A Study on Building Wind Impact Assessment in Seoul, Korea

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1. Introduction

- **Since late 1990`s**

  -> Lots of high-rise building has been built in Korea,

  Especially in 21st century skyscrapers have been built

- **It creates many micrometeorological impacts in adjacent area** <- due to turbulence from skyscrapers

- **It needs the careful and accurate impact assessment**

  -> for keeping the quality of life of urban residents

- **to assess building wind impact**

  In Korea, Only Seoul City Government is doing
  no assessment in Ministry of Environment

- **So far there has been no conceivable impact by several skyscraper construction EIA.**

- **It needs to be checked whether there is no impact or not irrespective of skyscraper construction**

● The purpose of this study

-> To review the current guideline

-> to confirm whether it has been assessed accurately or not

-> to investigate the improvement of current building wind impact assessment guideline in Korea.

2. Materials & Methods

- **To review the EIA in Seoul**
- **To measure the real data &CFD Simulation**
  -> WinMiskam Ver.9
- **comparison & analysis**

2. Materials and Methods

● **study site**

-> Shincheon-dong, Songpa-gu &
Euljiro-dong, Jung-gu, Seoul.

● **Tall buildings, traffic congestions**

● **Proposed constructions**

-> Residential-Commercial Complex Apartments
(123m. 117m, Shincheon), (148m, Euljiro)

Table 1. Micrometeorological assessment guideline of Seoul Government EIA

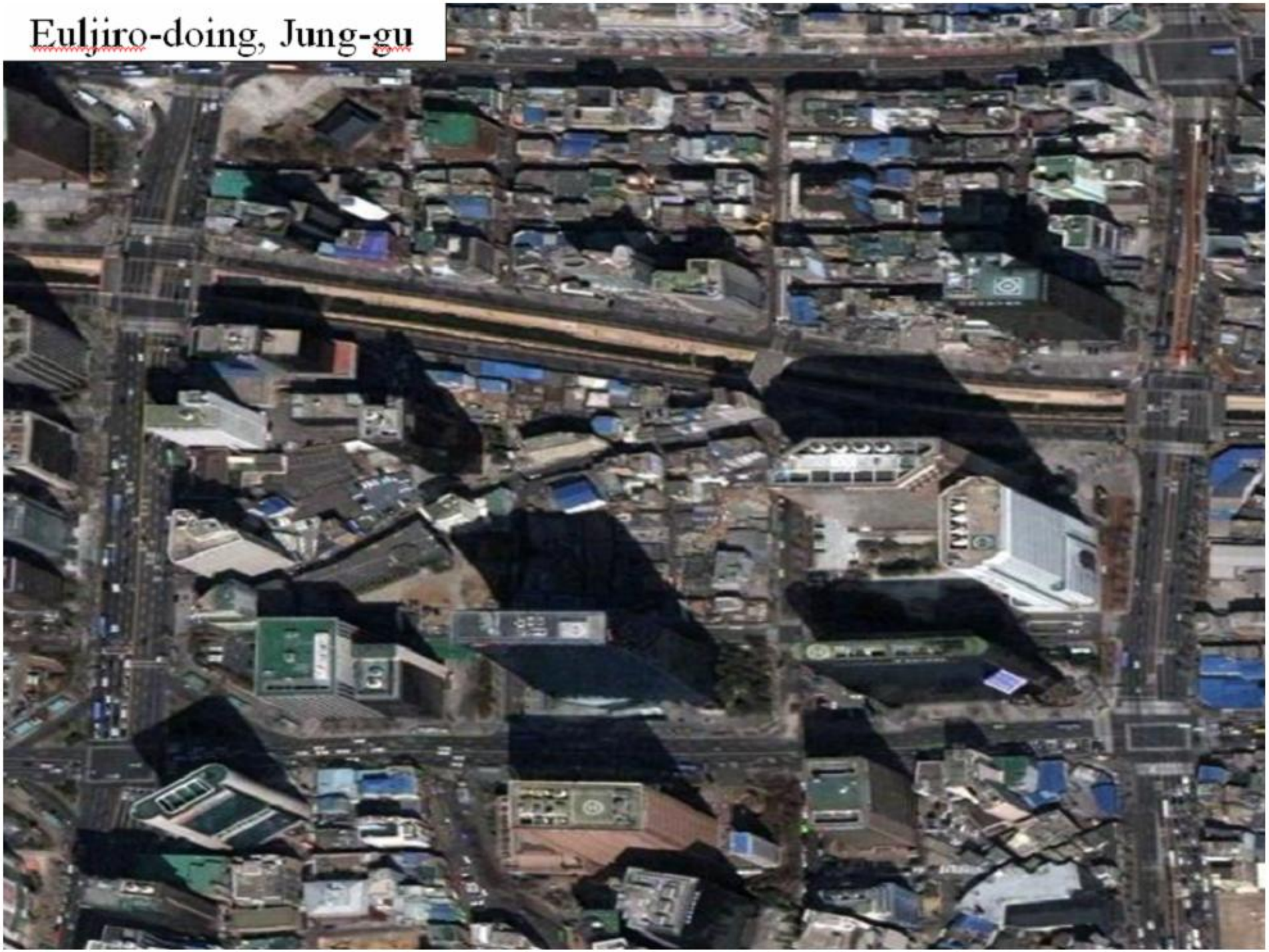
Section	Assessment Items
Impact Assessment Guideline	1) Micrometeorological imapct assessment using the maximum wind speed (95% range) data of weather measurement network and local weather measurement data together with air temperature, humidity, wind (wind speed and direction) 2) ENVI-met model or other environmental numerical simulation model 3) Wind corridor analysis for the adjacent area by the proposed building 4) Air quality impact assessment using micrometeorological impact assessment results
Assessment area	300m radius

