

Comparisons of direct-sun/Multi-Axis VCDs (NO₂, HCHO) observed in urban and rural PGN sites in Korea

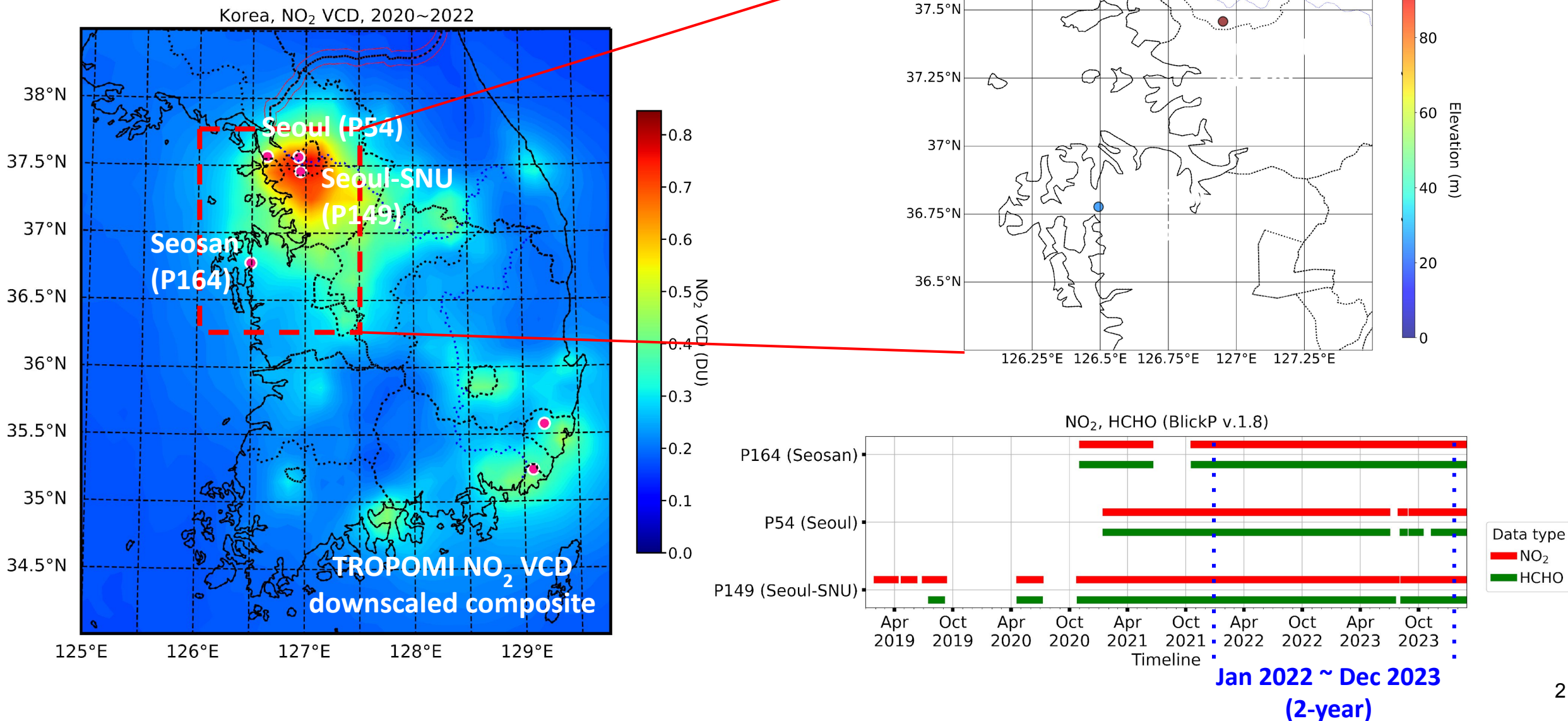
Jong-Uk Park*, Sang-Woo Kim¹, Jin-Soo Park²

