Vapour Dispersion

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What determines concentrations?

- volatilisation rate
- size of field
- distance of bystander from edge of field
- breathing height
- distribution of pesticide within crop canopy
- weather conditions

How to calculate concentrations?

- choose an appropriate dispersion model
- specify the source and bystander configuration
- characterise the range of weather conditions of interest
- run the model for each set of weather conditions

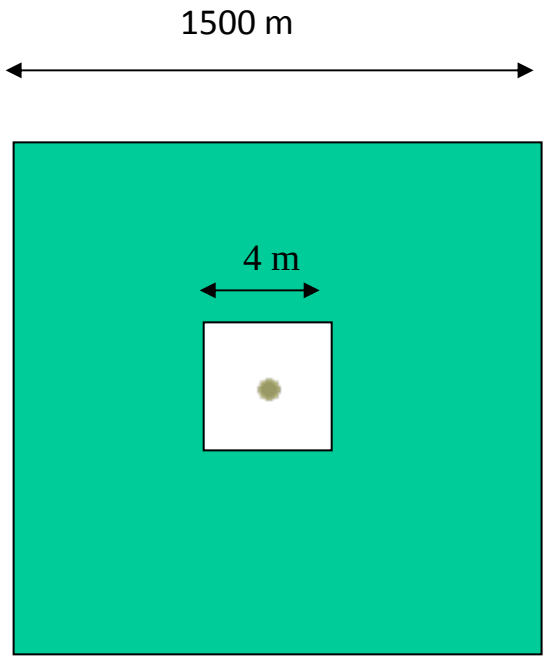
Choice of ADMS

- modern generation of atmospheric dispersion models
- appropriate to the distance range and source configuration of interest
- well validated

Model set up

- fields of 750 m size in any direction, uniform emission rate
- bystander 2 m from edge of field
- two breathing heights (adult and child)
- source distributed around 0.5 m from ground