Table 2. Seoul City Environment Impact Assessment Results

EIA Project	Resolution	Input wind speed (m/s)	Estimation result	Analysis model
Shincheon-doing*	8m×8m	0.95	<0.5m/s ↑	ENVI-met
Euljiro 2-ga*	6m×6m	2.6	<0.12m/s ↑	ENVI-met
Gajaewool New town	8m×8m	(2.9)	-	LES VBM FDM code
Ahyeon 3-zone	8m×8m	0.9	<0.2~0.9m/s	ENVI-met
Heungin-dong	8m×8m	1.5	<0.4~0.8m/s	ENVI-met
Dapsimni16- zone	8m×8m	1.1	<0.45m/s	ENVI-met
Tookseom 3-zone	8m×8m	(2.2)	-	LES VBM FDM code

Shinchon-doing, Songpa-gu

Euljiro-doing, Jung-gu



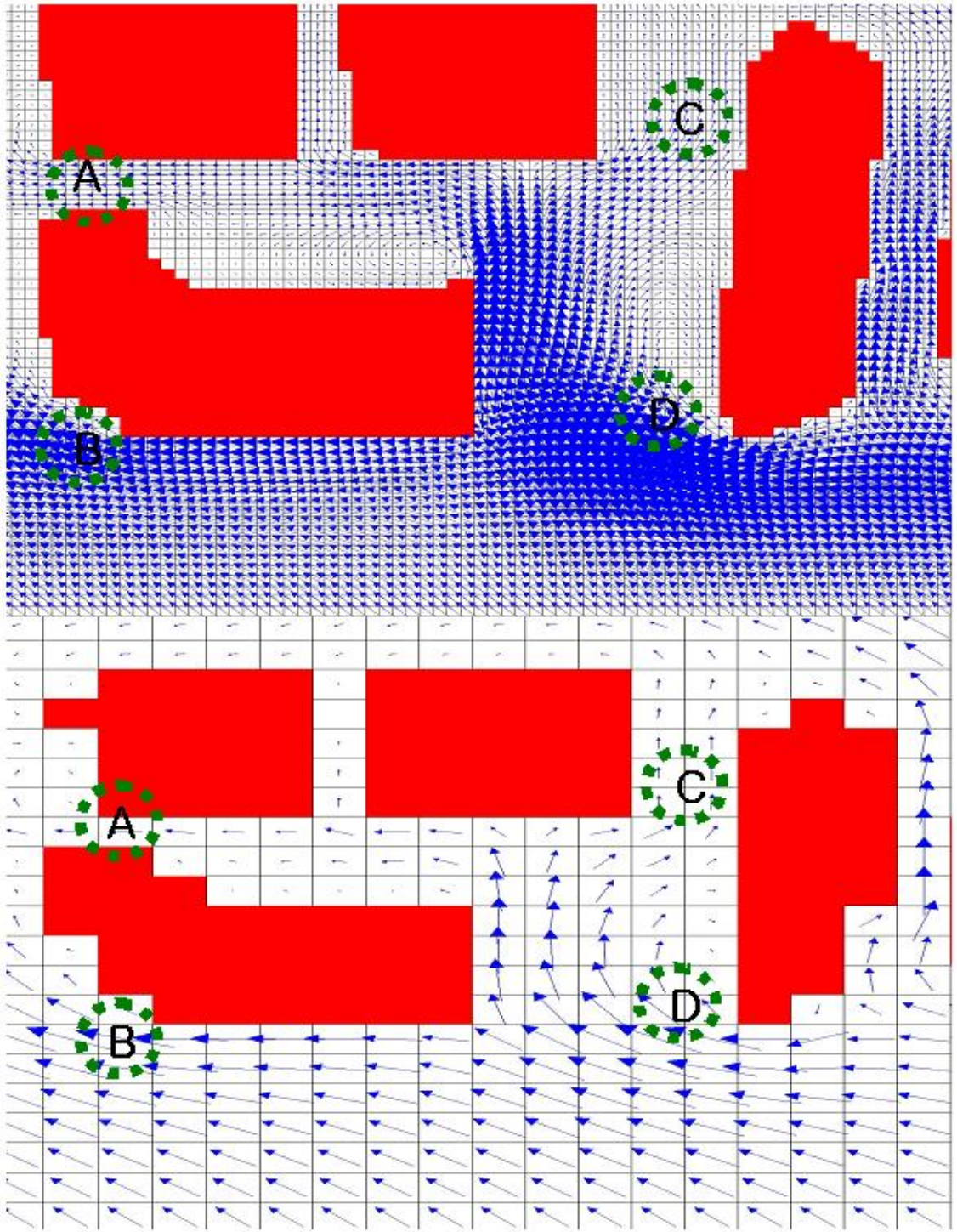
3. Results and Discussion

Table 3. comparison of two approaches

	Seoul Government EIA	**This Study**
Model	ENVI-met	WinMiskam
Resolution	8 ~ 6m	2m & 8m
Input (m/s)	0.95	8
	2.6	

