

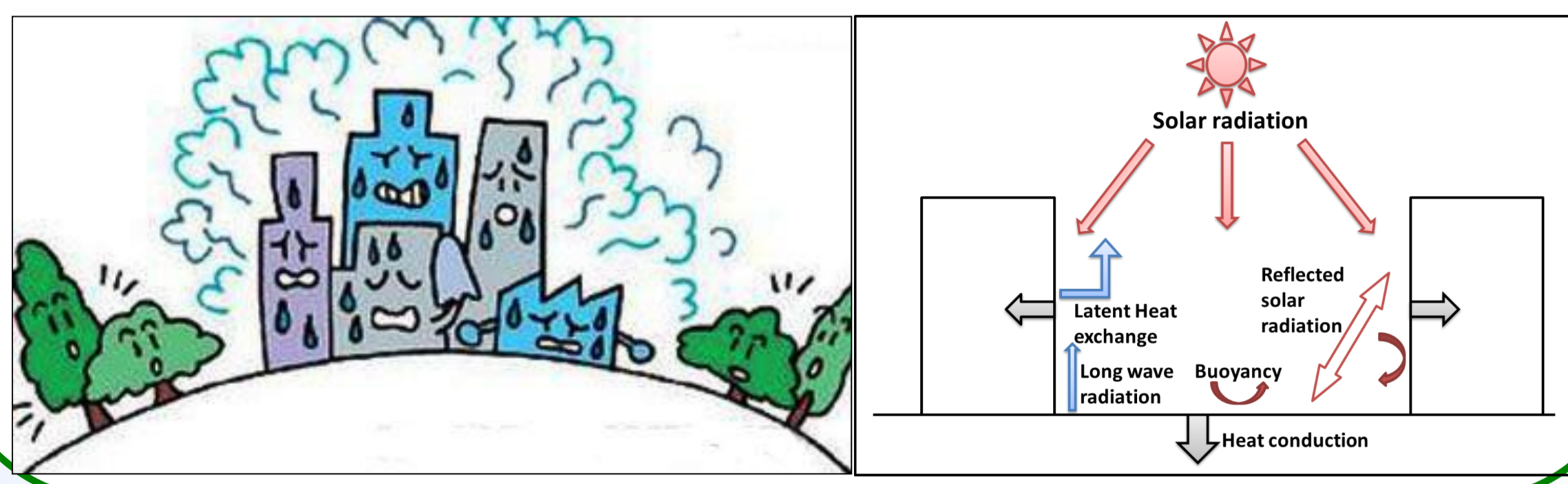
An Experimental Study on Exploring the Possibility of Applying Artificial Light as Radiation in Wind Tunnel