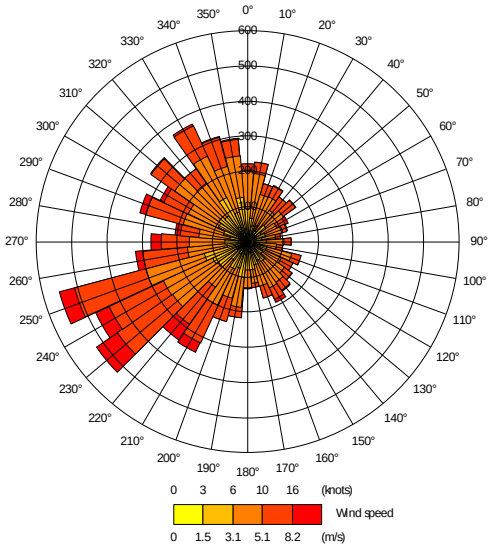
Source and receptor configuration



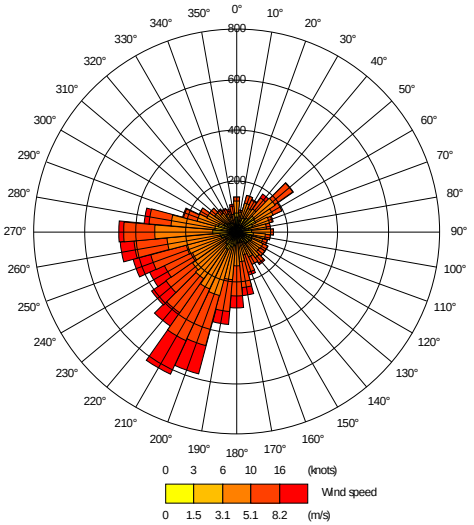
Weather data

- Andrewsfield 2005, 2006
- Castle Donington (East Midlands Airport) 2006

Wind rose

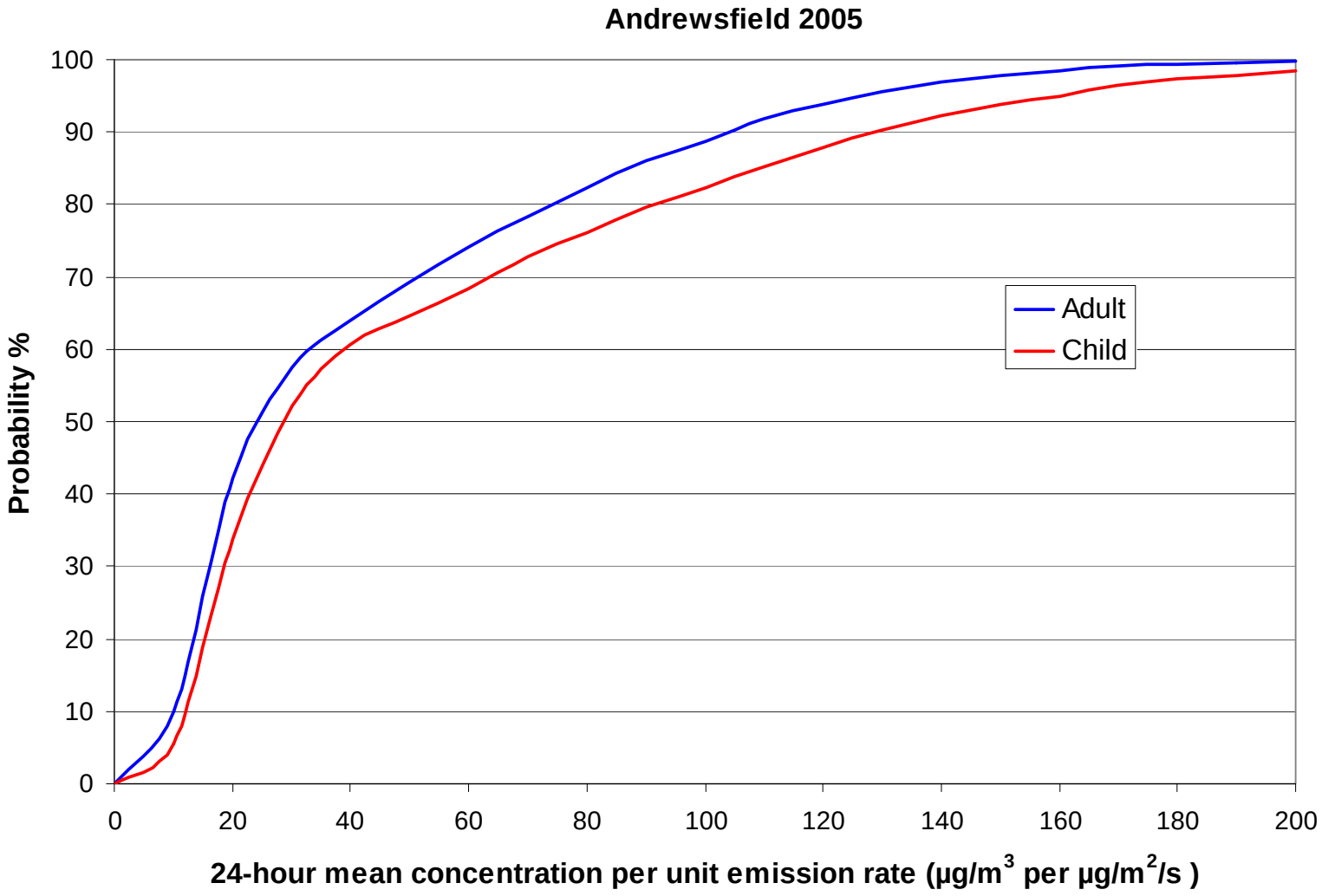


Andrewsfield, 2005



Castle Donington, 2006

Frequency distribution of 24-hour mean concentration per unit emission rate



Application

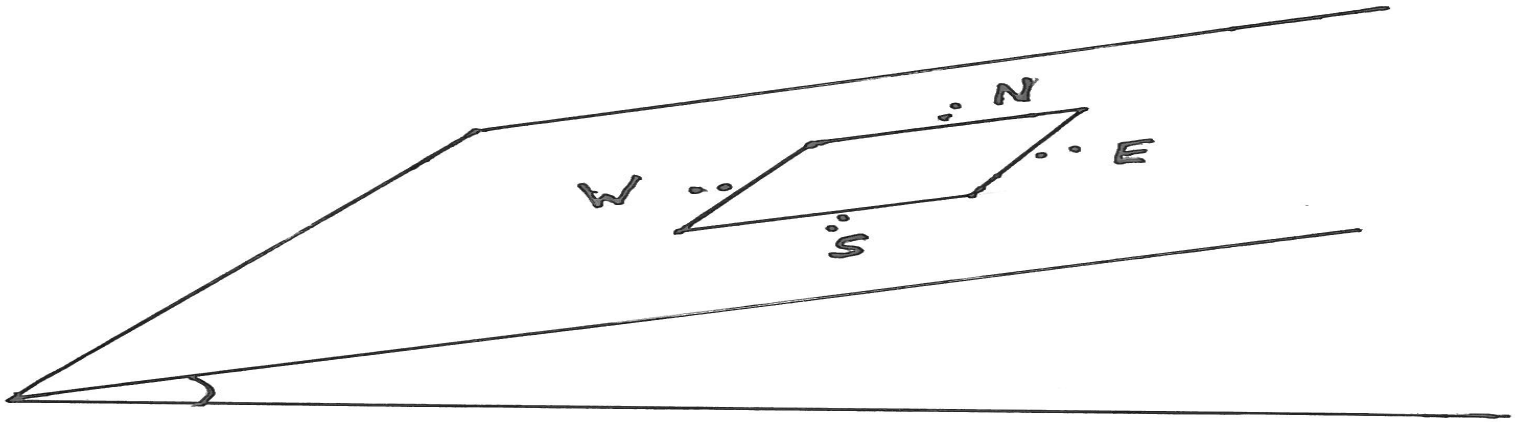
