

# Evaluation of ventilation capacity in urban areas using WRF/Chem

## Background

- Longer dwell time of pollutants inside the city due to high density of cities
- Since the generation condition varies depending on the substance, it is difficult to evaluate the ventilation capability uniformly in the city

## Objective

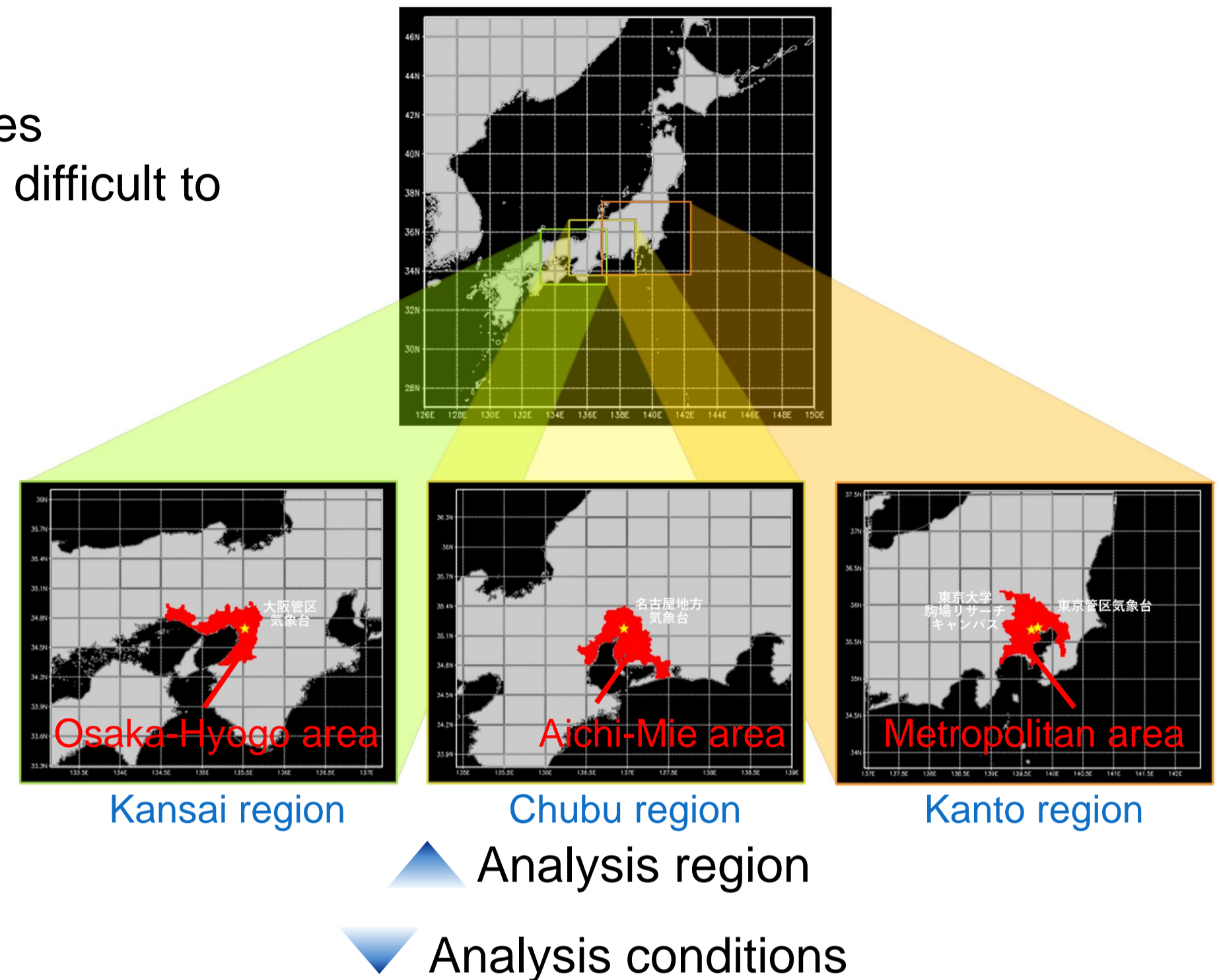
- Evaluation of ventilation capacity of major urban areas of Japan by tracer gas analysis

## Simulation conditions

- Simulation model: **WRF-Chem**  
(Weather Research and Forecasting coupled with Chemistry)
- Target area: Three major metropolitan areas where air pollution is severe (Metropolitan area, Aichi-Mie are, Osaka-Hyogo area)
- Tracer gas: Carbon monoxide
- Release rate: **100 mol/km<sup>2</sup>/h**  
(From the ground surface in the urban areas)
- Chemical reaction / Surface deposition process are ineffective
- No nesting of domains