¹) PI of Seoul-SNU (P149) Pandora

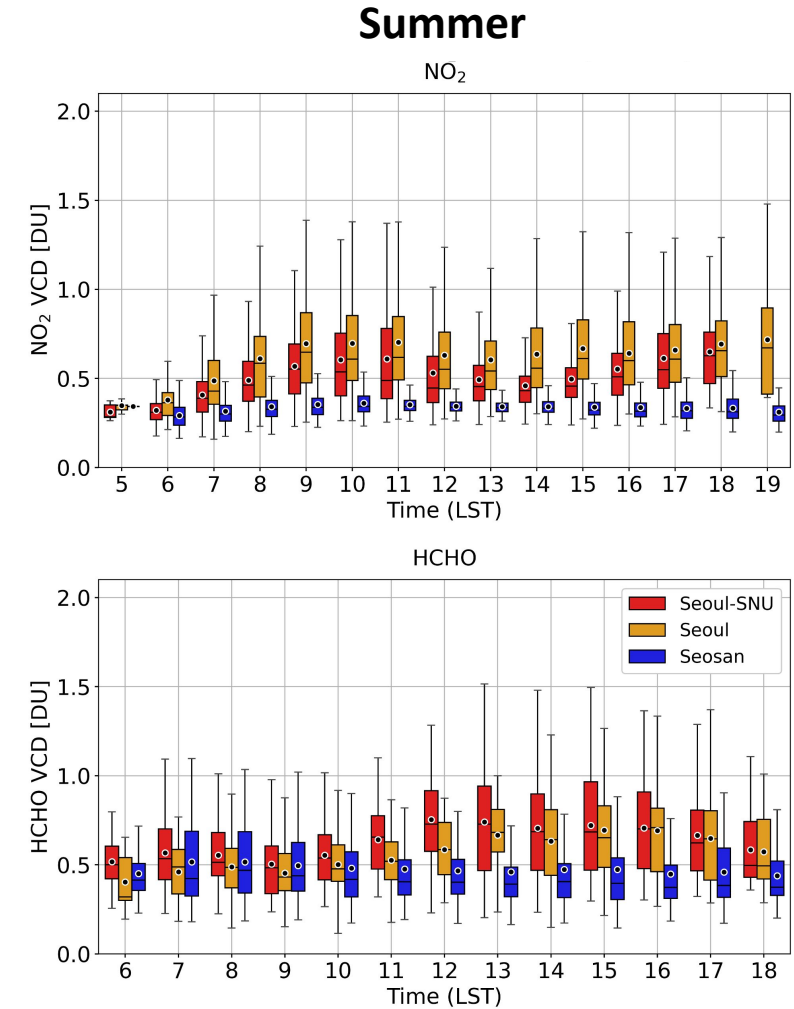
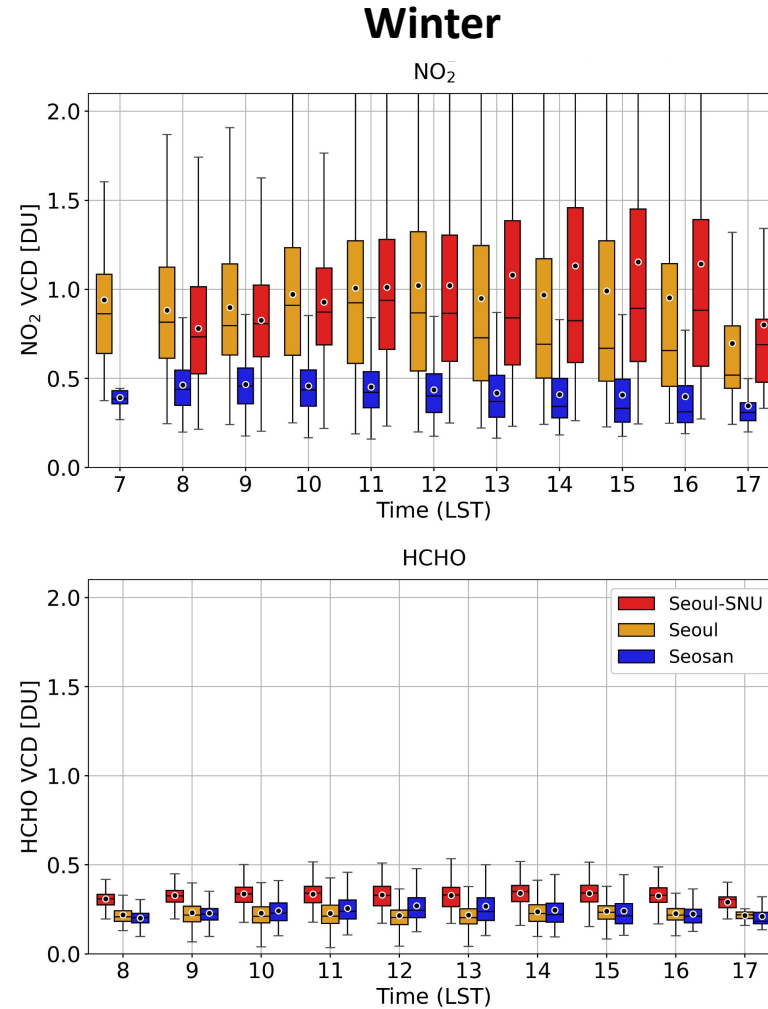
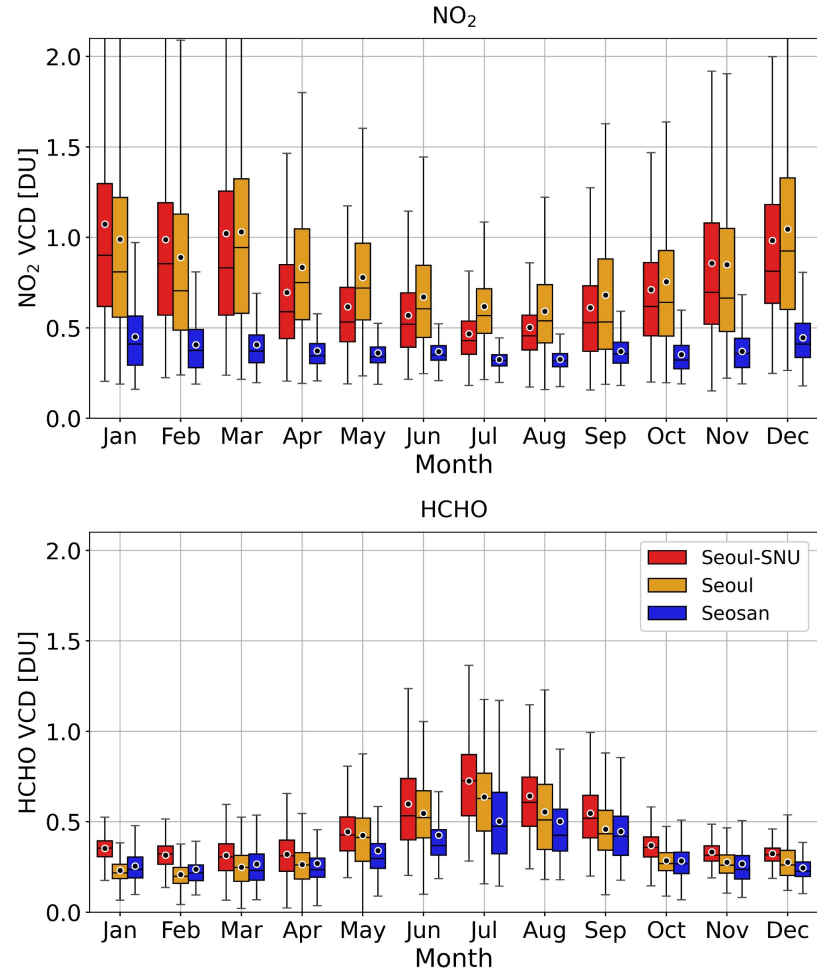
²) PI of Seosan (P164) Pandora