- could use average of the distribution for long-term exposure
- could use some high percentile to represent reasonable worst case, say 95th percentile

Sensitivity to location and year

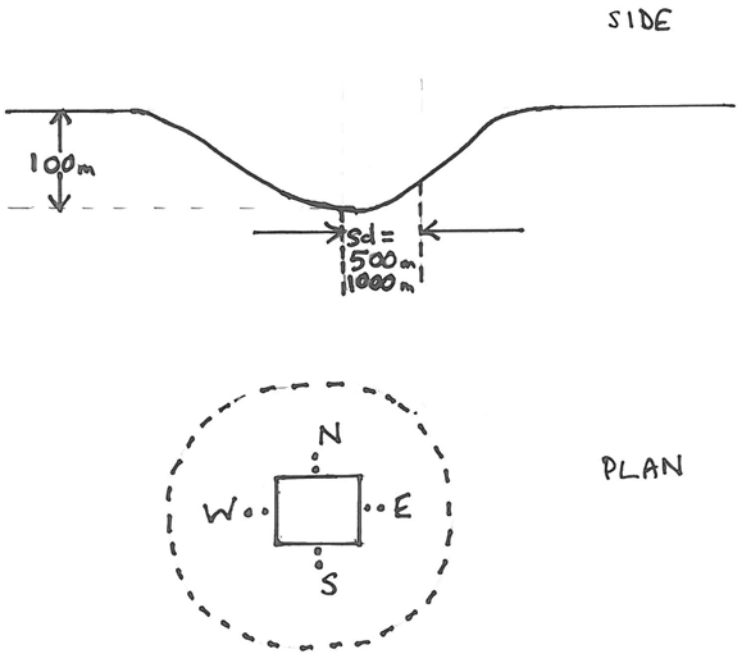
Receptor	Weather[a]	Conc per unit emission rate (s m^{-1})	
		95th %ile	Mean
Child	A 2005	158.7	51.0
	A 2006	160.5	52.0
	C 2006	157.4	44.9
Adult	A 2005	125.9	41.5
	A 2006	128.2	42.3
	C 2006	124.6	36.4

[a] A – Andrewsfield; C - Castle Donington (East Midlands Airport)