Summary

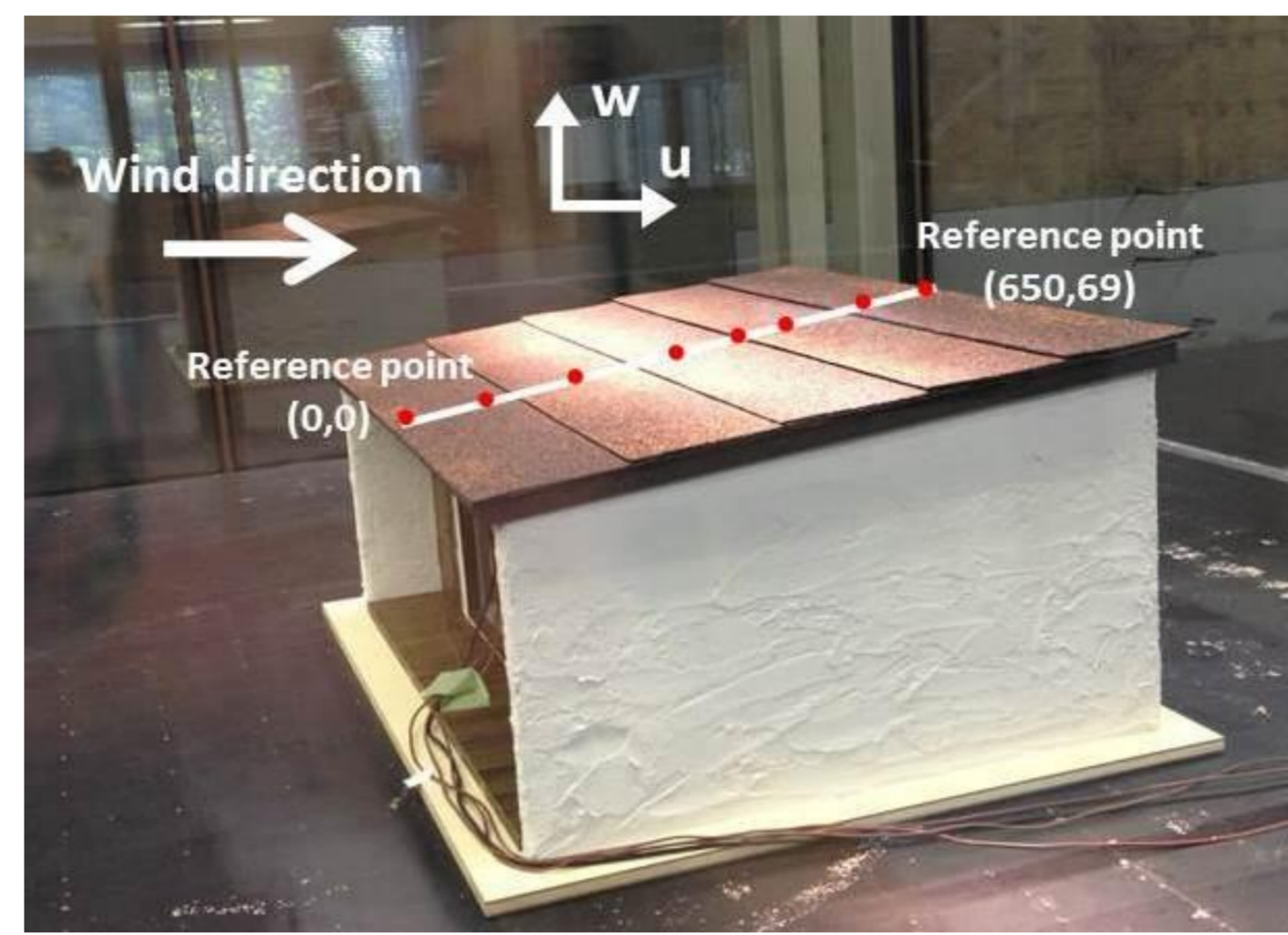
We conducted experiments to explore the possibility of applying artificial light as solar radiation using a scale building model made by real construction materials. Upon heating the roof top, the wind velocity increased while turbulent intensity decreased. We also changed the roof surface properties by applying insulated coating (composed of micro-size hollow silica particles), and found out the influence of radiation can be observed.

Background

- Solar radiation heats the wall and surface of canopy, generates a strong buoyancy flow.
- The impact of this buoyancy is more obvious at the condition of low wind velocity.
- Scale modeling is a very effective and economical way
- Fewer outdoor experiments were conducted because it is difficult to control the needed conditions.
- Most of the previous studies used heating elements to generate buoyancy flow and investigate the heating influence of canopy wall.