[* jonguk7628@snu.ac.kr](mailto:jonguk7628@snu.ac.kr)

PGN Pandora sites in Korea: Urban (Seoul, Seoul-SNU) and Rural (Seosan)

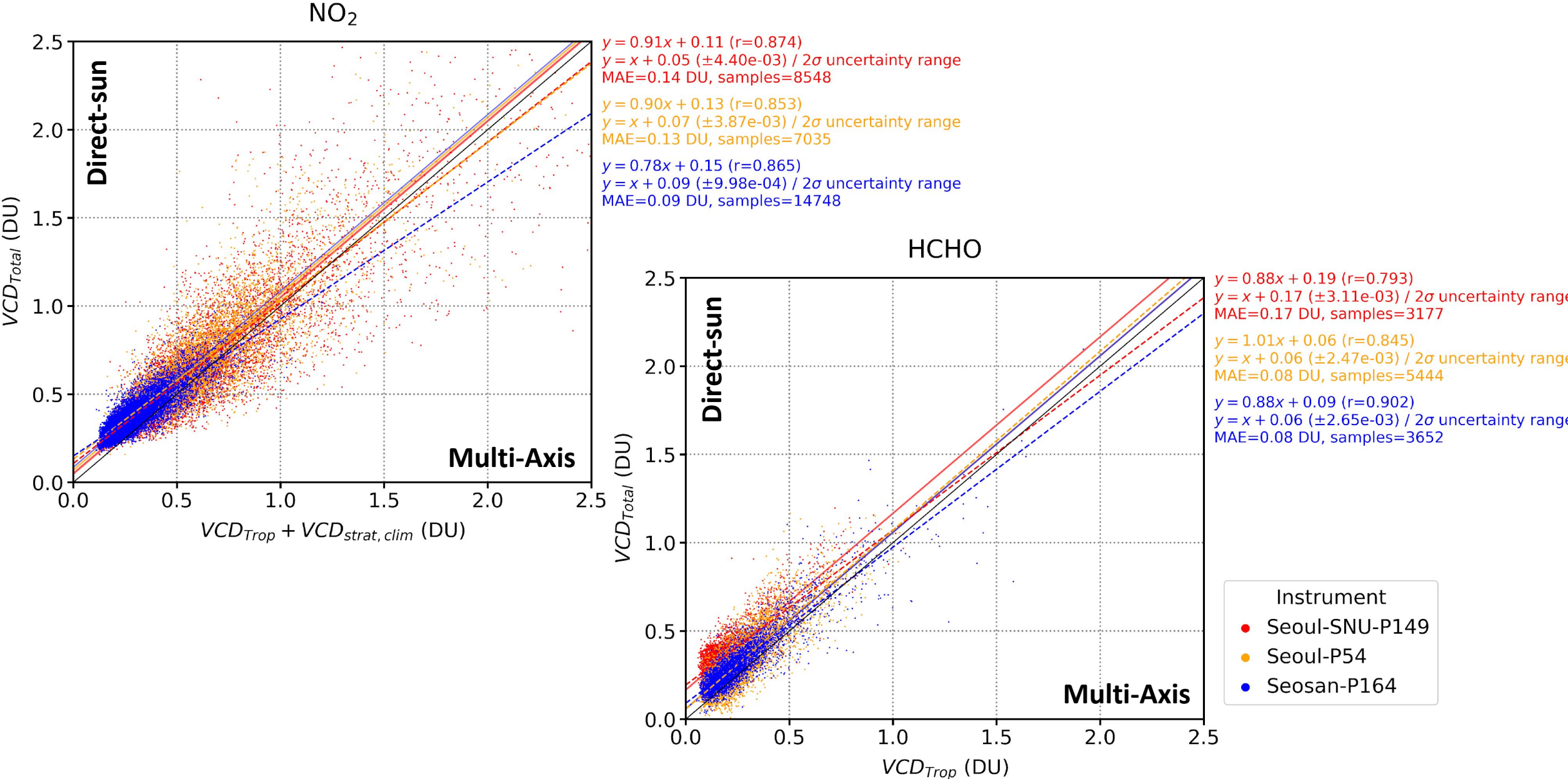