## Evaluation index

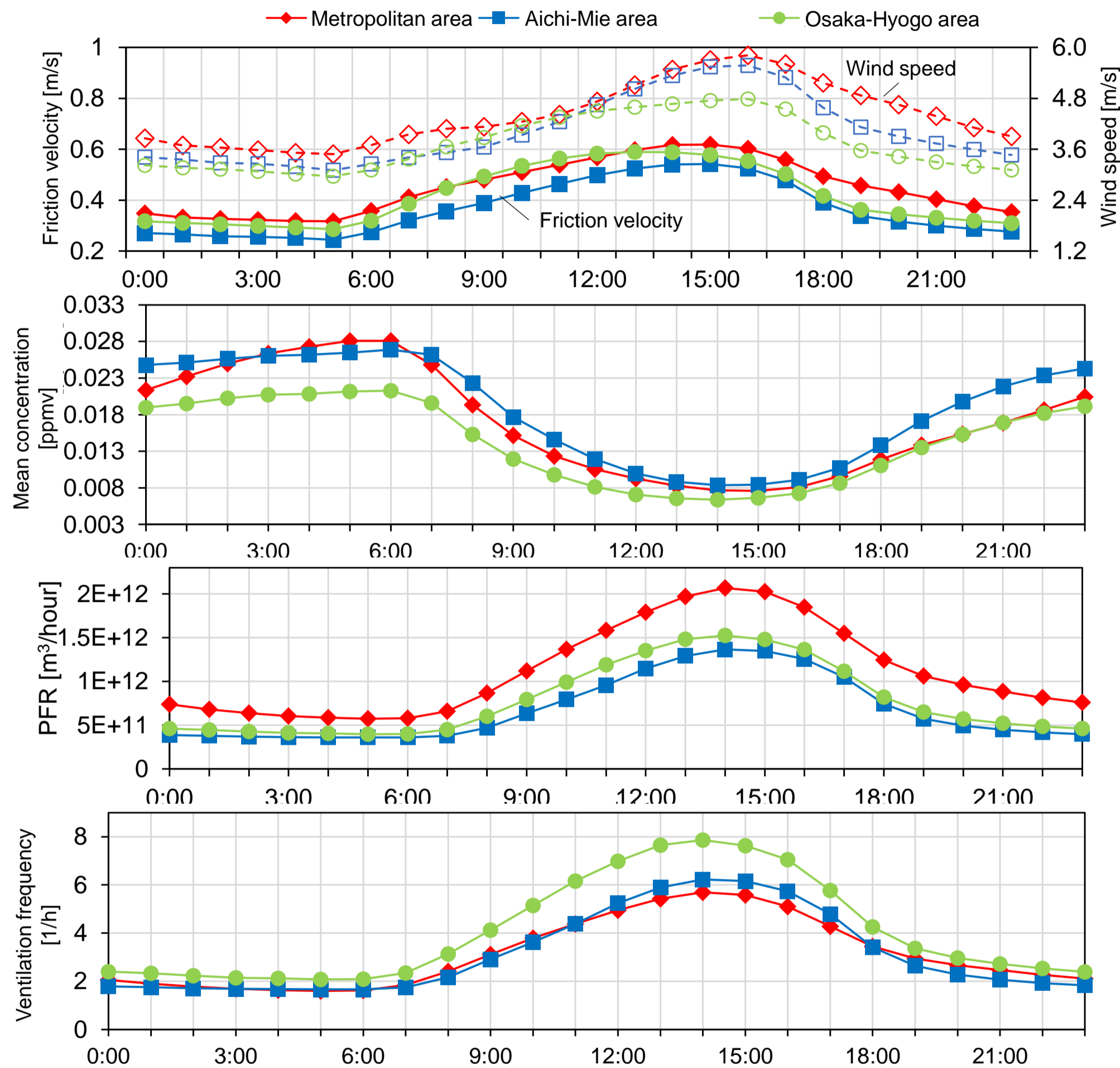
- **PFR** (Purging Flow Rate): Effective ventilation volume for contaminant removal [m<sup>3</sup>/h]
- **Ventilation frequency**: Value obtained by dividing PFR by the volume of the metropolitan area to be evaluated
- **Friction velocity**: The frictional stress of the ground surface which is converted into the dimension of velocity and it is related to the degree of turbulent diffusion