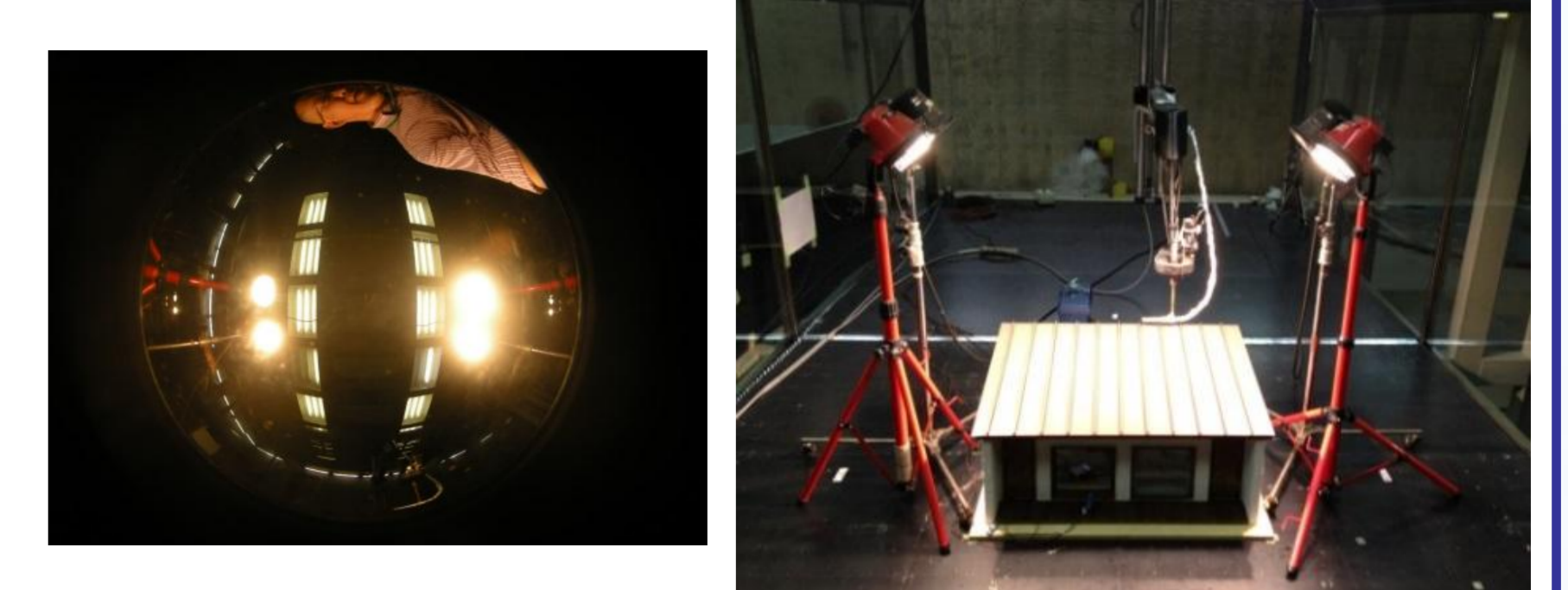
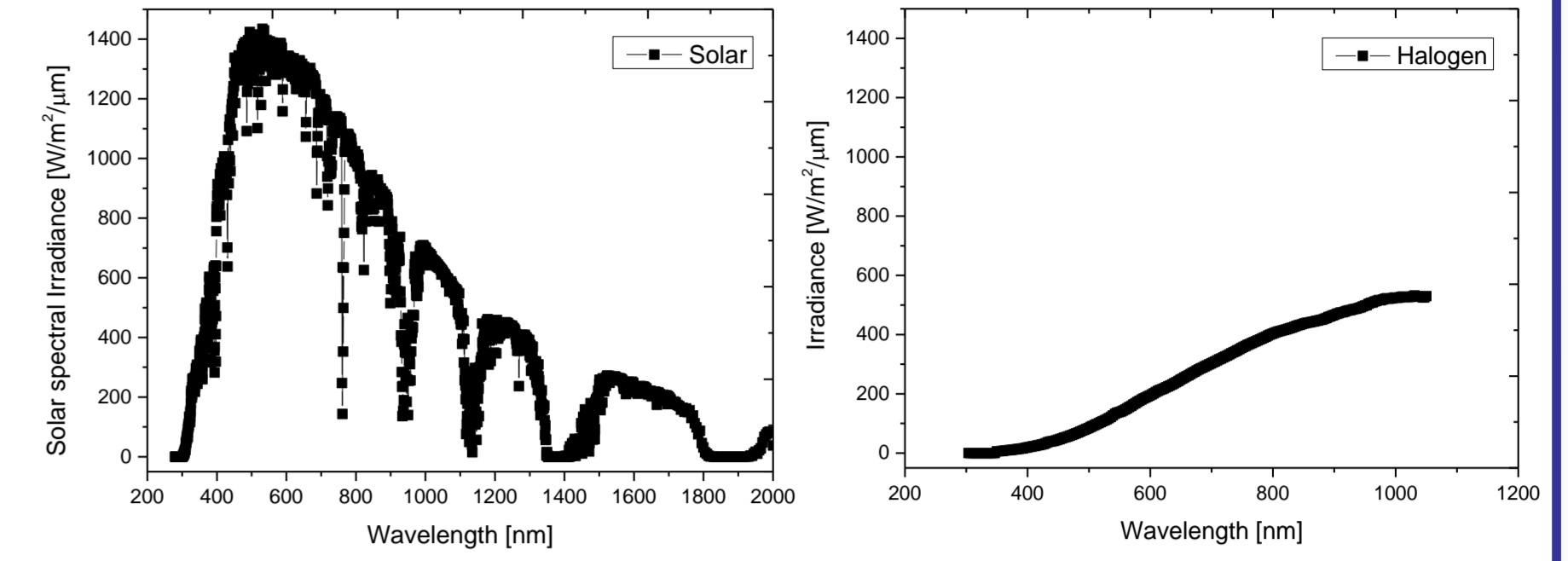