Table 4 Sincheon Area (Elev; 10m, CFD Simulation result)

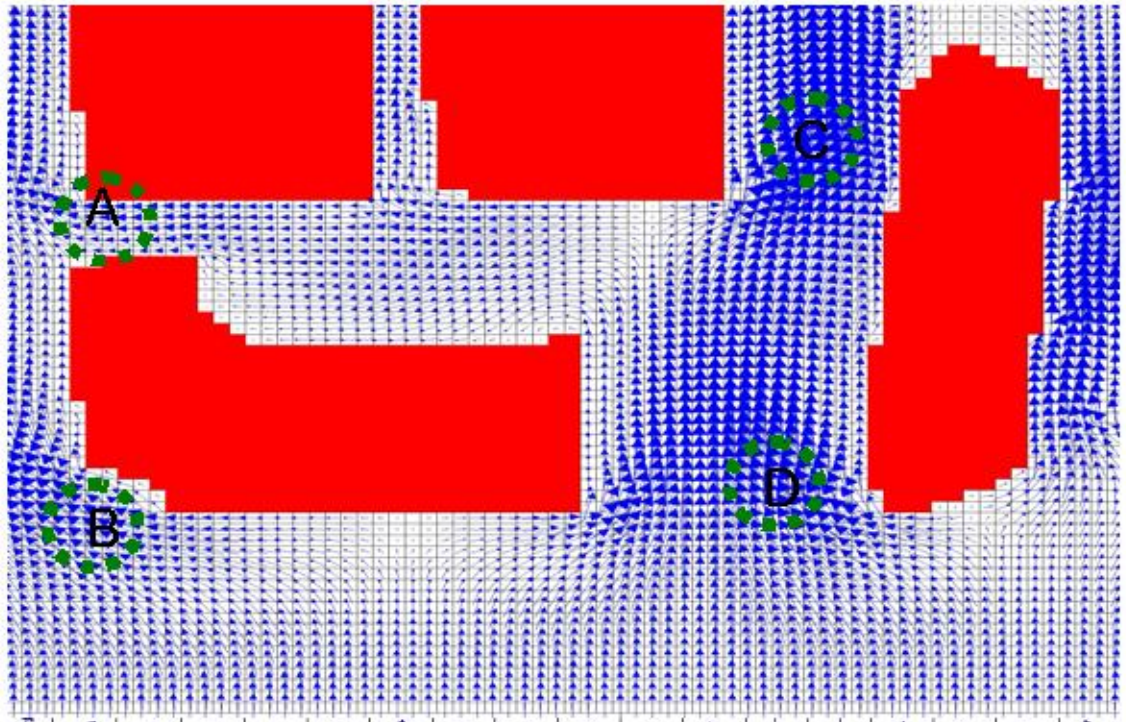
	135°		180°		270°		Seoul Government EIA
	2m	8m	2m	8m	2m	8m	
A	4.9	4.2	7.9	8.7	14.5	7.6	0.95
B	15.1	12.5	11.5	8.4	12.1	8.4	
C	4.5	4.4	14.9	11.7	7.3	7.3	
D	14.7	9.9	12.8	8.3	7.0	5.3	



