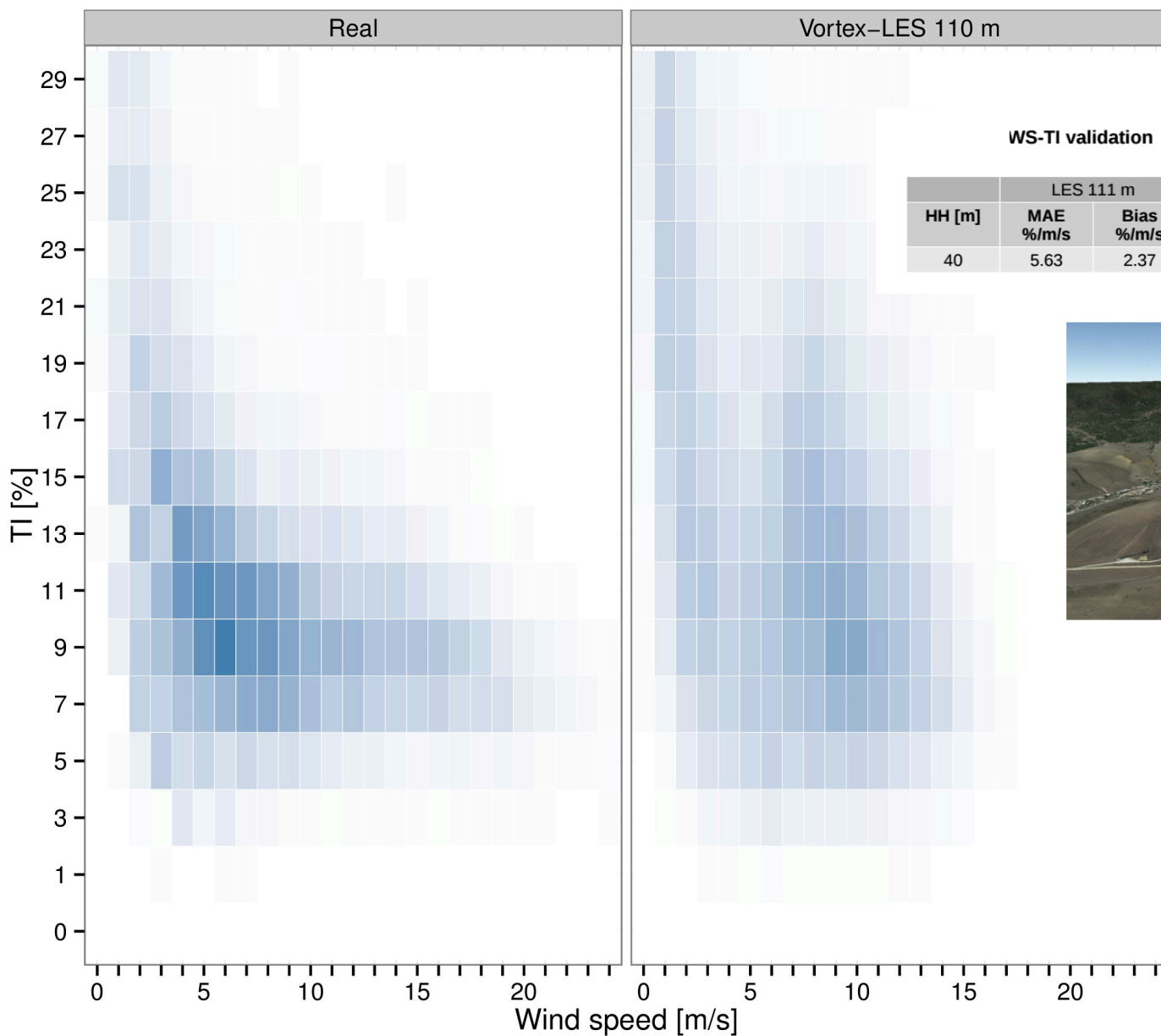


Binned TI vs WS

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	25%	10%	20%	24%	18%	12%	9%	5%	0%	-2%	-5%	-5%	-5%	-2%	0%	0%	0%	0%	0%	0%	0%	0%
	23%	10%	18%	21%	16%	10%	8%	4%	0%	-2%	-4%	-5%	-4%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	21%	10%	15%	18%	13%	9%	7%	3%	0%	-2%	-3%	-4%	-3%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	19%	8%	11%	14%	11%	7%	5%	3%	0%	-1%	-3%	-3%	-3%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	17%	4%	8%	11%	8%	6%	4%	2%	0%	-1%	-2%	-2%	-2%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	15%	0%	4%	8%	6%	4%	3%	2%	0%	-1%	-2%	-2%	-2%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
	13%	-4%	0%	5%	4%	2%	2%	1%	0%	0%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	11%	-8%	-3%	2%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9%	-12%	-7%	-2%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
7%	-16%	-10%	-5%	-4%	-2%	-2%	-1%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
5%	-20%	-14%	-8%	-6%	-4%	-3%	-2%	0%	1%	2%	2%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	
3%	-24%	-18%	-11%	-8%	-6%	-4%	-2%	0%	1%	2%	2%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	
1%	-28%	-21%	-14%	-11%	-7%	-5%	-3%	0%	1%	3%	3%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	
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		Normalised Wind Speed [m/s]																				