Methodology

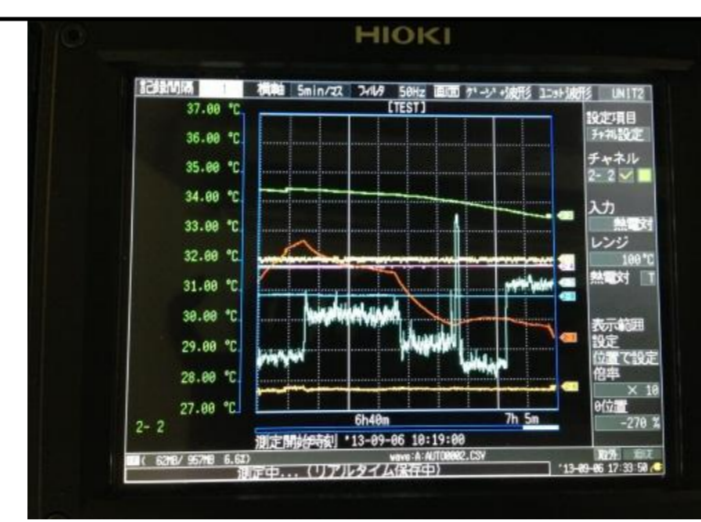


Experimental setup

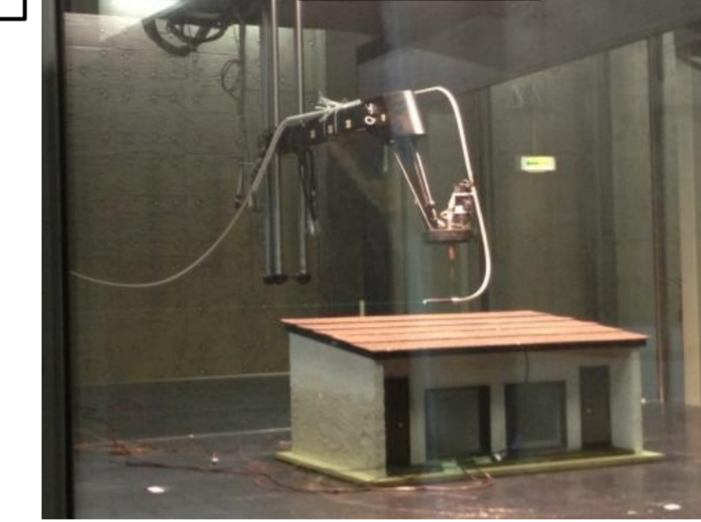
Comparison of Irradiance between solar and halogen