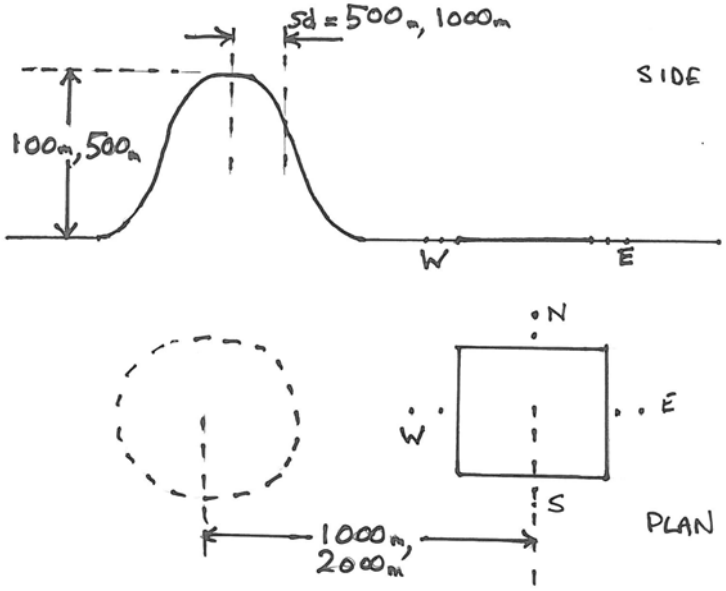
Configurations: uniform slope



Hollow



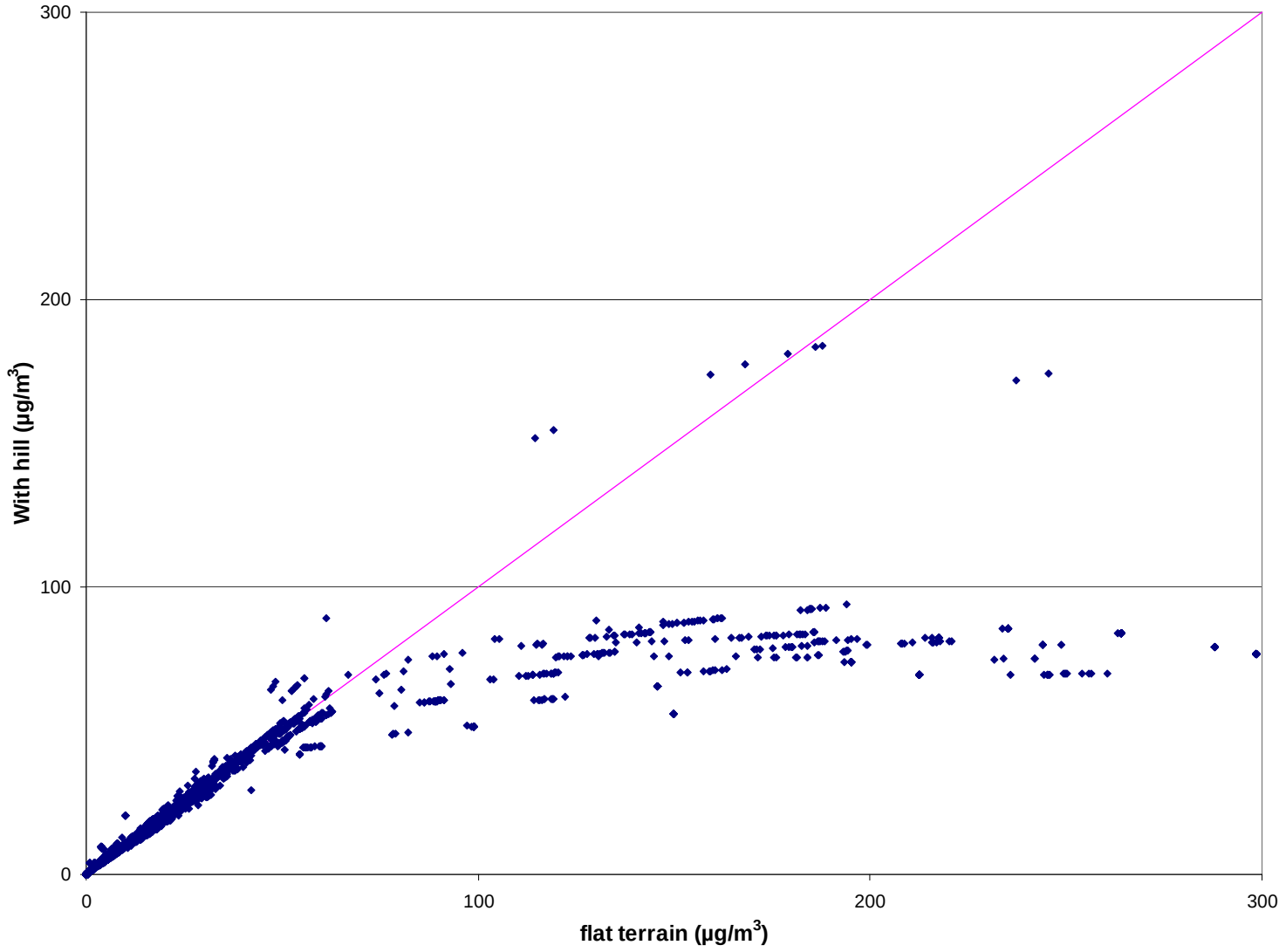
Hill



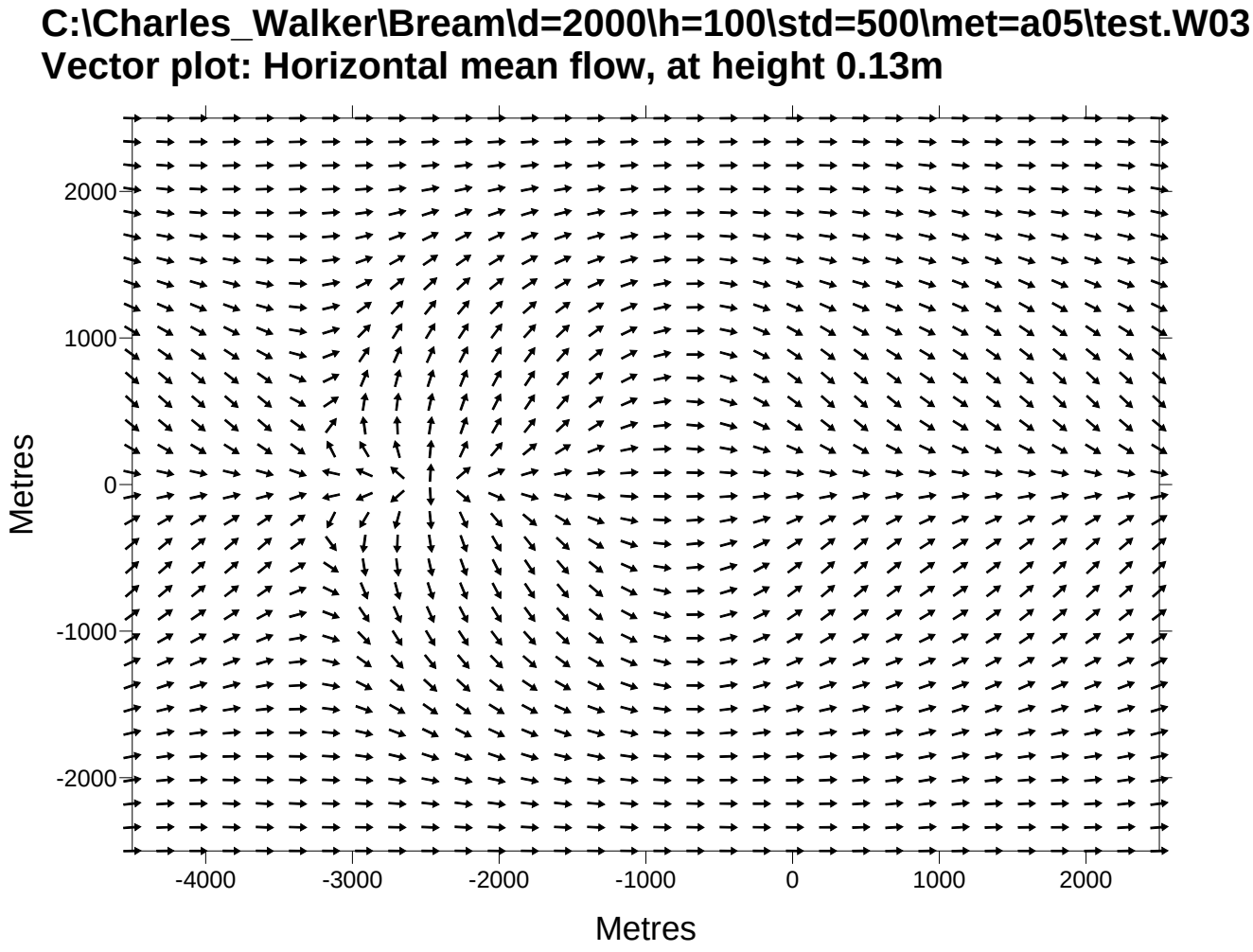
Effect of hills and hollows (1)

Case	Description	24-hour mean concentration ($\mu g/m^3$)			
		Mean	90th %ile	95th %ile	99th %ile
1	Flat terrain	26	68	91	155
2	Slope 10%	12	29	39	57
3	Slope 30%	14	29	38	56
4	Hollow depth 100m, sd=500m	12	26	33	49
5	Hollow depth 100m, sd=1000m	14	30	36	55
6	Hill d=1000m, h= 100m, sd=500m	16	33	39	52
7	Hill d=1000m, h= 100m, sd=1000m	15	27	32	42
8	Hill d=1000m, h= 500m, sd=500m	13	22	26	35
9	Hill d=1000m, h= 500m, sd=1000m	12	22	26	37
10	Hill d=2000m, h= 100m, sd=500m	16	33	42	57
11	Hill d=2000m, h= 100m, sd=1000m	17	34	42	55
12	Hill d=2000m, h= 500m, sd=500m	15	28	36	54
13	Hill d=2000m, h= 500m, sd=1000m	13	22	27	33