Region	Analysis area	Target area	Area of the target	Grid resolute.	Analysis period
Kanto	$2.01 \times 10^5$ km <sup>2</sup>	Metropolitan area	5,624km <sup>2</sup>	2km	One month (May 2006)
Chubu	$1.13 \times 10^5$ km <sup>2</sup>	Aichi-Mie area	3,400km <sup>2</sup>	2km	One year (2006)
Kansai	$1.13 \times 10^5$ km <sup>2</sup>	Osaka-Hyogo area	3,012km <sup>2</sup>	2km	One month (May 2006)

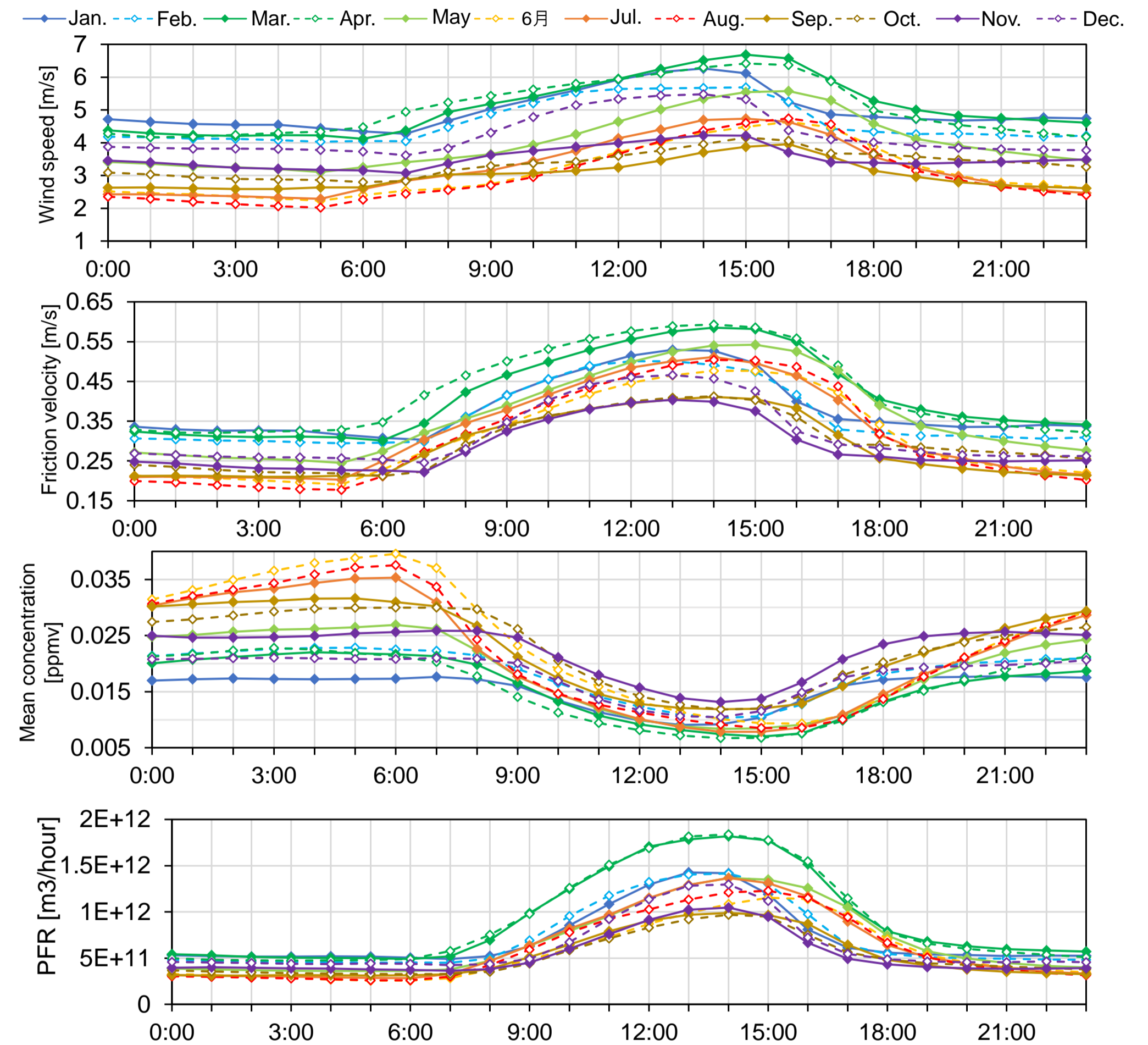
# Evaluation of ventilation capacity in urban areas using WRF/Chem

Comparison of ventilation capacity (May, monthly average)



■ Osaka-Hyogo area has a narrower urban area. Because the influence of the sea breeze is large due to its topographical features, the ventilation capacity is better than in other urban areas.

Seasonal change in ventilation capacity (Aichi-Mie area, monthly average)



■ The ventilation capacity was shown to be high in spring, low from summer to autumn.