Logger for thermo couples



LDV



- Neutral condition, no roughness
- Blockage effect: 5%

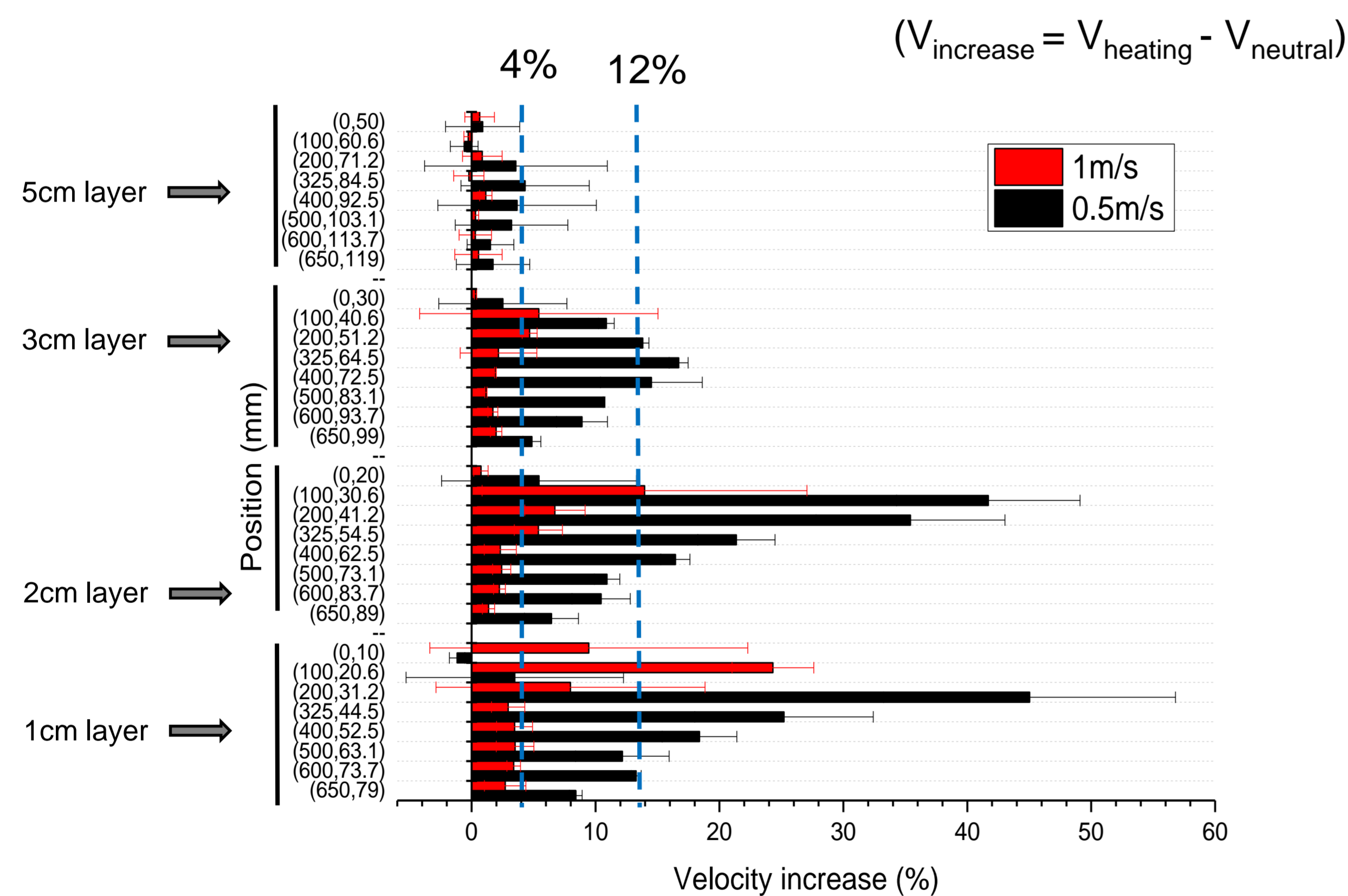
	Albedo (%)
Asphalt	2

Coordinate of testing points(unit: mm)

