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Comparison of the IFDM building downwash model predictions with field data

W. Lefebvre, G. Cosemans, J. Kegels

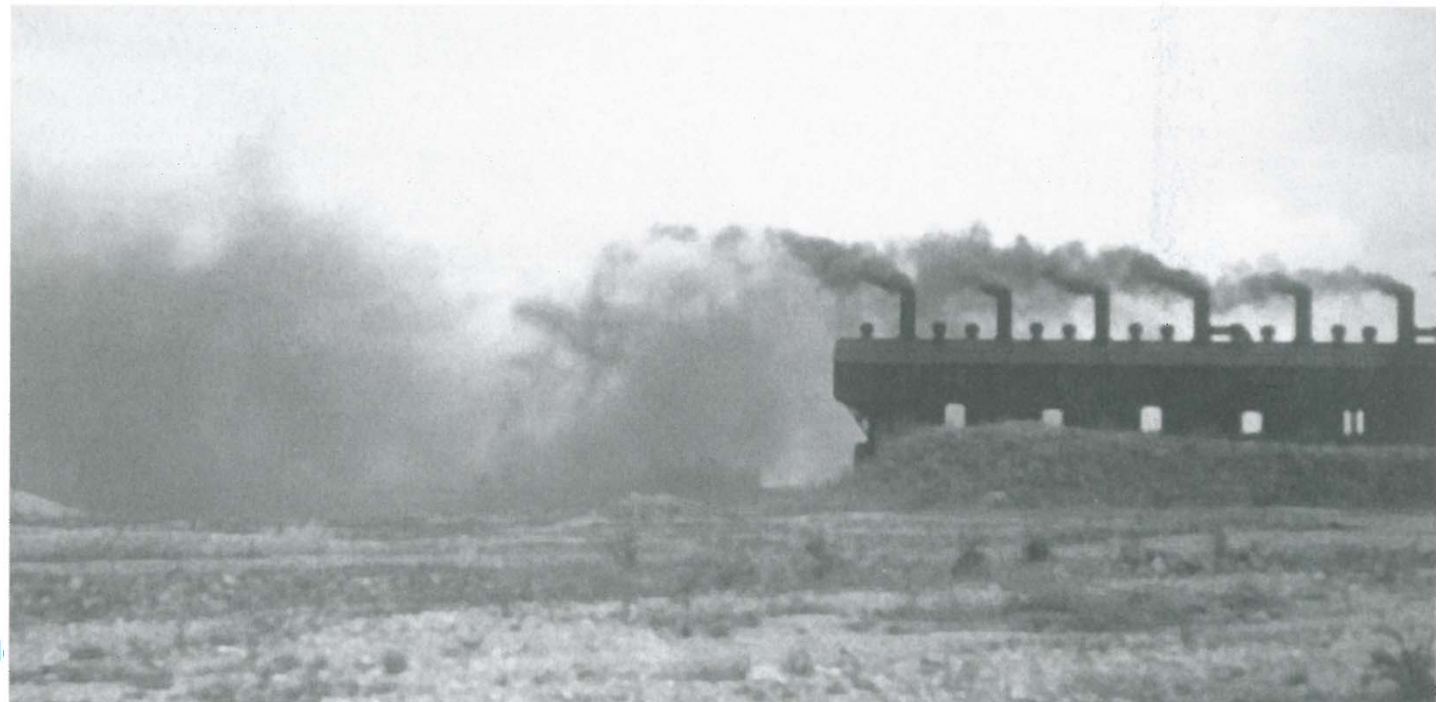
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Introduction

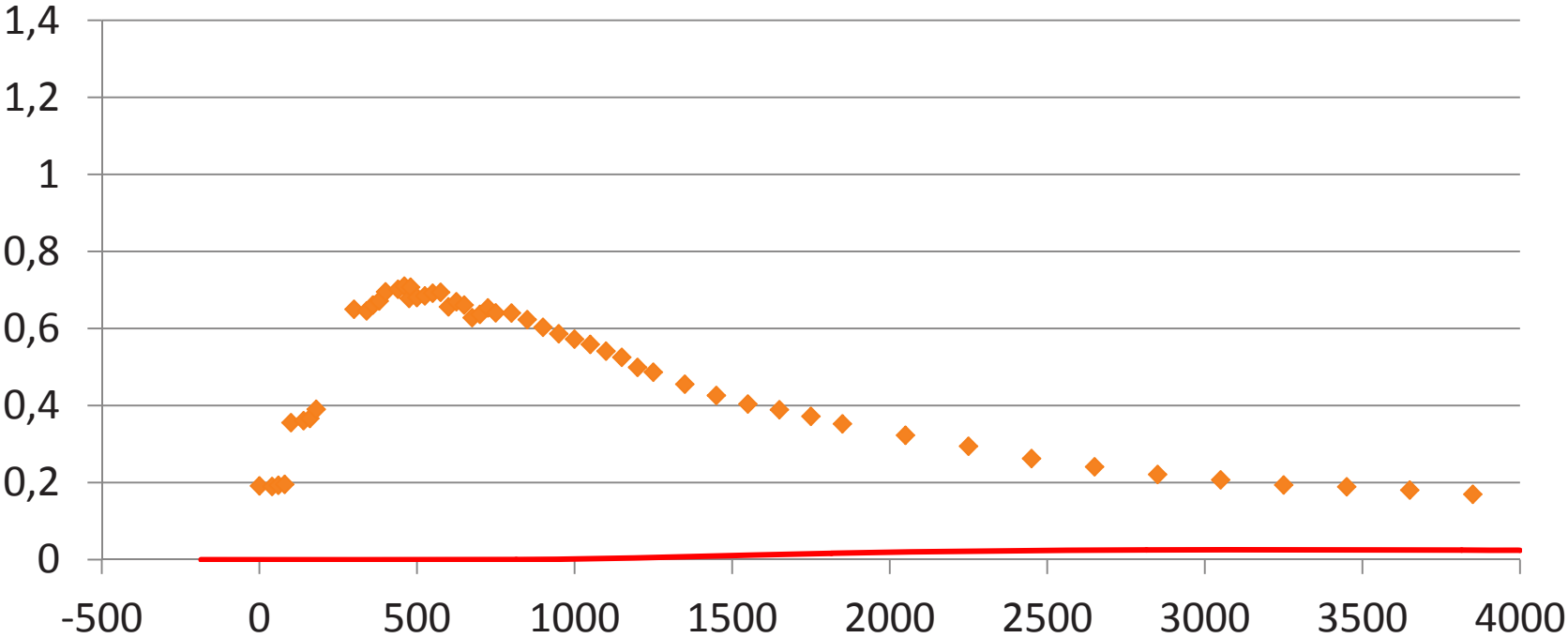
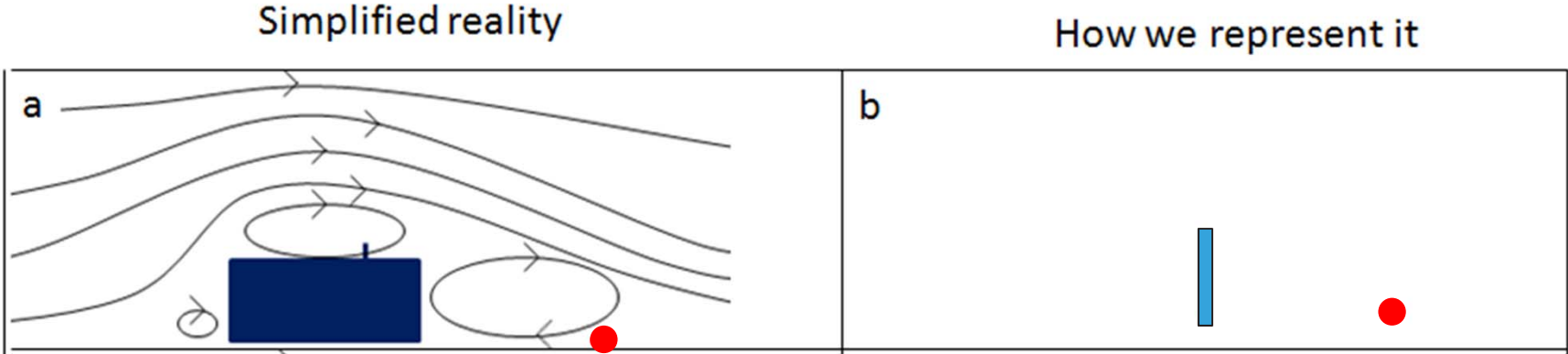
- » Olesen et al. (2009):
 - » Limitations of current building downwash models, especially close to the buildings.
 - » Interesting dataset by Thompson, not fully exploited
- » Development of new building downwash routine (Cosemans et al., 2012)