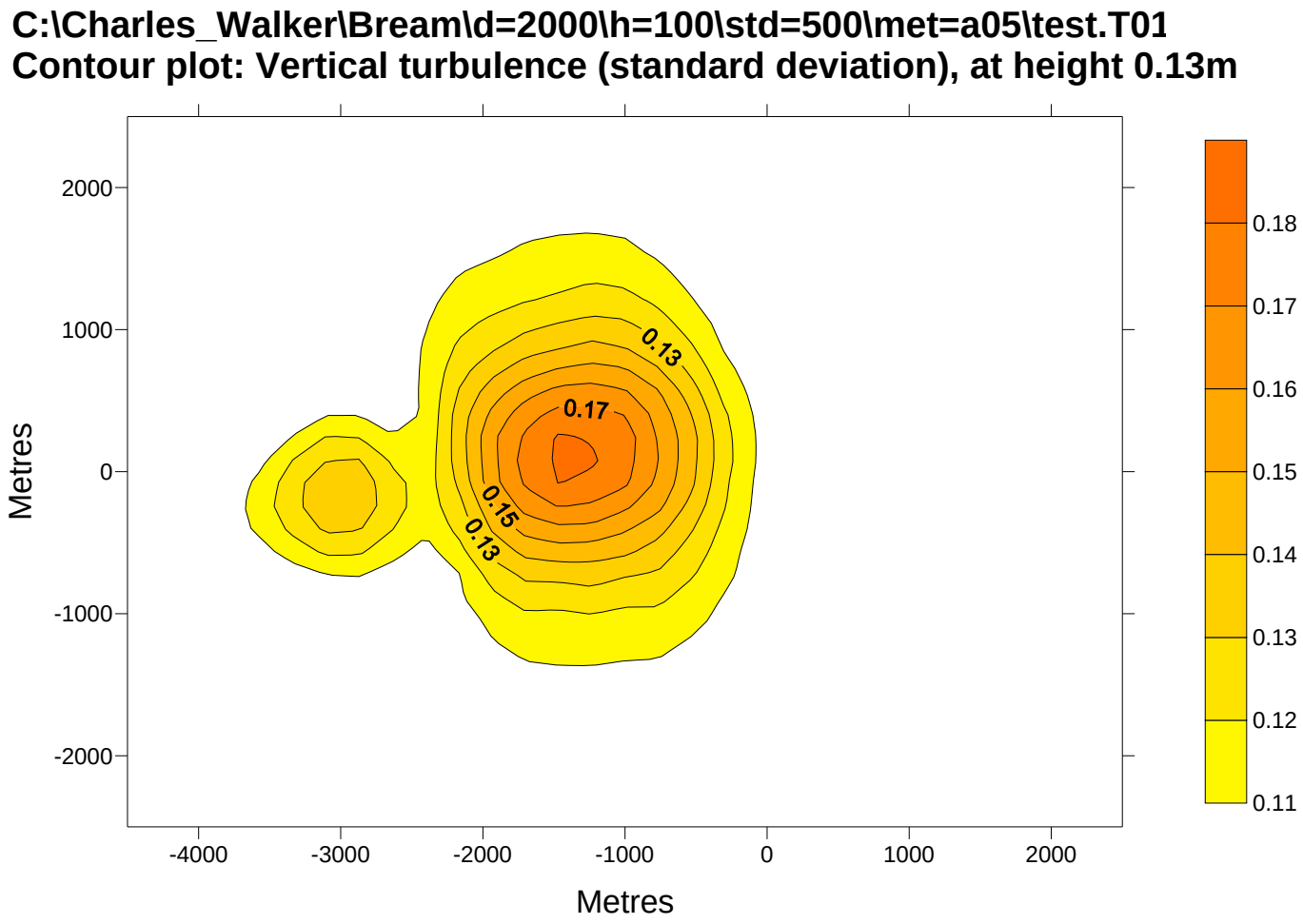
Scatter plot of hourly concentrations (field between hill and receptor)



Higher (hourly) concentration with hill: wind field



Vertical turbulence



Lateral turbulence

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Contour plot: Transverse turbulence (standard deviation), at height 0.13m