Variability of NO₂ and HCHO VCDs in Urban (Seoul, Seoul-SNU) and Rural (Seosan) environments

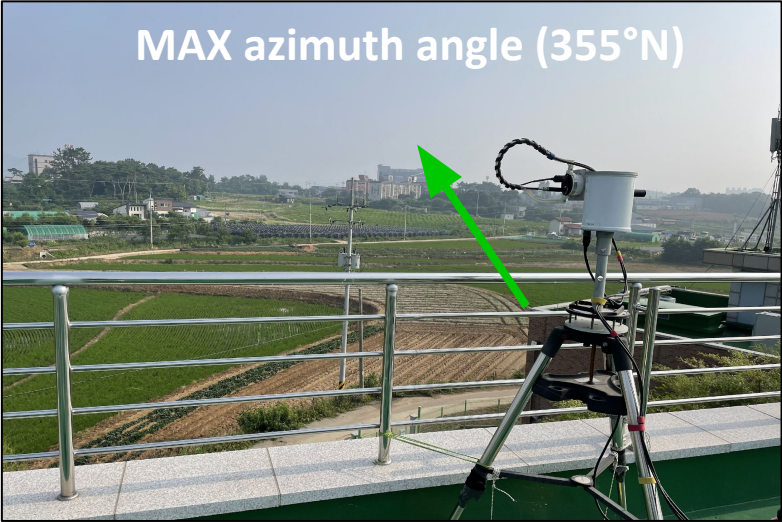
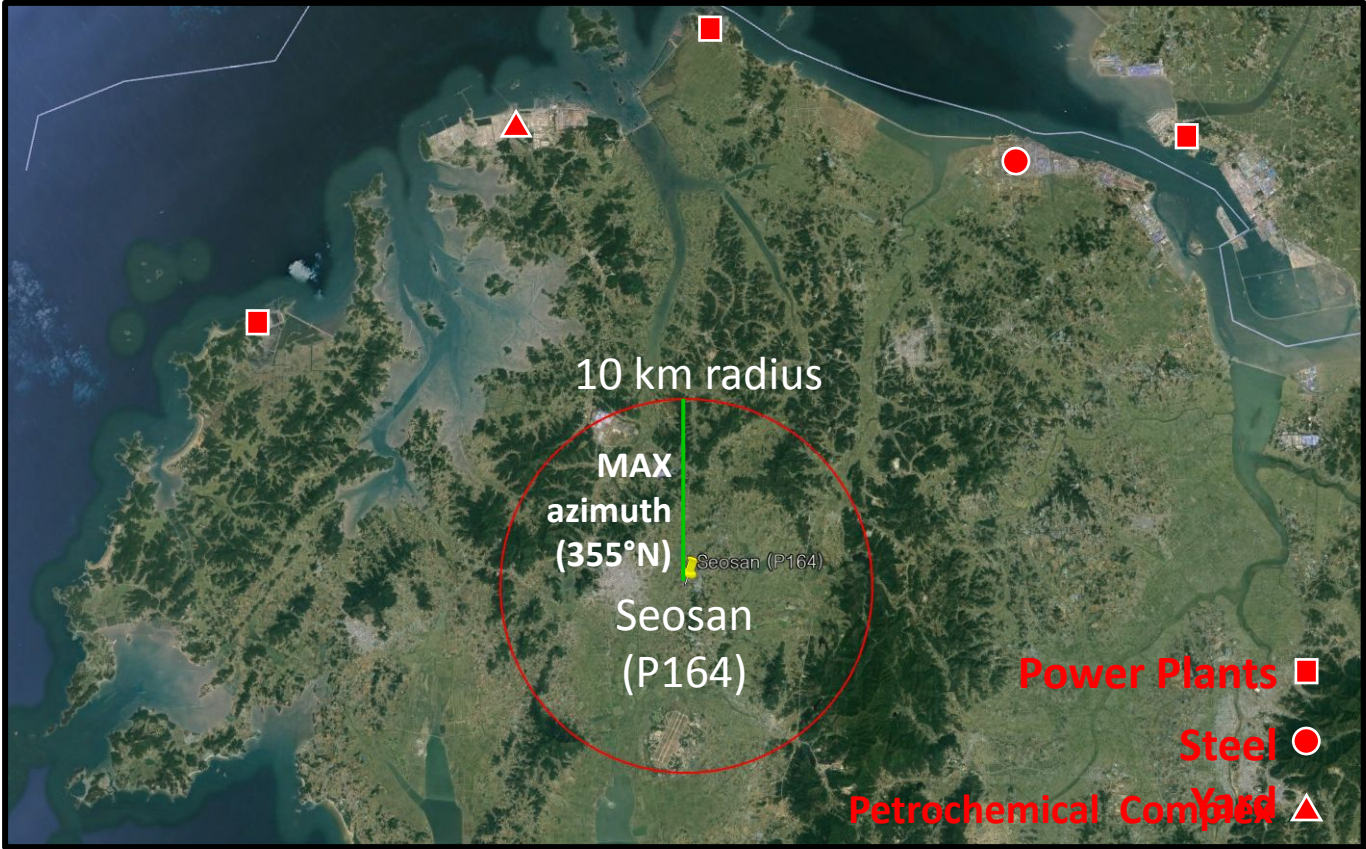