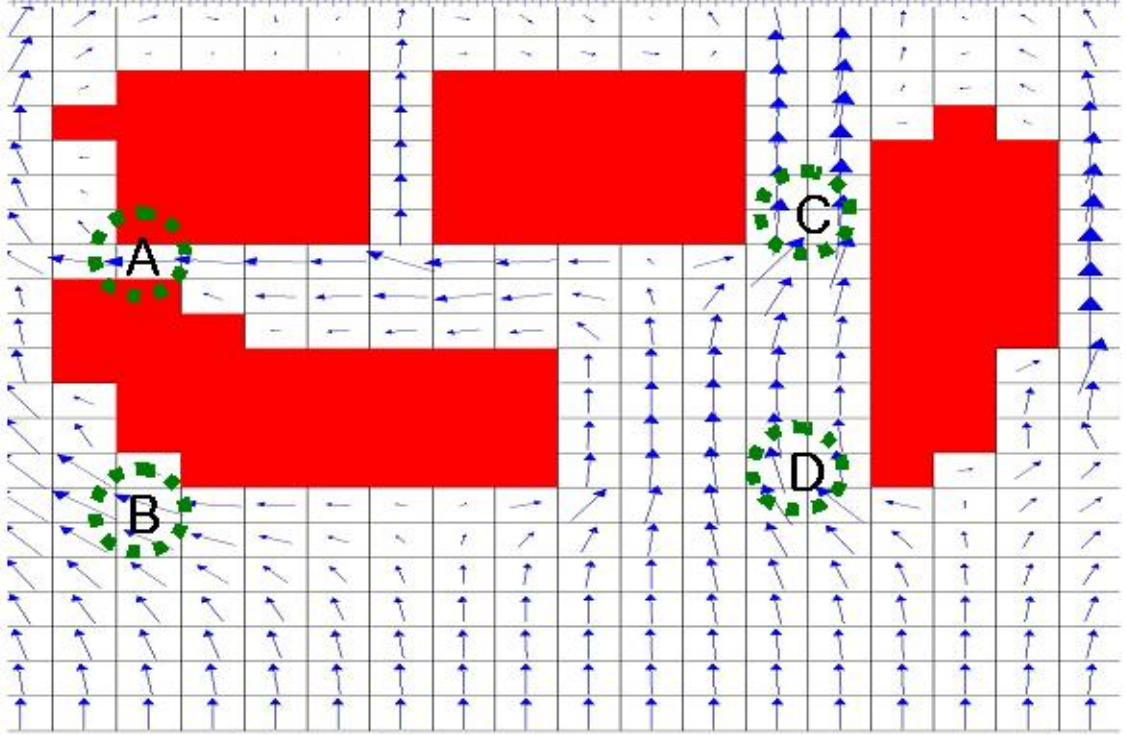
Resolution : 2m×2m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 135°
(B :15.1m/s)

Resolution : 8m×8m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 135°
(B :12.5m/s)

Shincheon

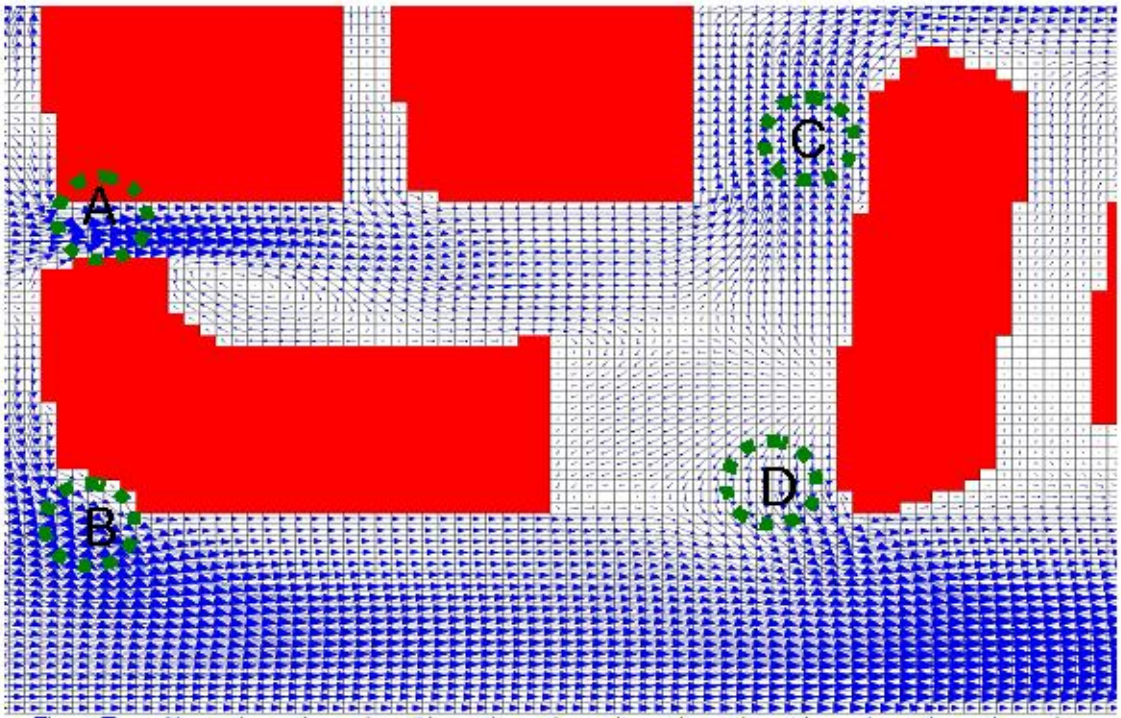


Resolution : 2m×2m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 180°
(C : 14.9m/s)