Source photo:
Scorer, 2002



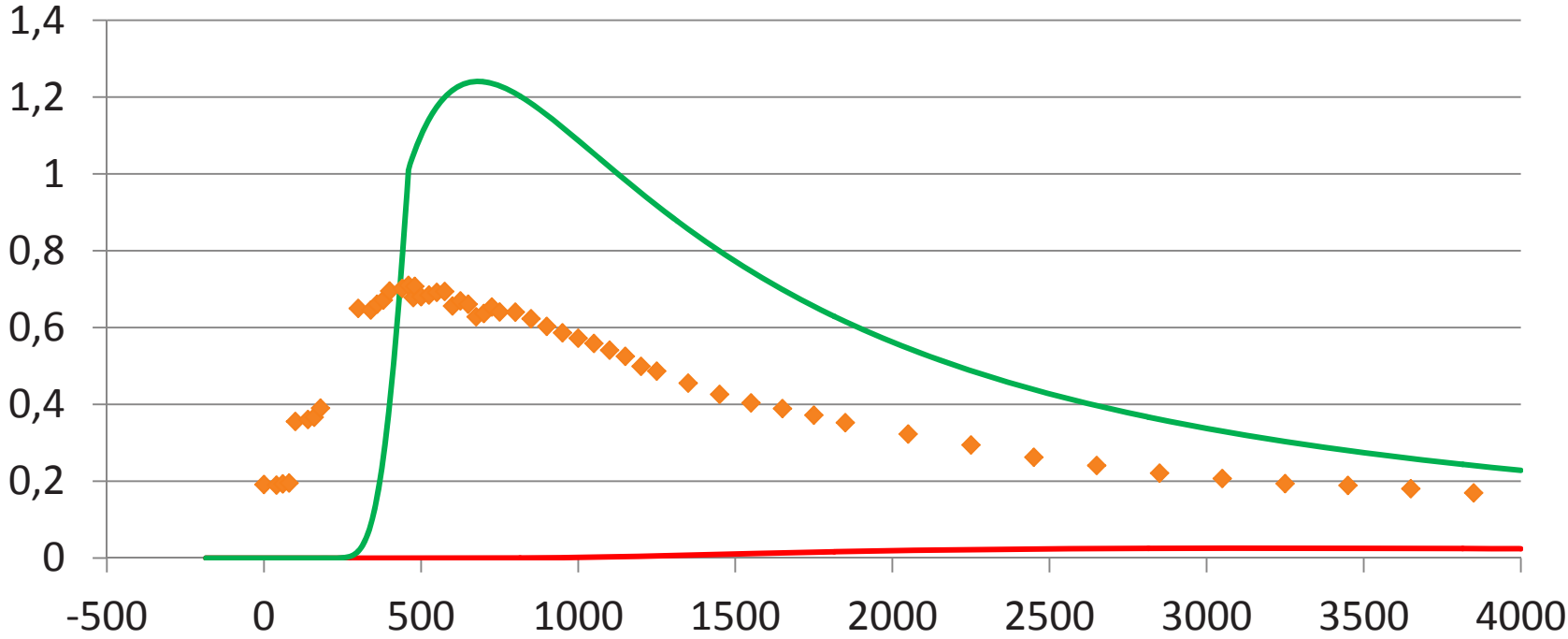
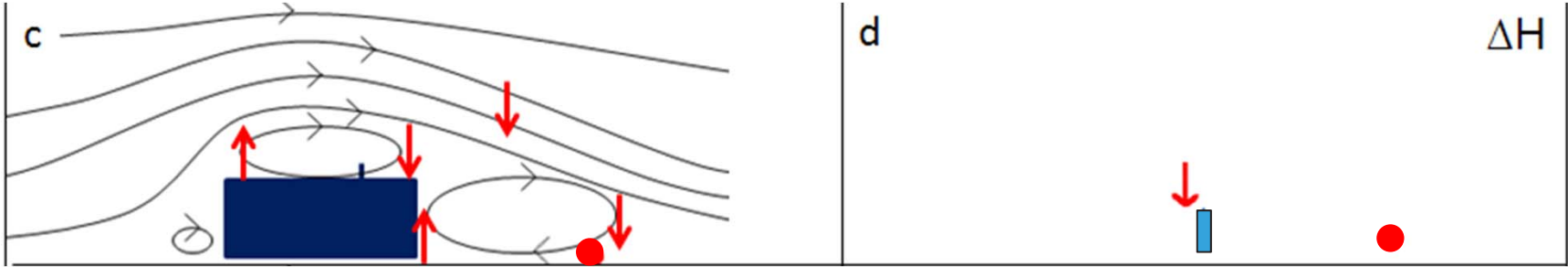
Model description