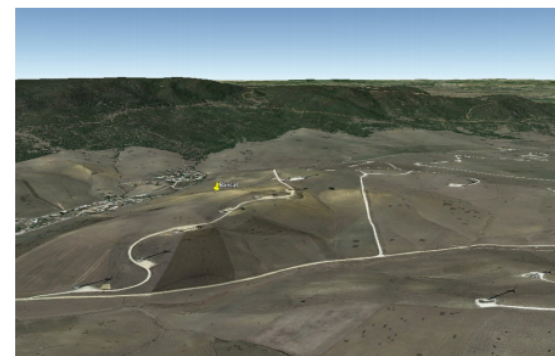


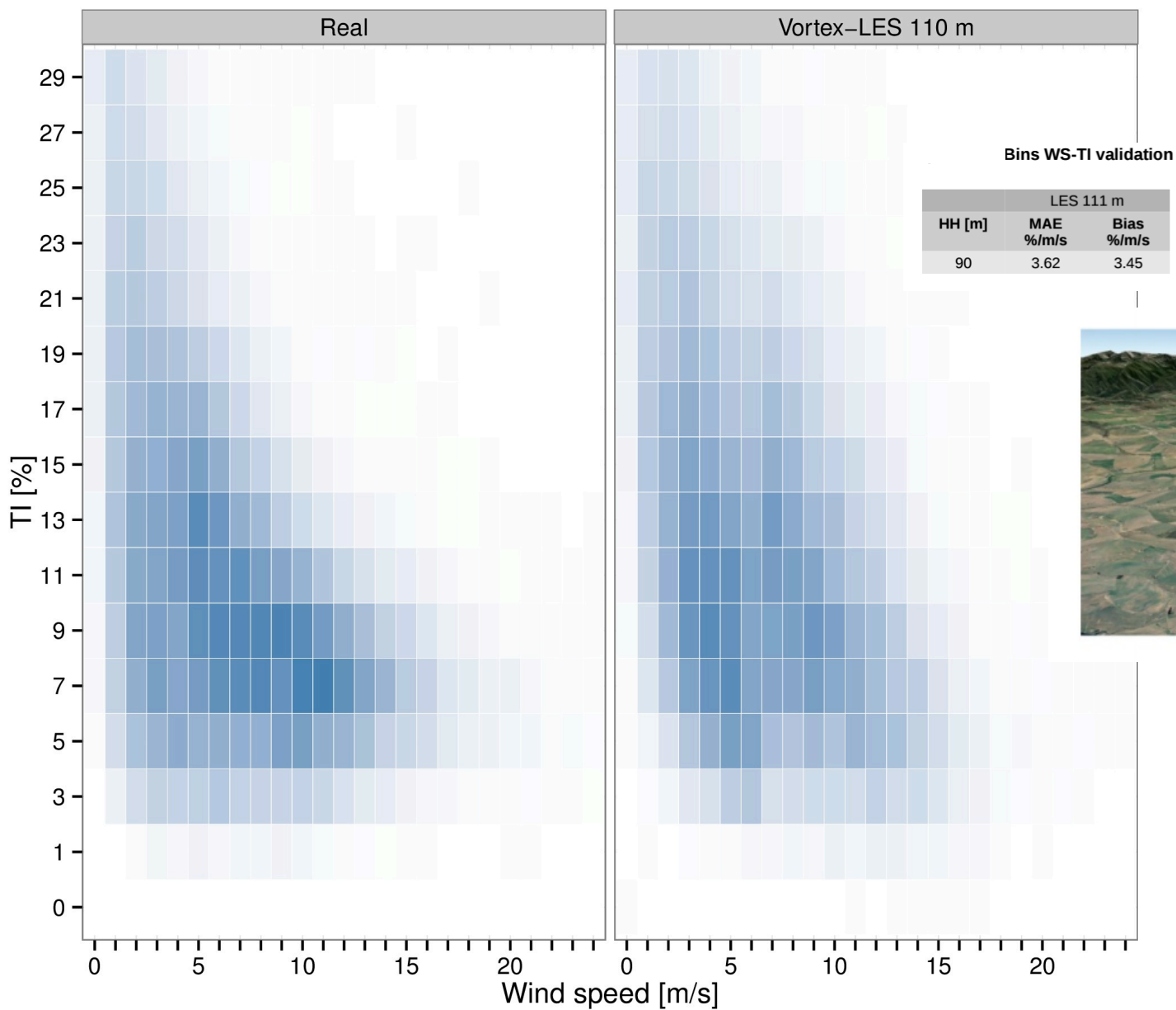
WS-TI validation

HH [m]	LES 111 m	
	MAE %/m/s	Bias %/m/s
40	5.63	2.37

Annual Production

Real	MWh	
	LES 111 m	Vortex 3 km
5162	4908	3133