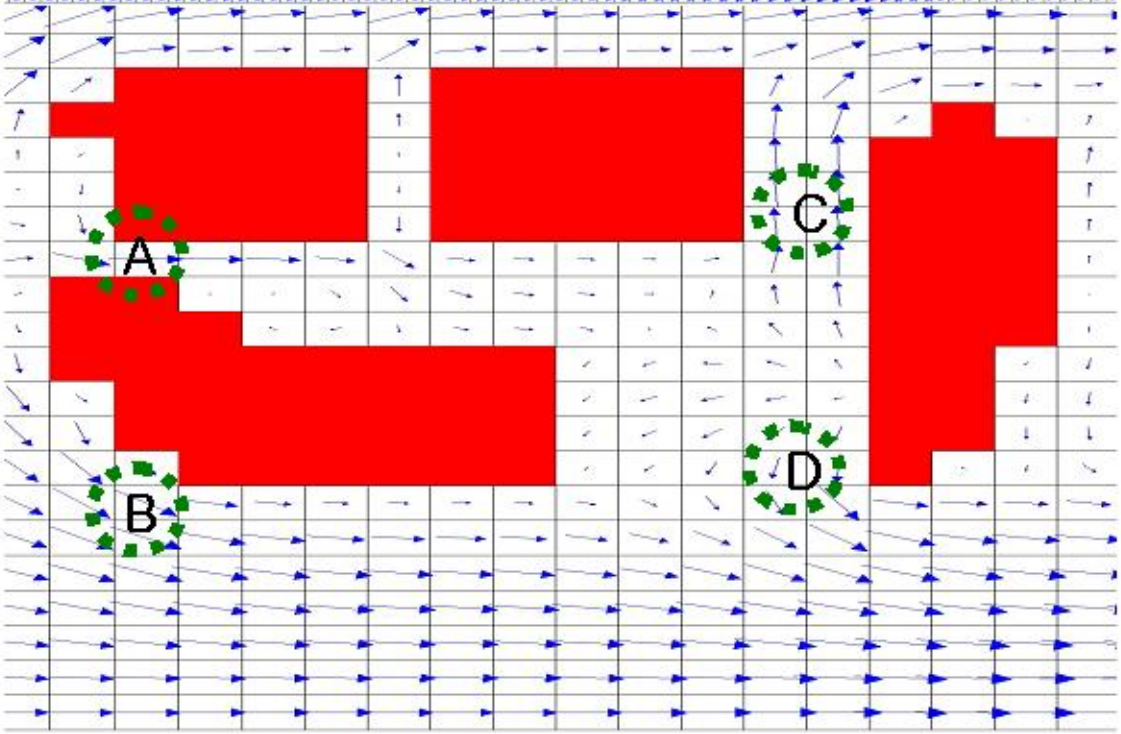


Resolution : 8m×8m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 180°
(C :11.7m/s)

Shincheon



Resolution : 2m×2m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 270°
(**A** : 14.5m/s)