Cosemans et al., 2012



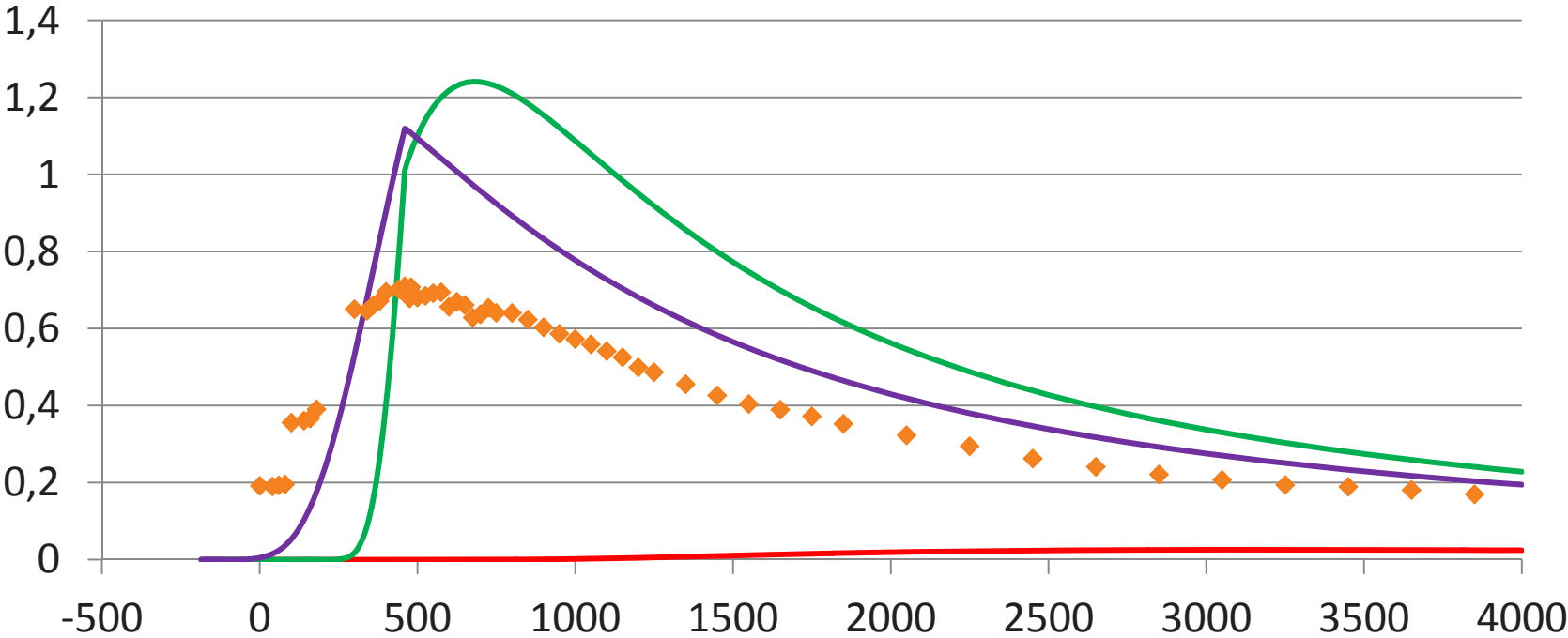
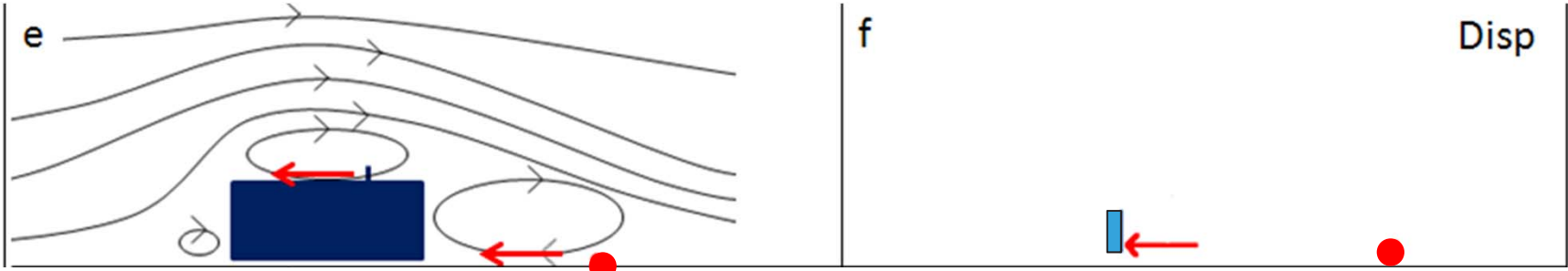
Model description