- ❑ Clear separation of year-round NO₂ VCDs in urban (Seoul, Seoul-SNU) and rural (Seosan) sites, while HCHO VCDs were comparable
- ❑ Pronounced seasonal variability
 - Higher NO₂ VCDs in winter: longer lifetime, greater anthropogenic emissions
 - Higher HCHO VCDs in summer: enhanced photochemistry, higher natural (biogenic) VOCs emissions

Comparison of NO₂ and HCHO VCDs from direct-sun (DS) and multi-axis (MAX) observations



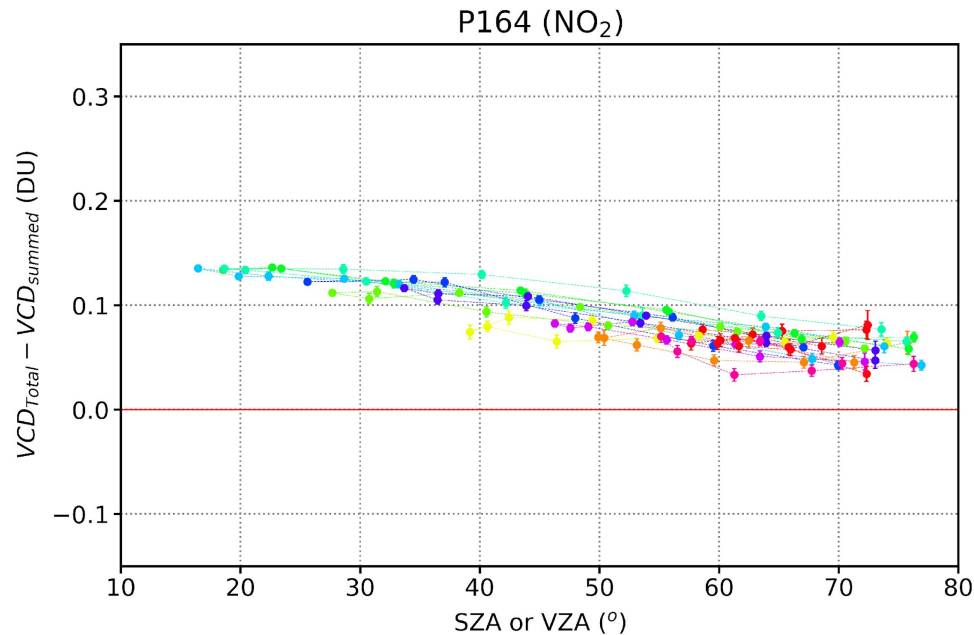
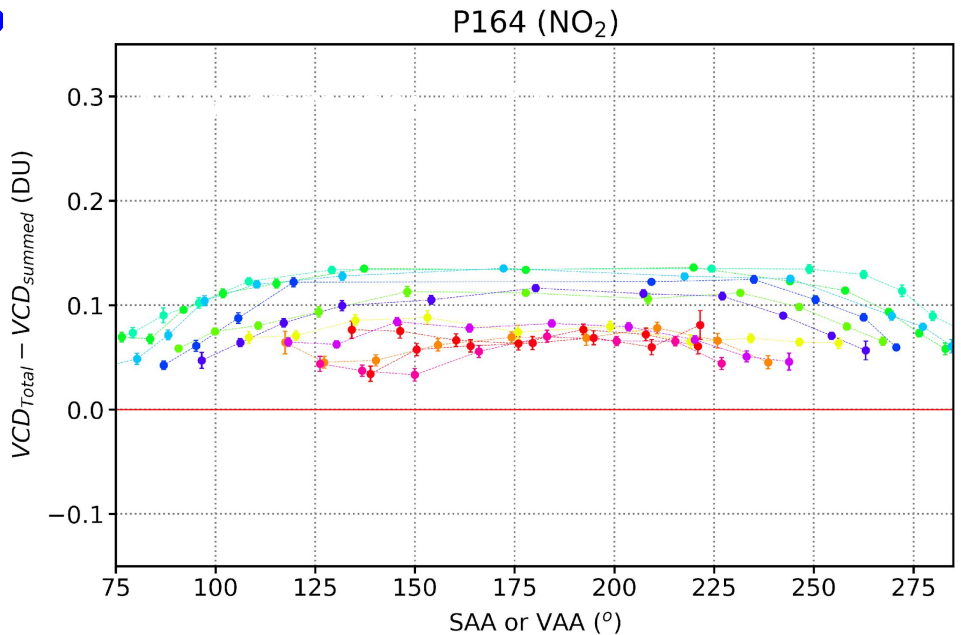
Surrounding environments of P164 (Seosan) site