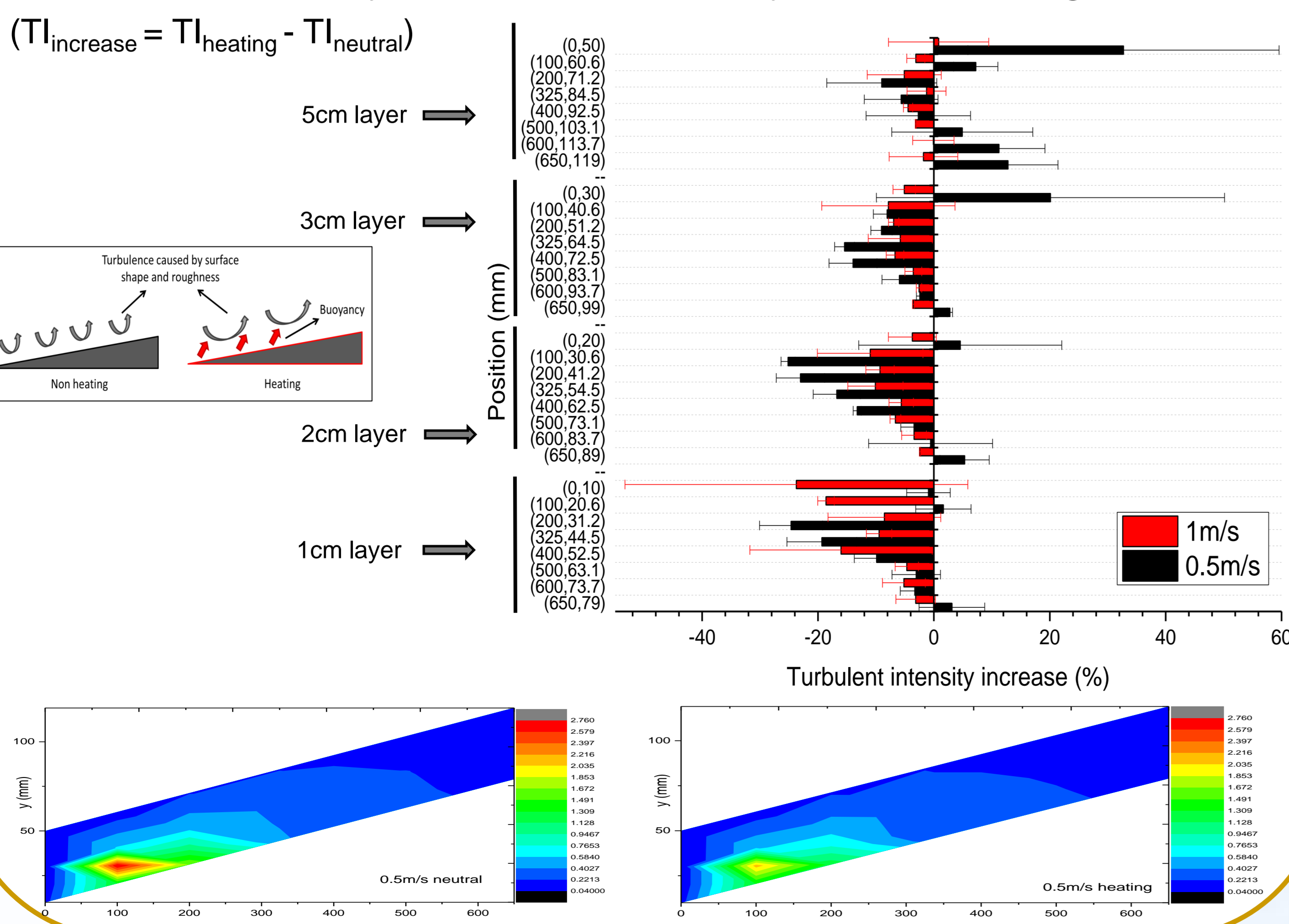
Layer distance above roof	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
50mm	(650,119)	(600,113.7)	(500,103.1)	(400,92.5)	(325,84.5)	(200,71.2)	(100,60.6)	(0,50)
30mm	(650,99)	(600,93.7)	(500,83.1)	(400,72.5)	(325,64.5)	(200,51.2)	(100,40.6)	(0,30)
20mm	(650,89)	(600,83.7)	(500,73.1)	(400,62.5)	(325,54.5)	(200,41.2)	(100,30.6)	(0,20)
10mm	(650,79)	(600,73.7)	(500,63.1)	(400,52.5)	(325,44.5)	(200,31.2)	(100,20.6)	(0,10)