Cosemans et al., 2012



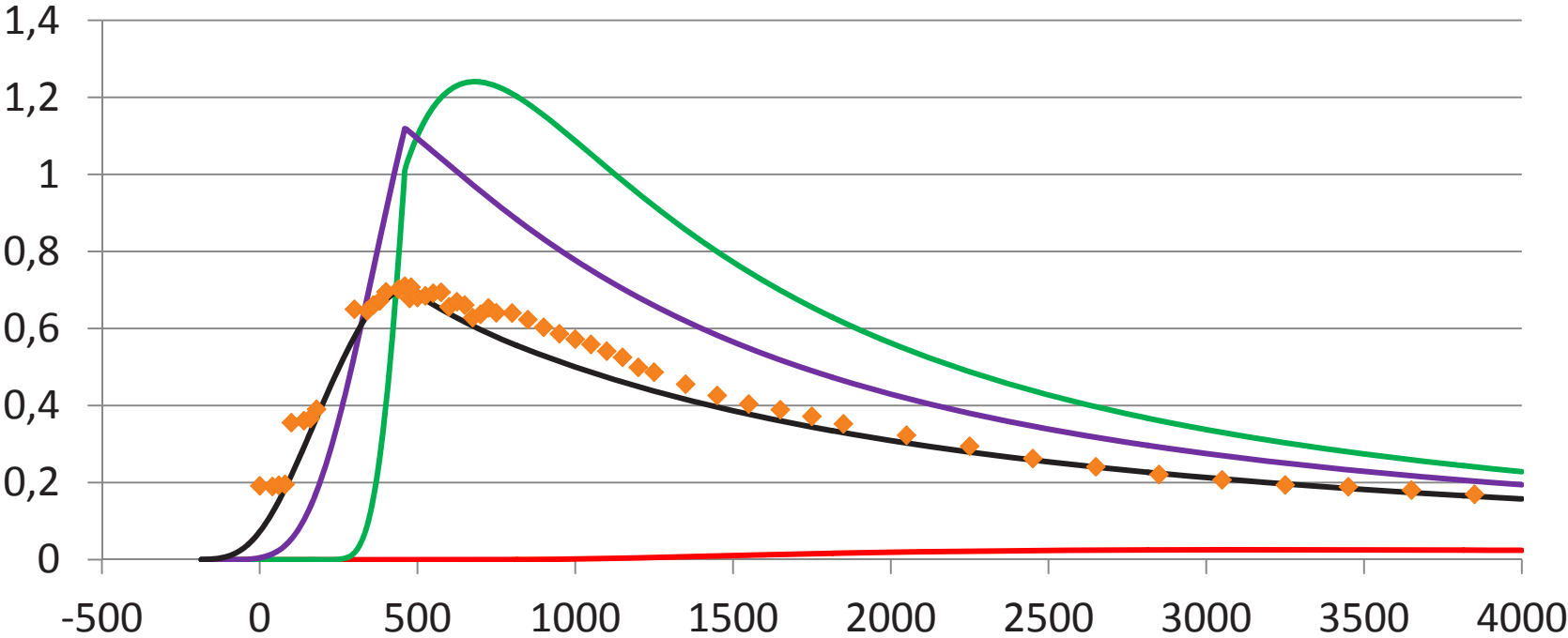
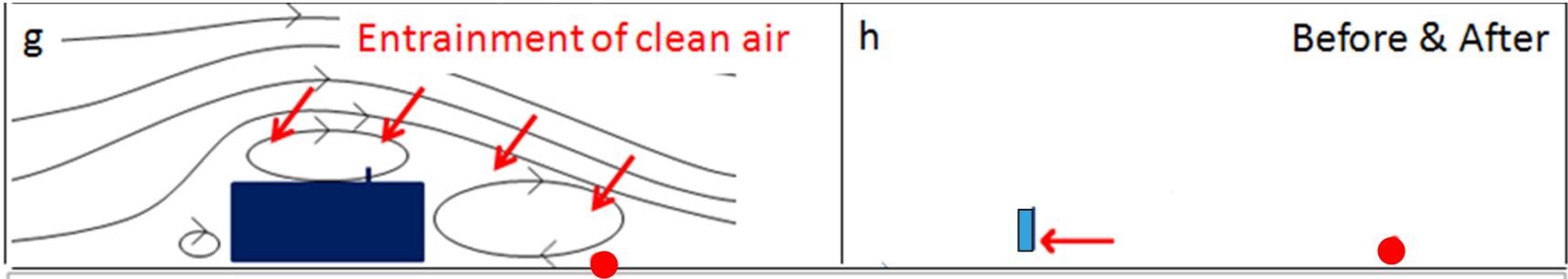
Model description

Cosemans et al., 2012



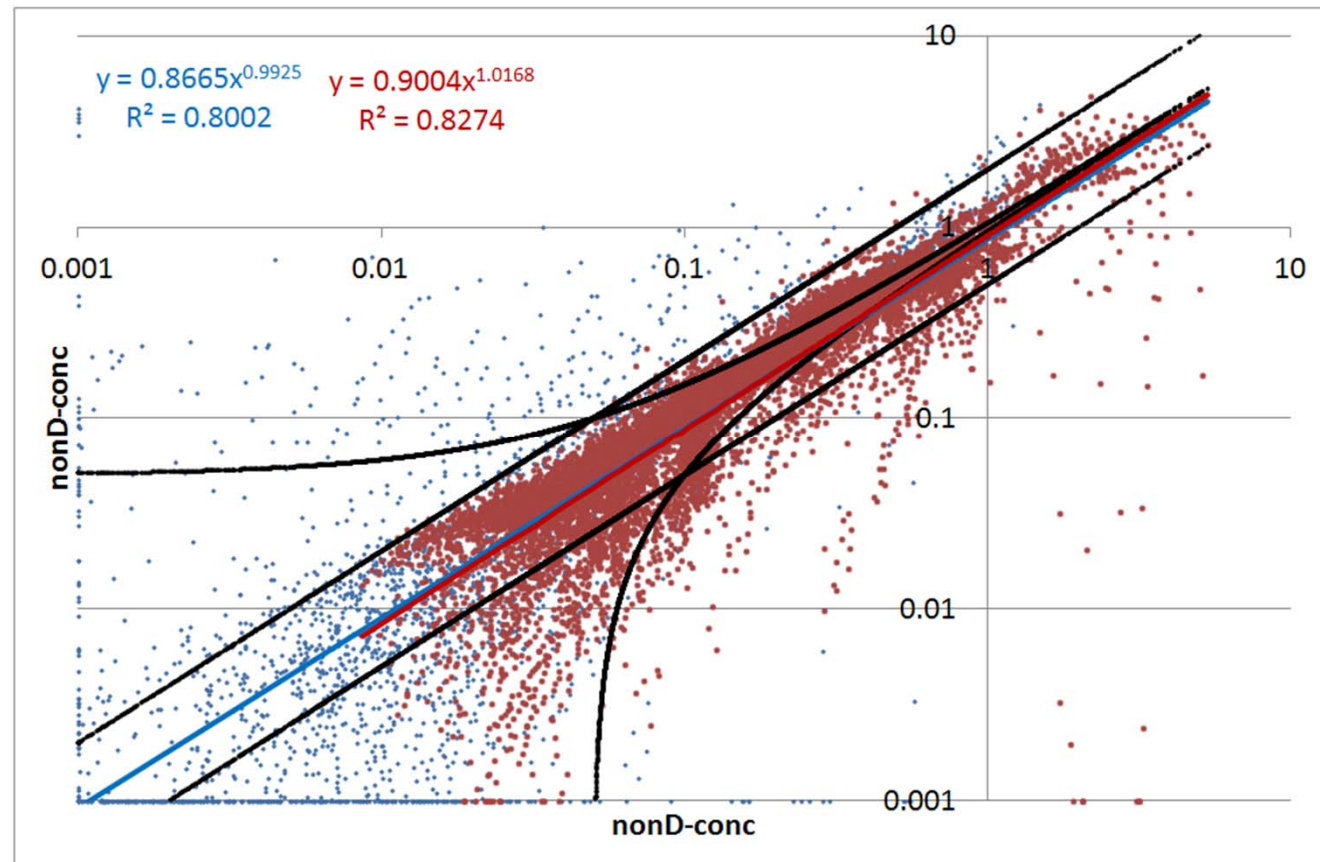
Model description

Cosemans et al., 2012



Model description

- » It reproduces the Thompson dataset



- » But also reality?