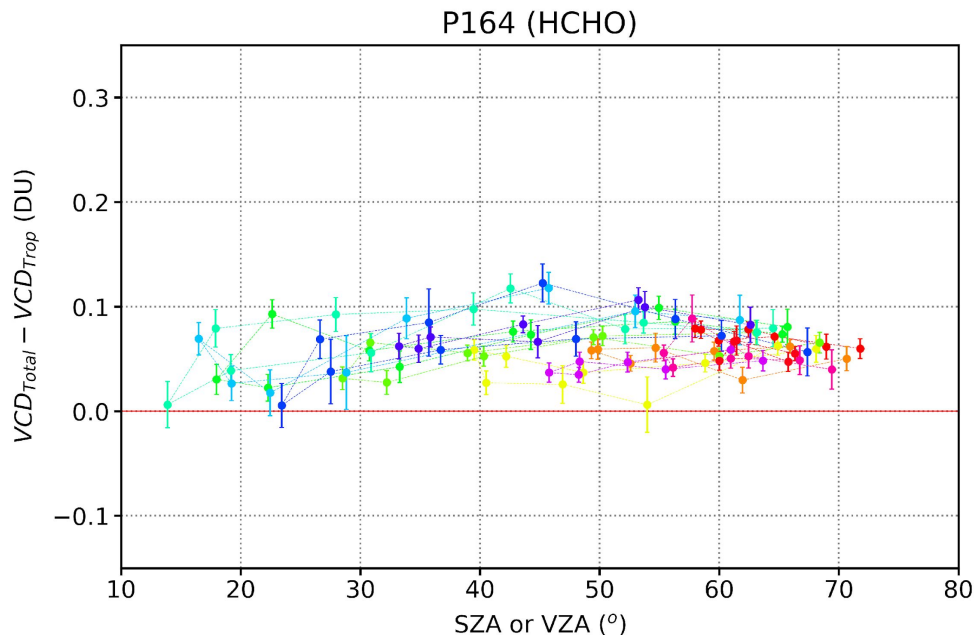
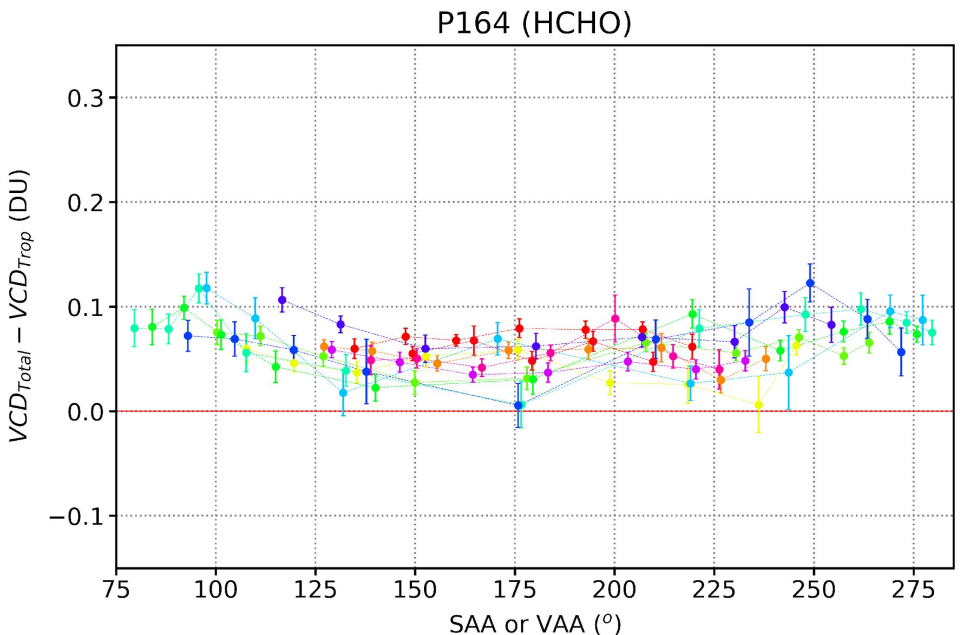
NO₂ and HCHO VCDs from Pandora DS and MAX observations: Rural site