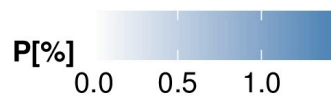


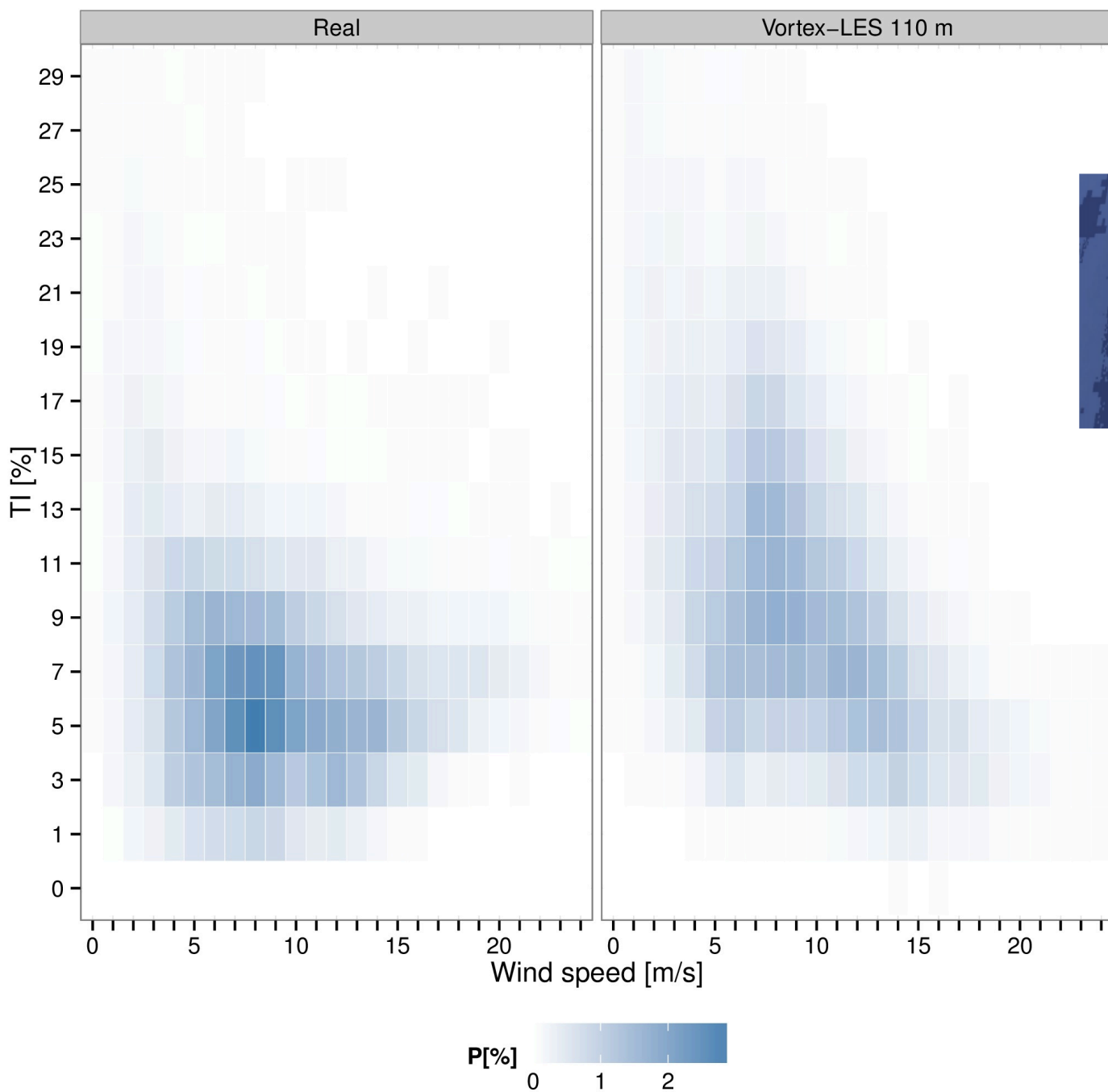
Bins WS-TI validation

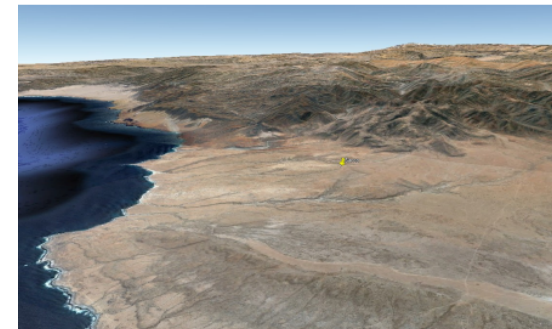
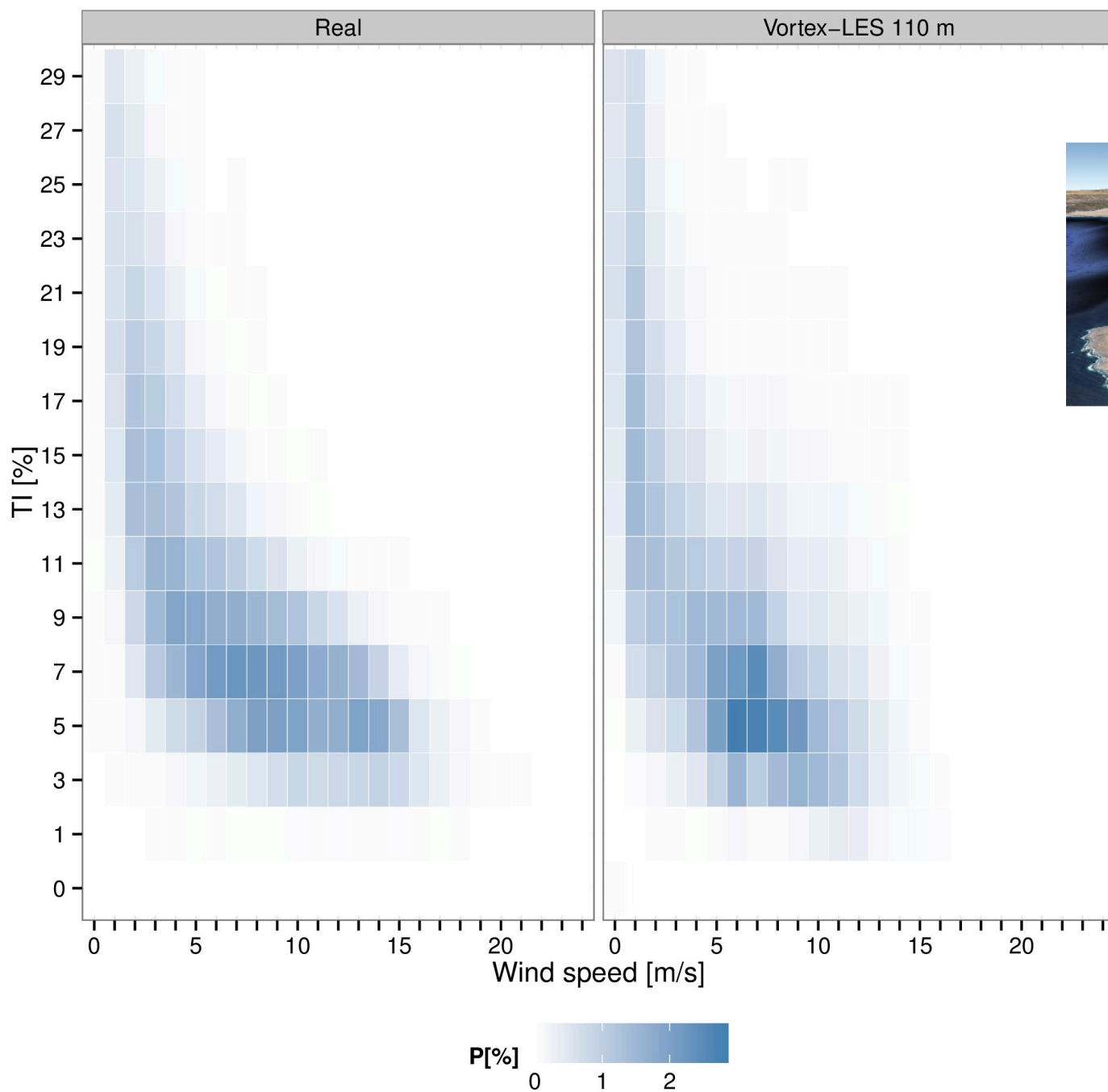
HH [m]	LES 111 m	
	MAE %/m/s	Bias %/m/s
90	3.62	3.45

Annual Production

	GWh		
	Real	LES 111 m	Vortex 3 km
	4908	5005	4046







- Validations WRF-LES for 10 Sites
- Encouraging results - keep posted
- More tests are needed
- Potential usage within PCWG activities
- *Shareable* Modeled time series