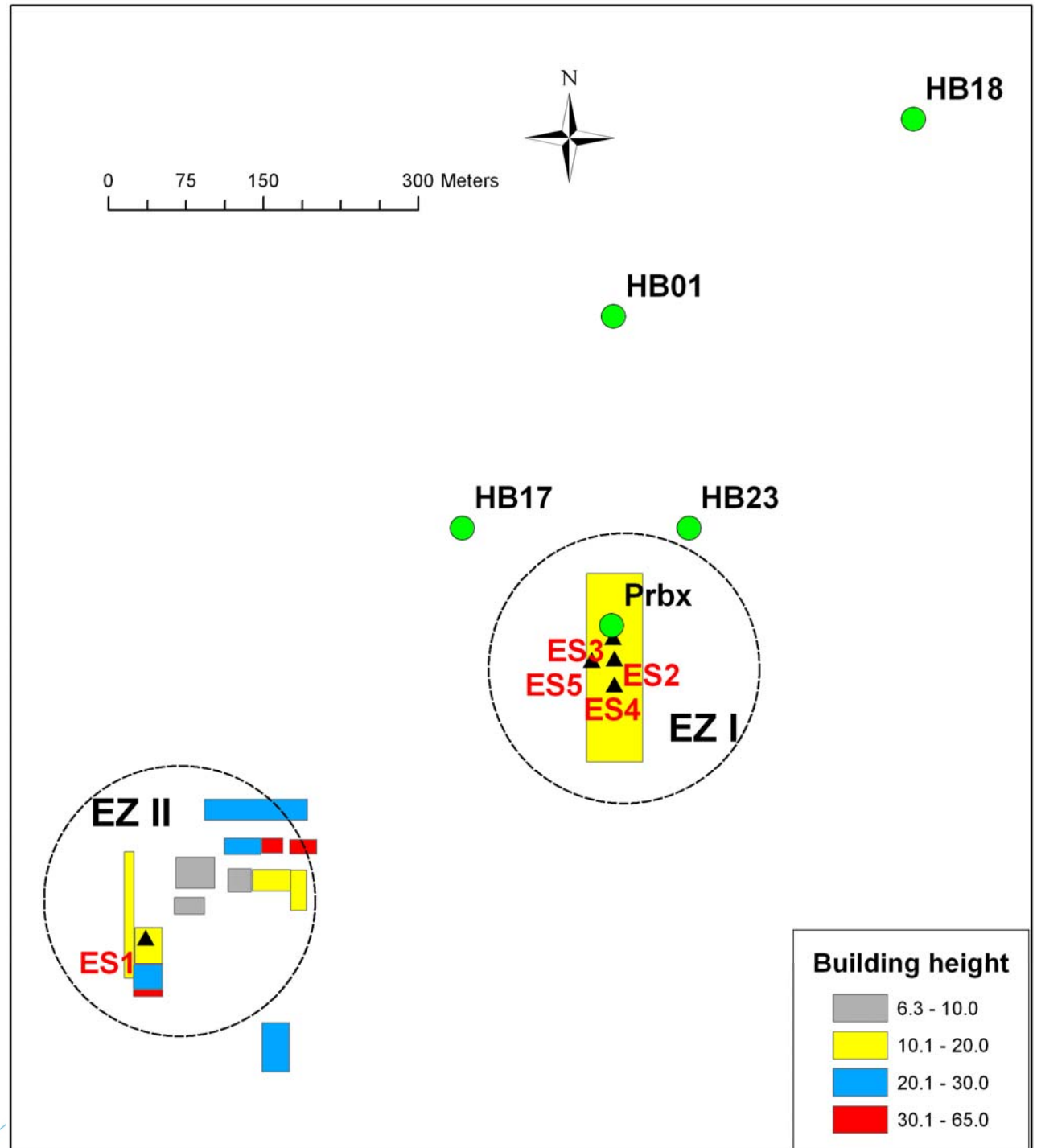
Field data

Daily measurements
at four locations
close to the sources
During 2 years (2010-2011)

Two zones with emissions

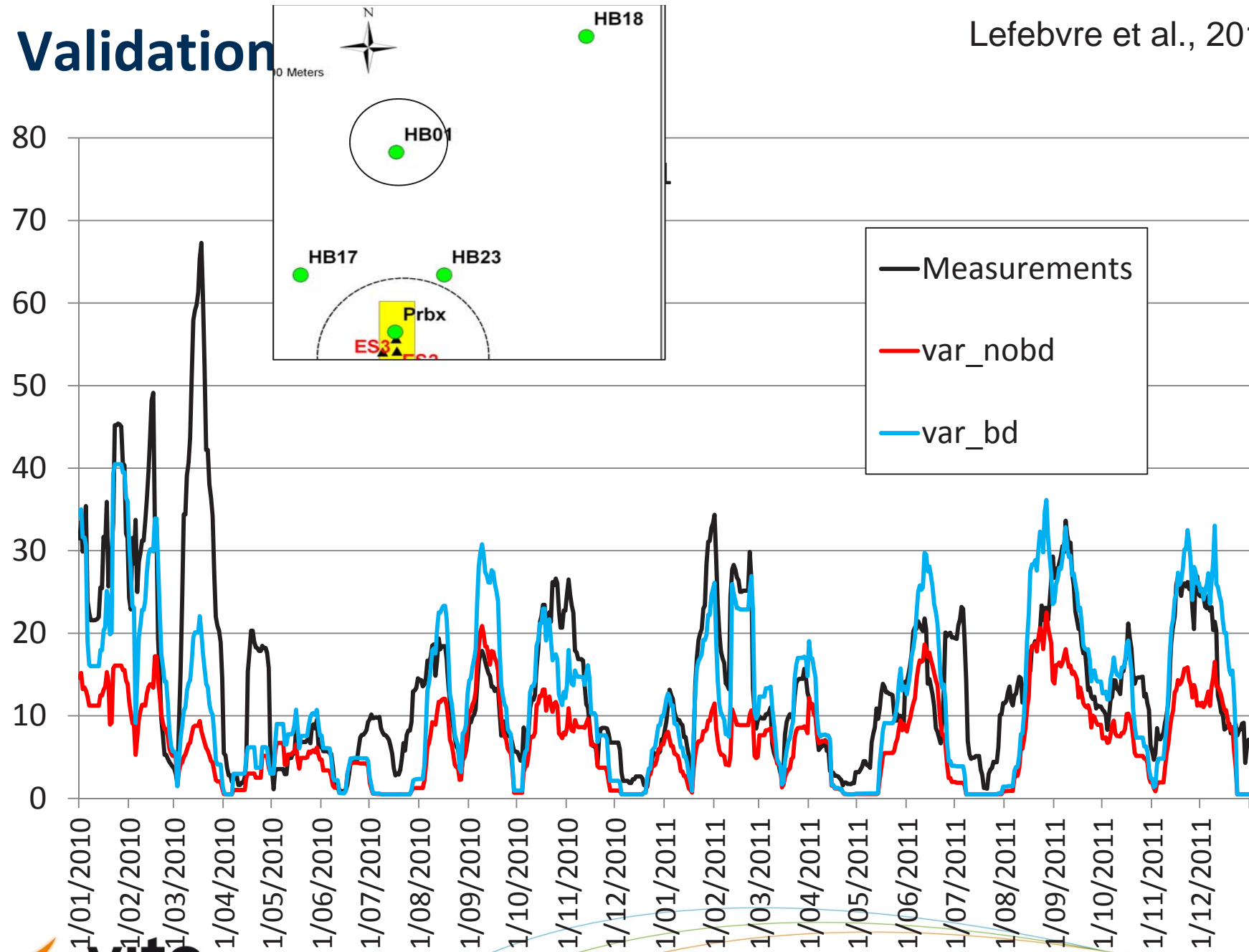
Simulations:

- With building downwash
- Without building downwash



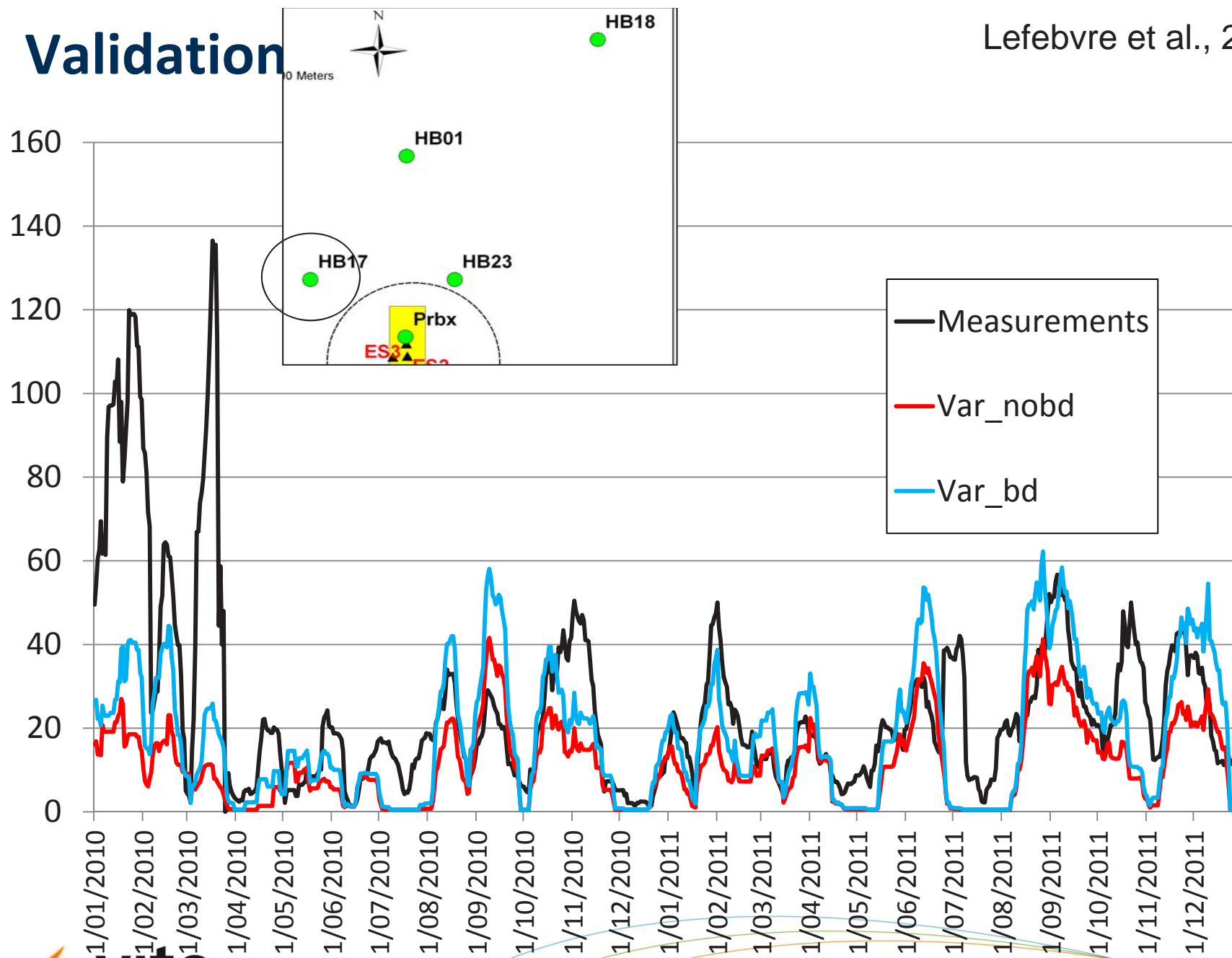
Validation

Lefebvre et al., 2013



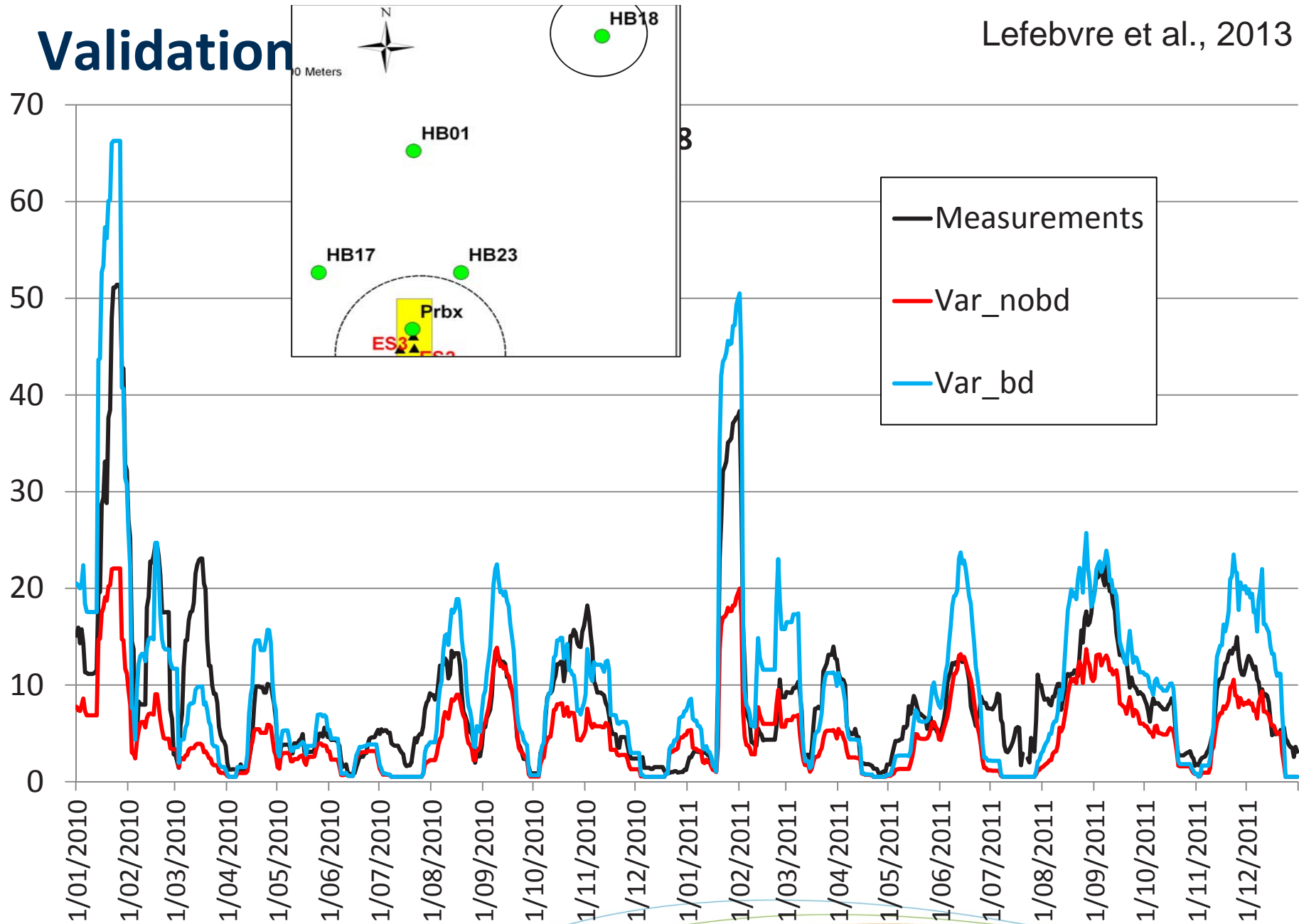
Validation

Lefebvre et al., 2013



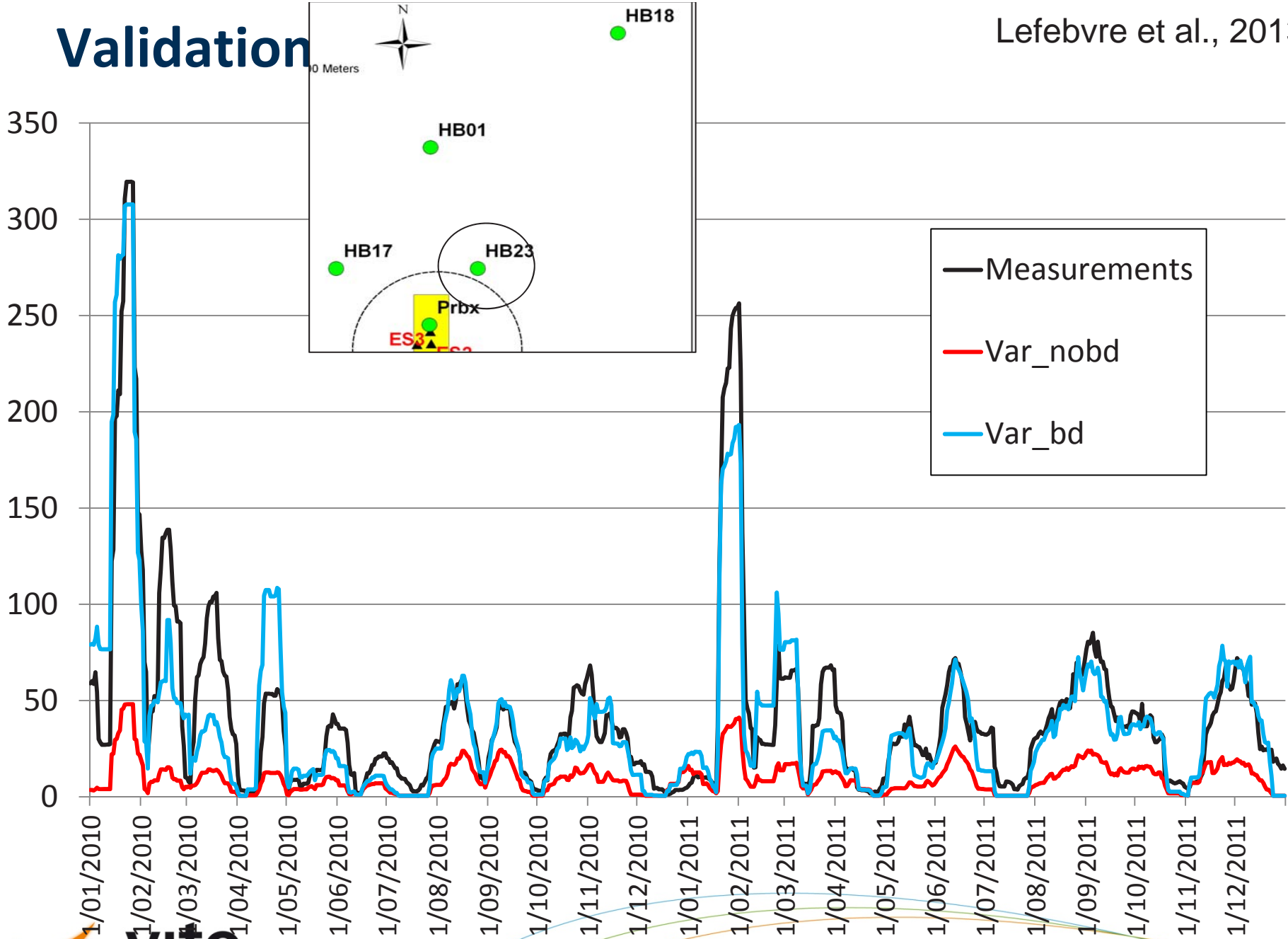
Validation

Lefebvre et al., 2013

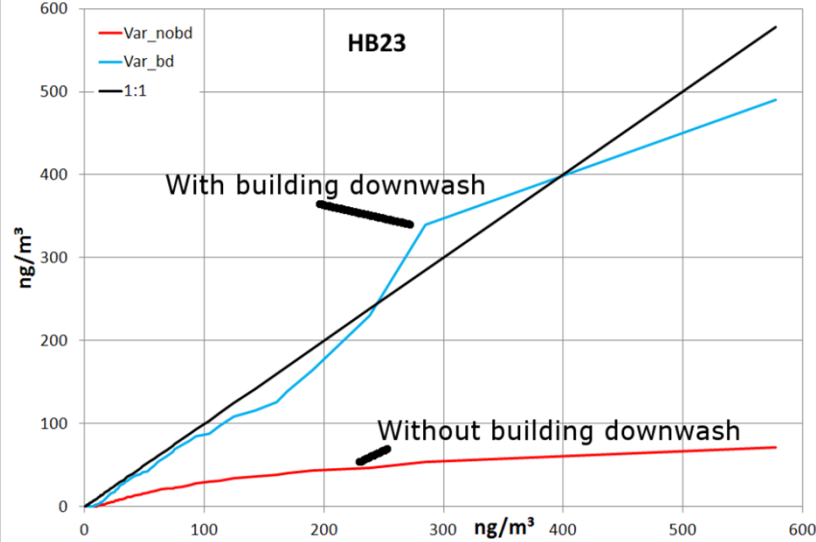
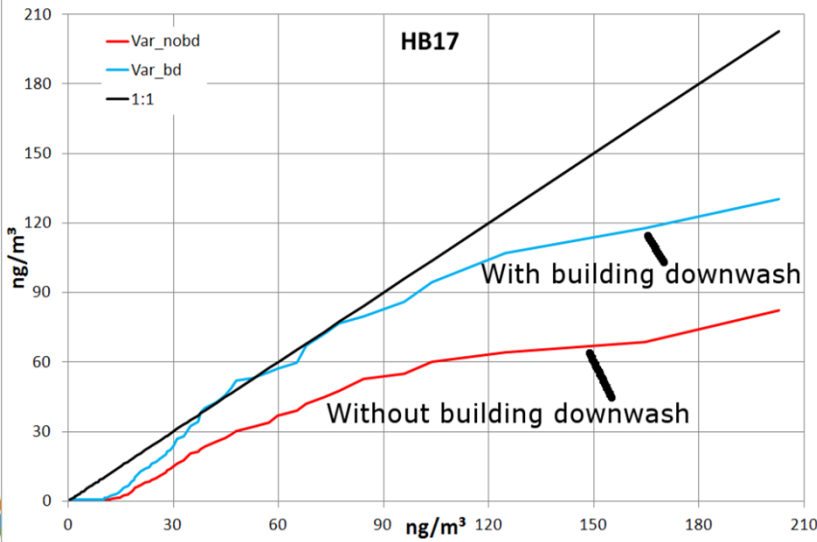
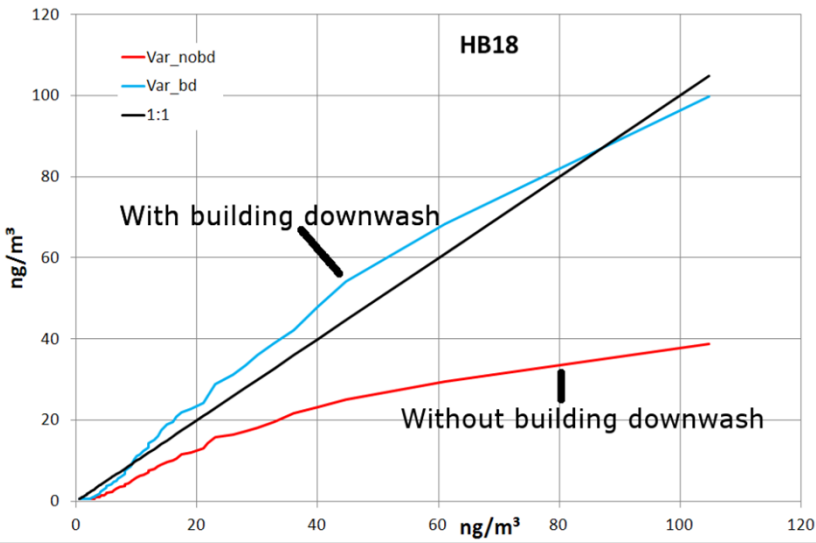
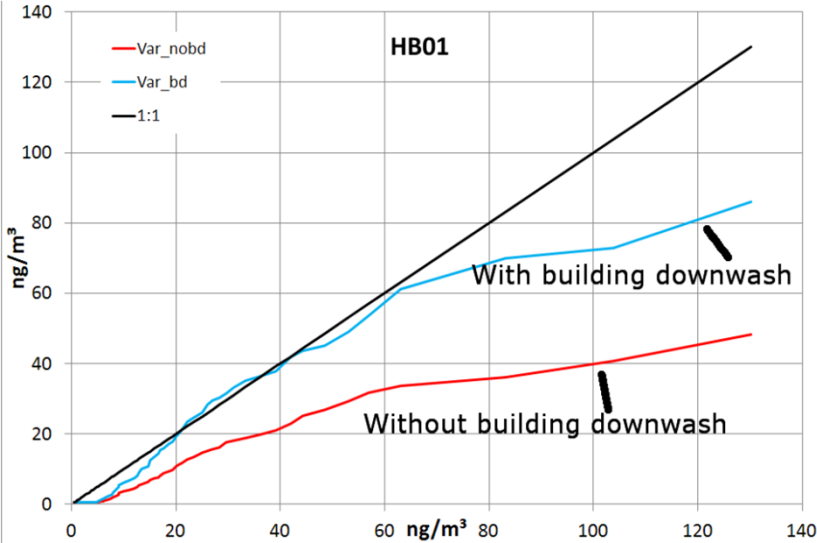


Validation

Lefebvre et al., 2013



Validation: Q-Q plots



Validation

Monitoring site	Year	Number of measurements	Period Average concentration (ng/m ³)		
			Measured	No building downwash	Building downwash
HB01	2010	358	16	6.6	11.9
	2011	364	14	7.5	13.4
HB17	2010	349	29	10.1	16.3
	2011	357	23	13.0	20.7
HB18	2010	364	9.6	4.6	10.2
	2011	348	8.8	5.4	10.8
HB23	2010	364	44	8.7	40.3
	2011	357	41	11.0	37.0

Conclusions

- » New building downwash model
- » Application on field data
- » Good validation
- » Model can be used for: regulatory purposes, exposure estimates, scenario analysis
- » References:
 - » Cosemans G., Lefebvre W., Mensink C., 2012. Calculation scheme for a Gaussian parameterization of the Thompson 1991 wind tunnel building downwash dataset, *Atm. Env.*, 59, 355-365, doi: 10.1016/j.atmosenv.2012.05.17
 - » Lefebvre W., Cosemans G., Kegels J., 2013. Comparison of the IFDM building downwash model predictions with field data, *Atm. Env.*, published online, doi:10.1016/j.atmosenv.2013.04.022