Applying artificial light with different inflow velocities

- Velocity increase at each layer after heating the roof



- Turbulent intensity increase at each layer after heating the roof

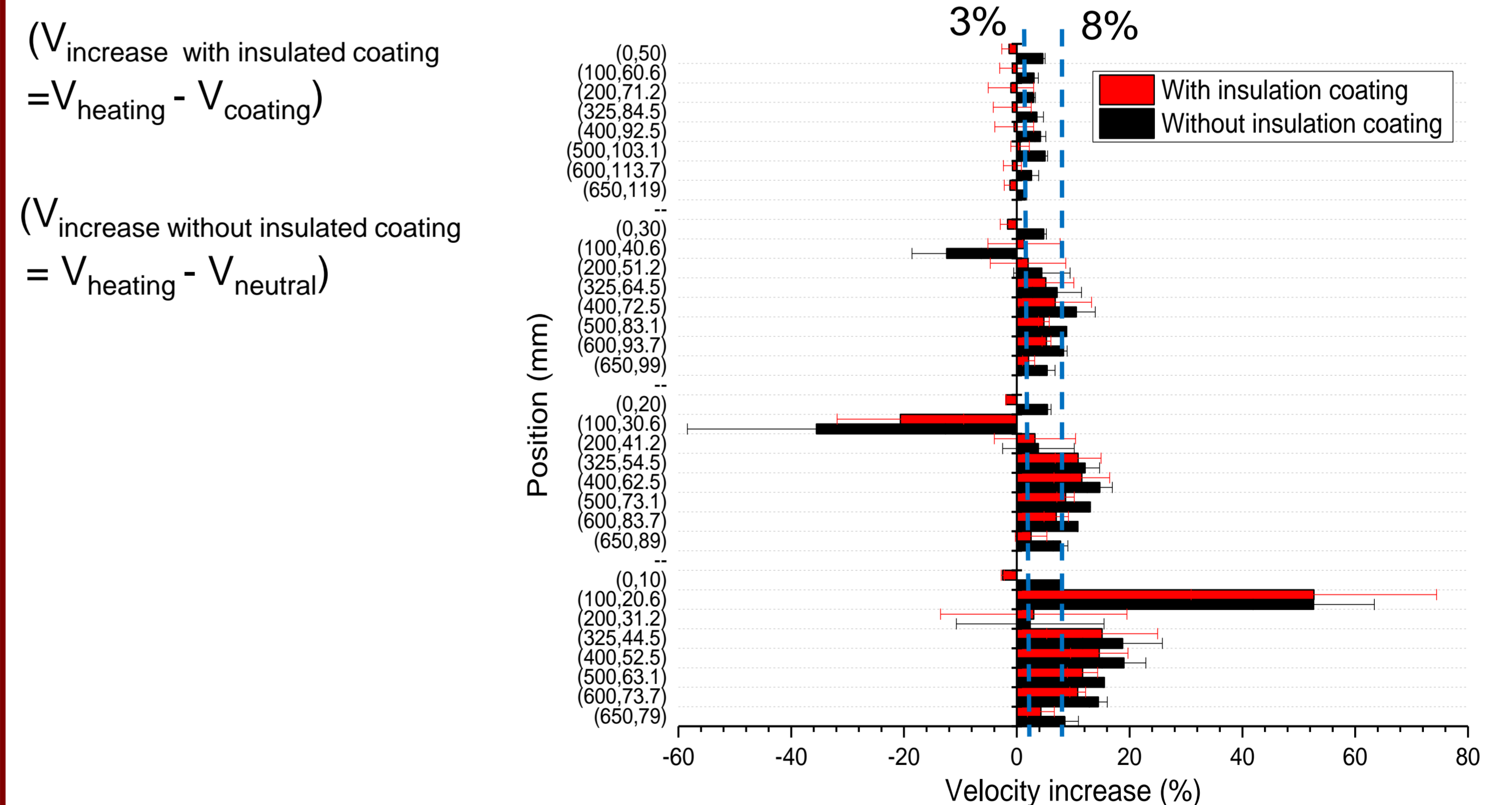


Applying insulated coating on rooftop

	Temperature increase (°C)	
	No coating	coating
Roof	44.47	44.48
Indoor	6.38	5.63



- Velocity increase at each layer after heating the roof (with and without insulated coating)



- Turbulent intensity increase at each layer after heating the roof (with and without insulated coating)