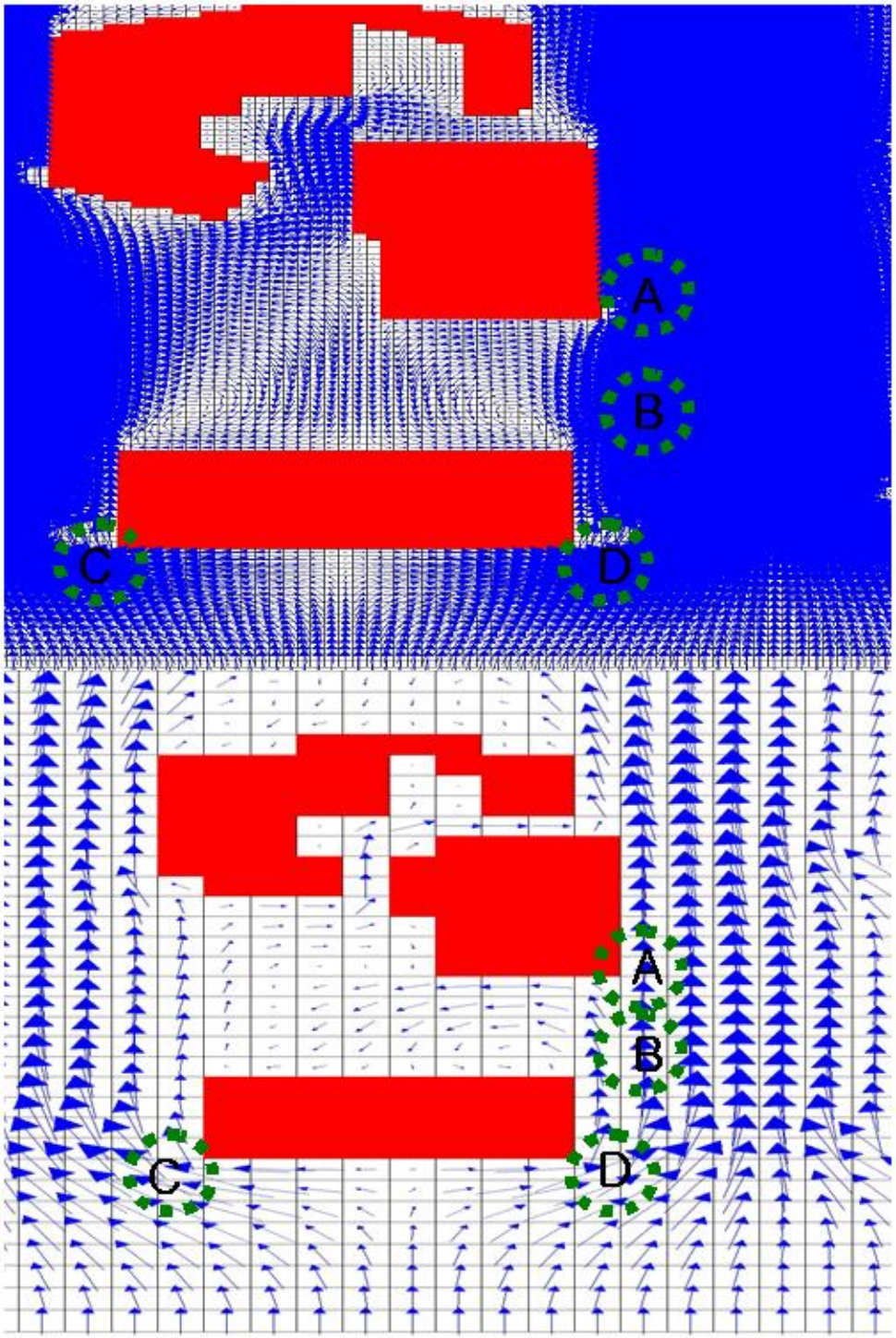


Resolution : 8m×8m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 270°
(**A** : 7.6m/s)

Shincheon

Table 5. Euljiro area (Elev; 10m, CFD Simulation result)

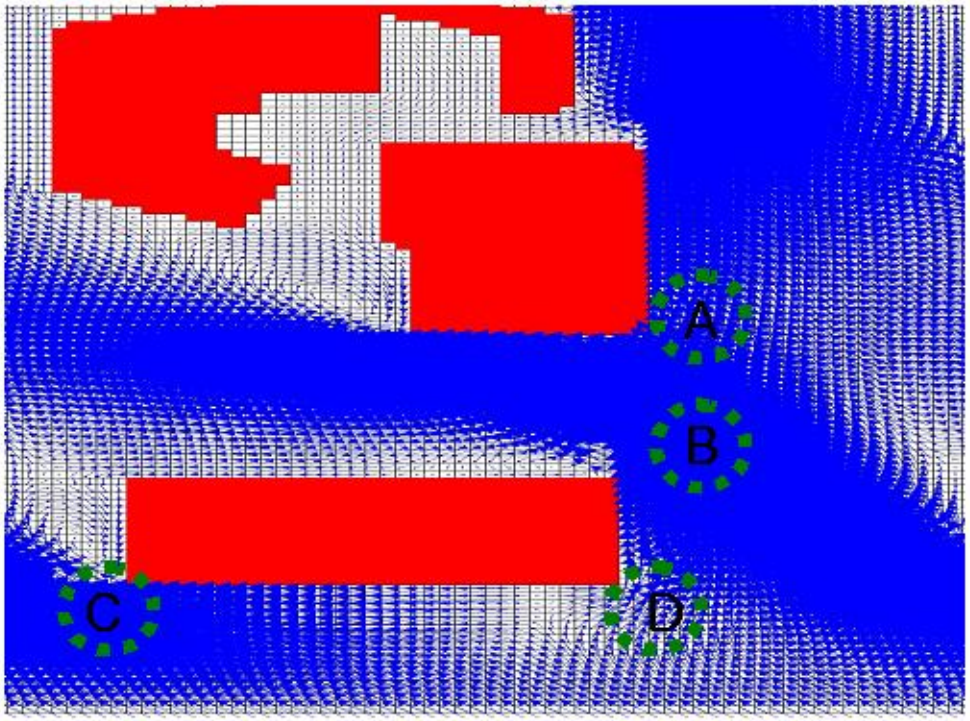
	135°		180°		270°		Seoul Government EIA
	2m	8m	2m	8m	2m	8m	
A	7.9	8.5	10.7	11.1	8.5	8.4	2.6
B	22.7	15.4	10.7	8.2	16.6	18.9	
C	21.8	19.2	23.9	15.9	19.0	12.5	
D	10.0	7.1	24.2	15.0	11.6	6.1	



