

LES Building Model

10/6/23
Priscilla Pak

Completed items

- Generated topography matrix
- Lectures

References:

- Input dataset for experimental results
- Roughness file for LES precursor simulations
(https://www.aij.or.jp/jpn/publish/cfdguide/index_e.htm)

Simulation dimensions

- Simulation domain lengths match test domain lengths exactly
- Discretized domain with a constant grid spacing:

Test domain lengths (H = 0.1 m)	Value	Units
x	2.8	m
y	1.2	m
z	1	m
Test building lengths	Value	Units
x	0.2	m
y	0.1	m
z	0.2	m
spacing = 0.05 m		
Sim domain lengths	Value	Units
x	2.8	m
y	1.2	m
z	1	m
Cells	Domain	Building
x	56	2
y	24	2
z	20	4

Experimental reference variables

variables		value	unit
U0	Reference Velocity	5.27944	m/s
H	Building height	0.2	m
uH		3.226	m/s
c			ppm
q		5.83E-06	m^3/s
cgas	released tracer gas concentration	1.00E+06	ppm
c0	reference gas	4.52E+01	ppm
	c0=cgasq/uHH^2		
Re	Reynolds number	4.3e4	
rH=uH/uref	velocity ratio	0.611	

Grid spacing

Okaze used “10-grid discretization” for their coarse mesh:

- grid spacing at boundary layer = building width / 10

Chose to do “5-grid discretization”: 0.05 m

$$Y^+ = 600$$

U_∞ :

3.226

freestream velocity (m/s)

Δs :

0.05115417165873145

wall spacing (m)

ρ :

1.225

freestream density (kg/m³)

Re_x :

44169.5540404605

Reynolds number

μ :

0.000017894

dynamic viscosity (kg/m s)

L :

.2

reference length (m)

y^+ :

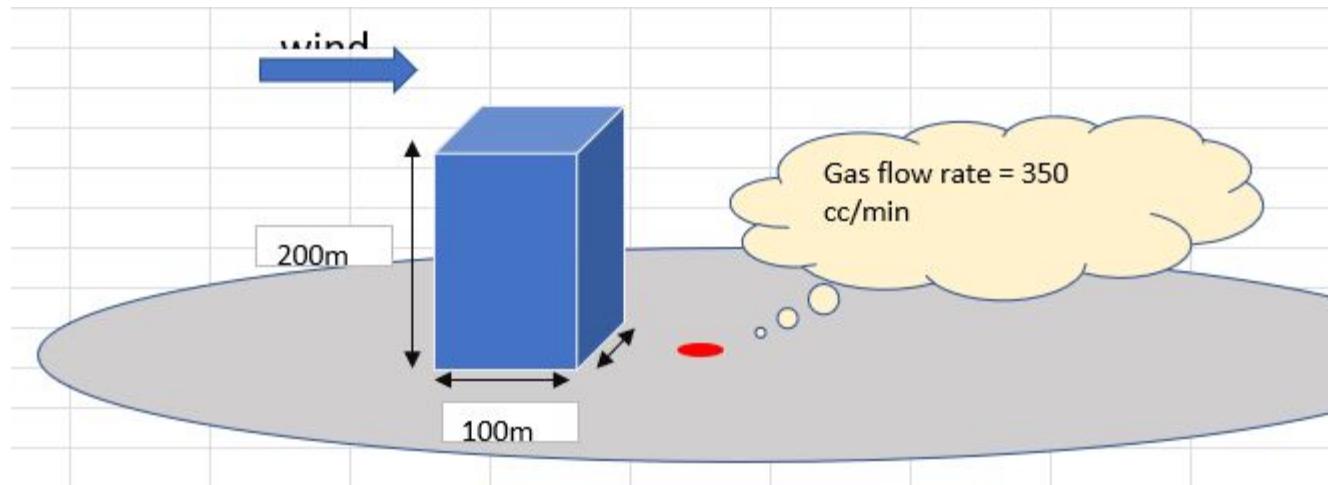
600

desired y^+

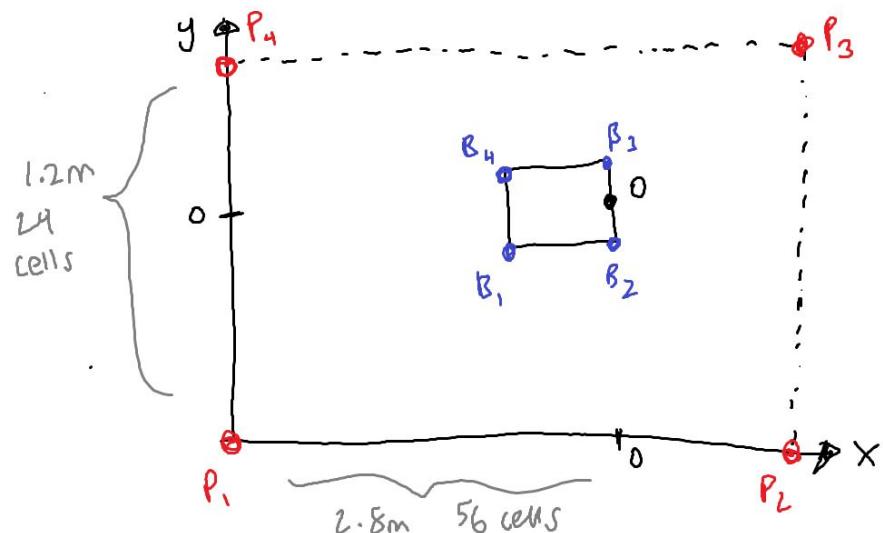
Note: -1 indicates an input error

Reynolds number

- Since the actual building is scaled down by a factor of 1000 in the wind tunnel, in order to keep the reynolds number constant, should the density of the tunnel's air be $1.225 \text{ kg/m}^3 * 1000 = 1225 \text{ kg/m}^3$?



Topography



Locations	Domain	0.05		
Point	x location (m)	x cells	y location (m)	y cells
P1	-0.5	10	-0.6	12
P2	2.3	46	-0.6	12
P3	2.3	46	0.6	12
P4	-0.5	10	0.6	12

Locations	Building	0.05		
Point	x location (m)	x cells	y location (m)	y cells
B1	-0.1	2	-0.05	1
B2	0	0	-0.05	1
B3	0	0	0.05	1
B4	-0.1	2	0.05	1

Reference topography