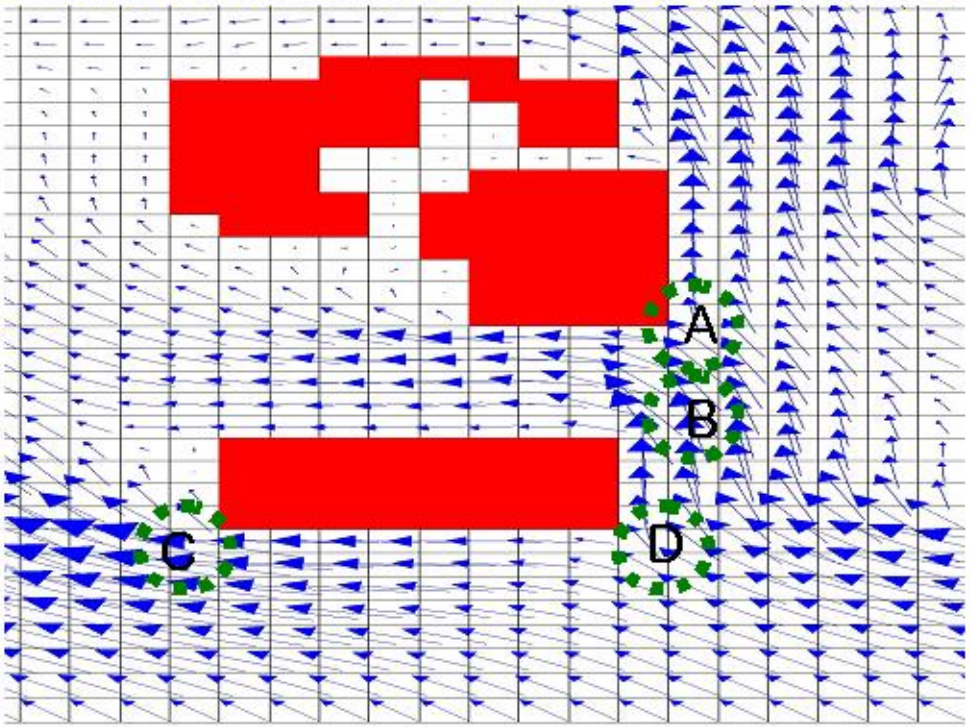
Resolution : 2m×2m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 180°
(**D** :24.2m/s)

Resolution : 8m×8m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 180°
(**D** :15.0m/s)

Euljiro

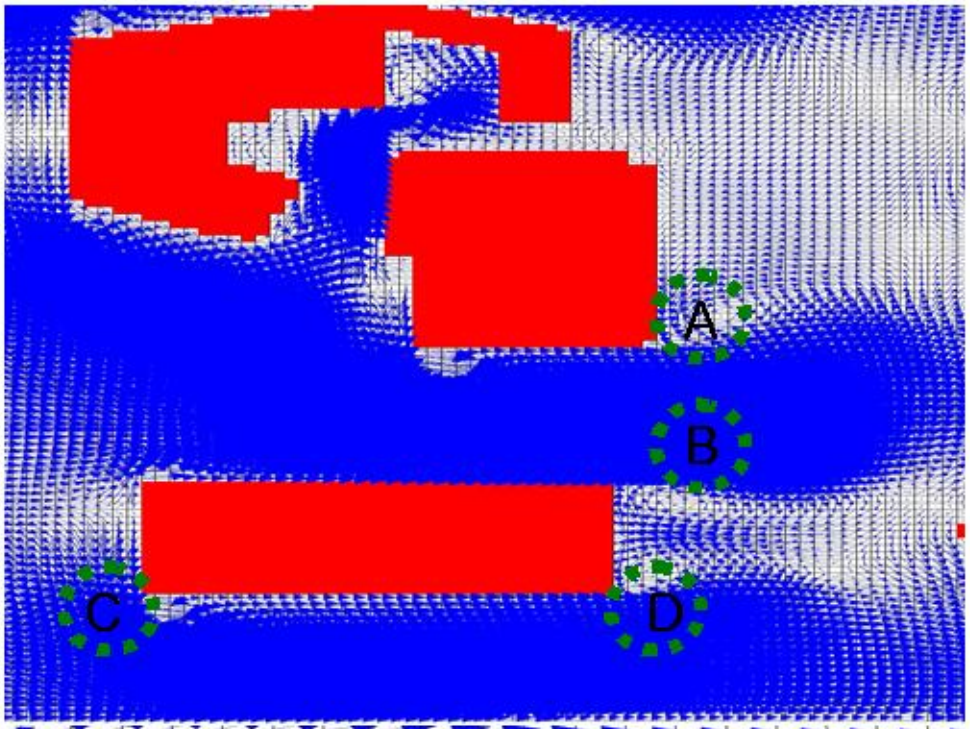


Resolution : 2m×2m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 135°
(**B** :22.7m/s)

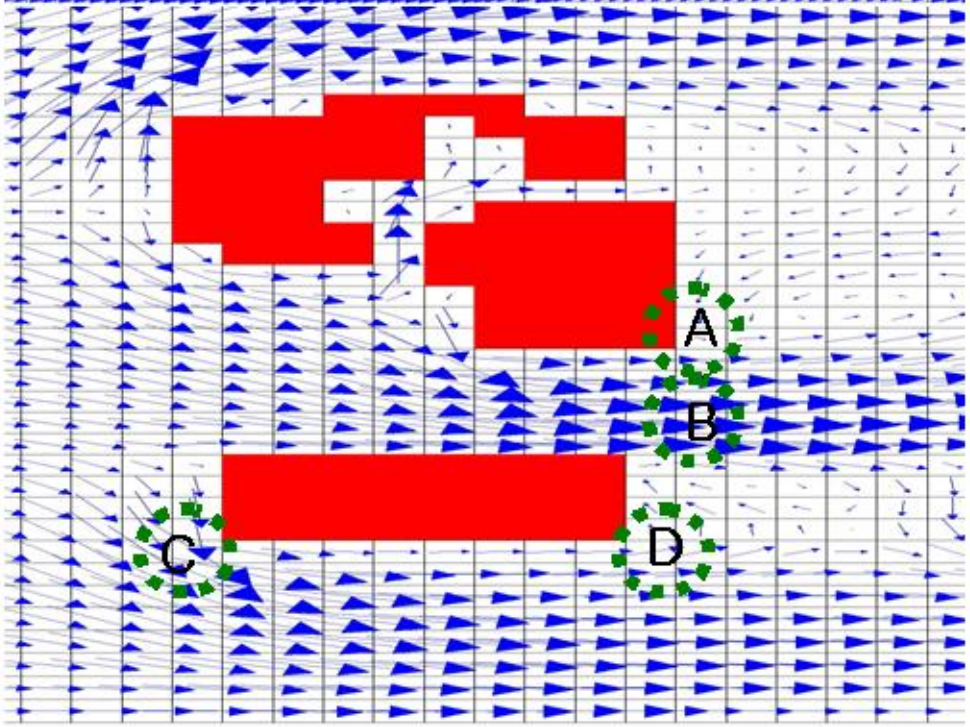


Resolution : 8m×8m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 135°
(**B** :15.4m/s)

Euljiro



Resolution : 2m×2m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 270°
(**C** :19.0m/s)

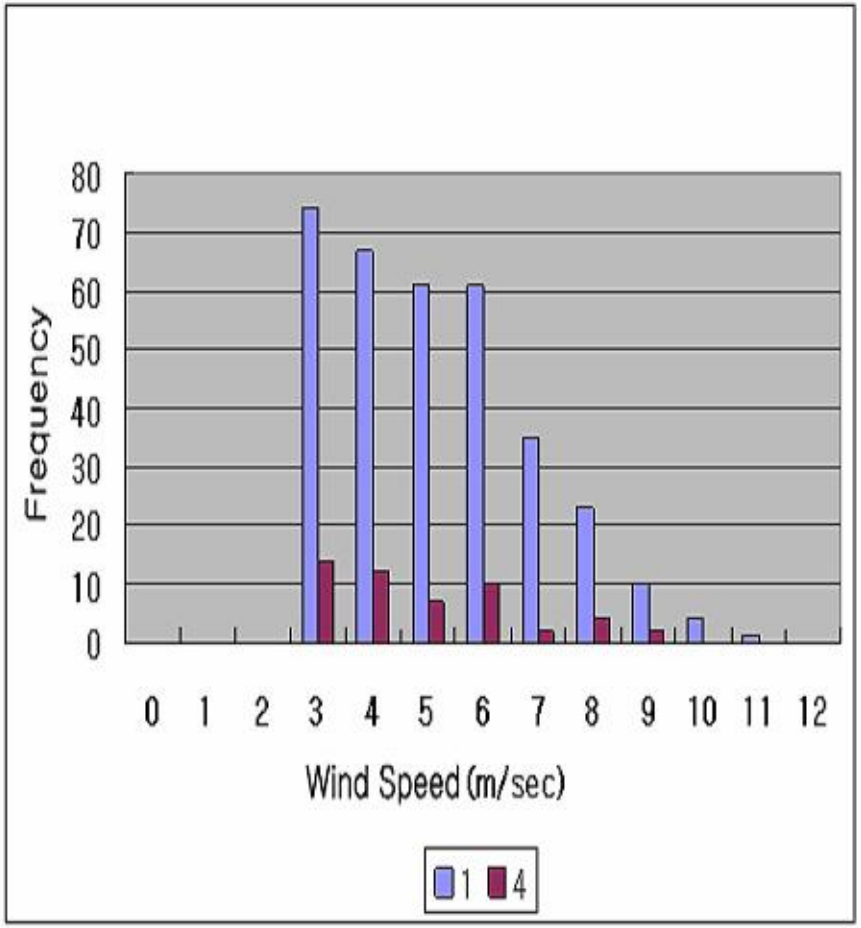


Resolution : 8m×8m
Initial z : 10m
Wind Velocity : 8m/s
Wind Direction : 270°
(**C** :12.5m/s)

Euljiro

Measured Data before Construction at 'B' for ½ hour

2 sec. interval 2006/11/09 14:00 – 14:30



Beaufort scale	Wind speed	Point B
(m/sec)	(m/sec)	1
10.8-13.8	>11	1
	>10	4
8.0~10.7	>9	10
	>8	23
5.5~7.9	>7	35
	>6	61
	>5.5	36
3.4~5.4	>5	25
	>4	67
	>3.4	47
< 3.3	>3	27
		337

Discussion

● **The Wind speed at Shincheon area and Euljiro area**

-> Neglectable change vs. abrupt increase

Why?

1) When the model input data

−> the mean wind speed input,
not the maximum wind velocity

2) Problem of Resolution

densely built area, 8m −> too coarse

3) Model selection problem

−> (ENVI-met) max. # of cells −> 25

Because this CFD model is designed for low-rise building in Germany, not for skyscrapers in Korea

4. Conclusions

Suggestion
for building wind EIA improvement

1) Resolution should be finer

2) Initial input wind speed data should be higher

3) Model should handle large volumes of data