(Seosan-P

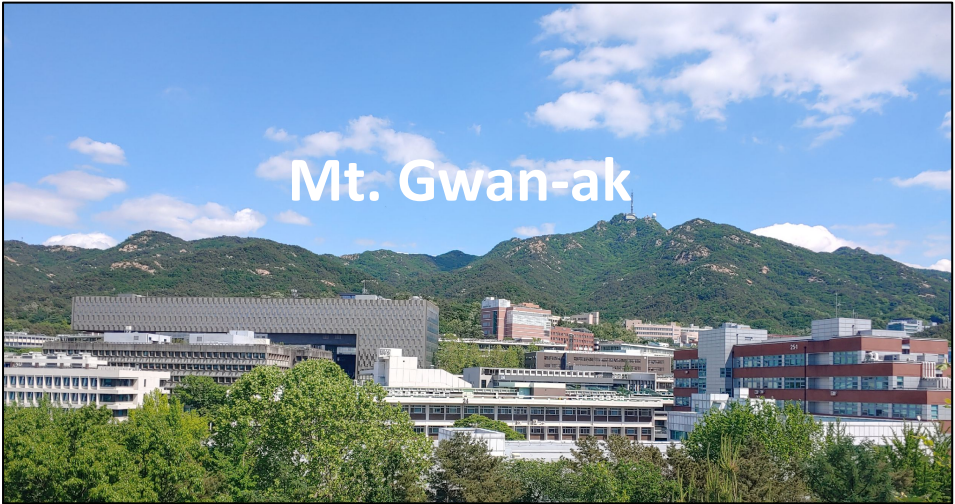
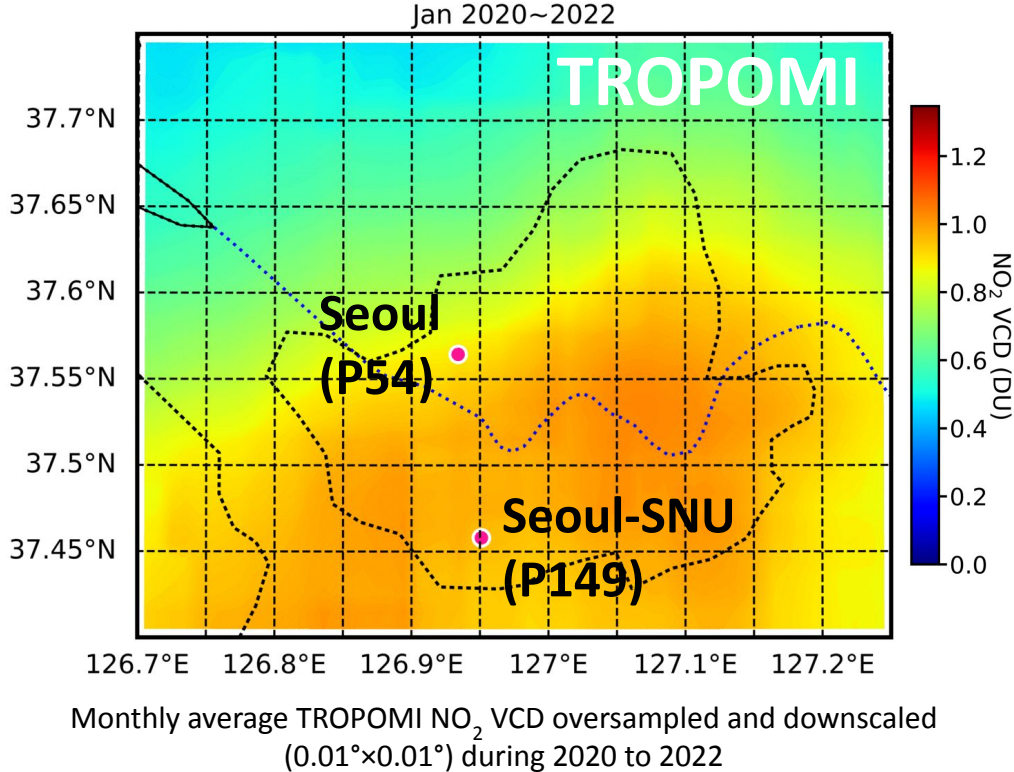
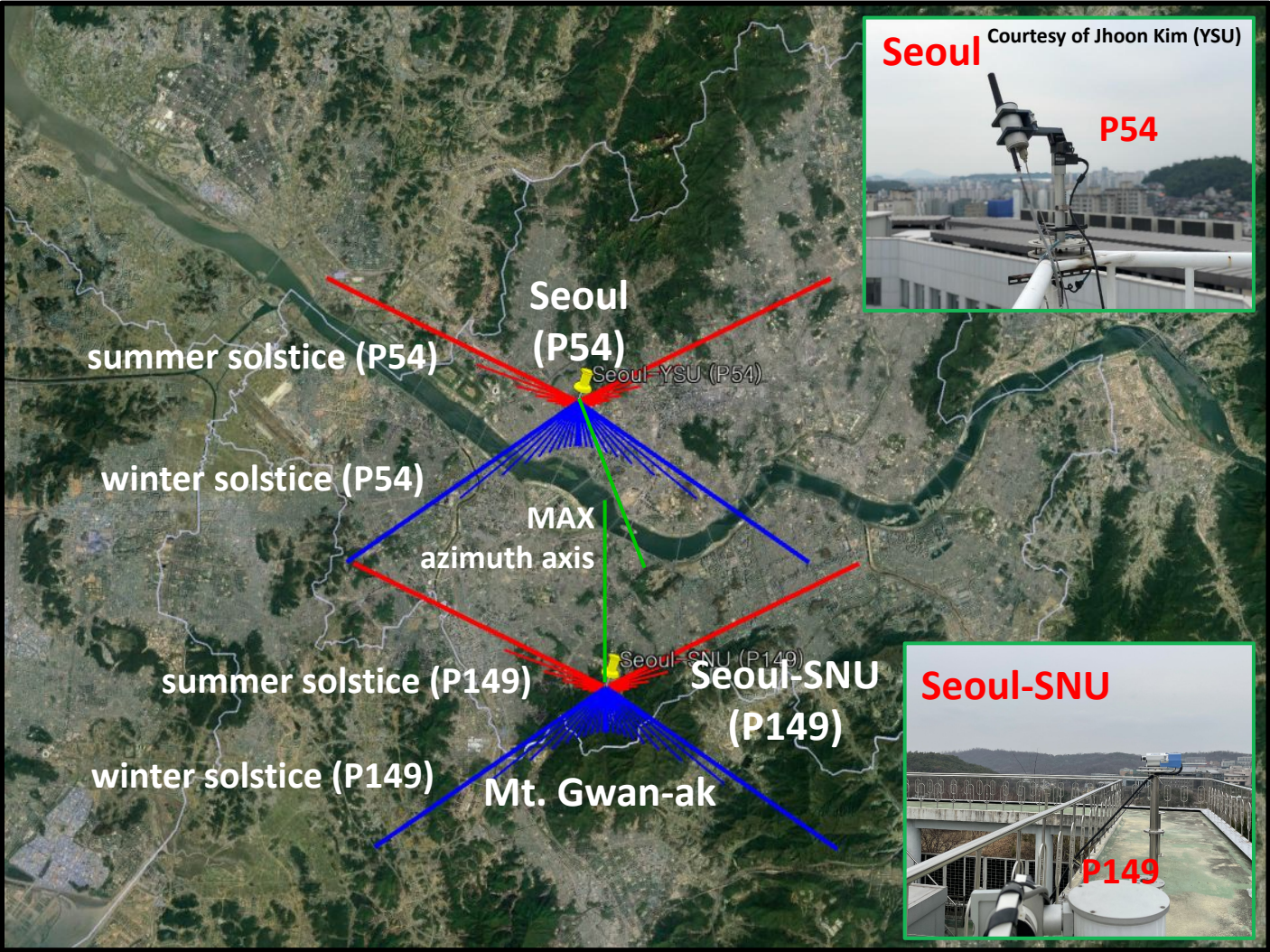
NO₂



HCHO



Pandora direct-sun (DS) and multi-axis (MAX) horizontal viewing geometries in Seoul

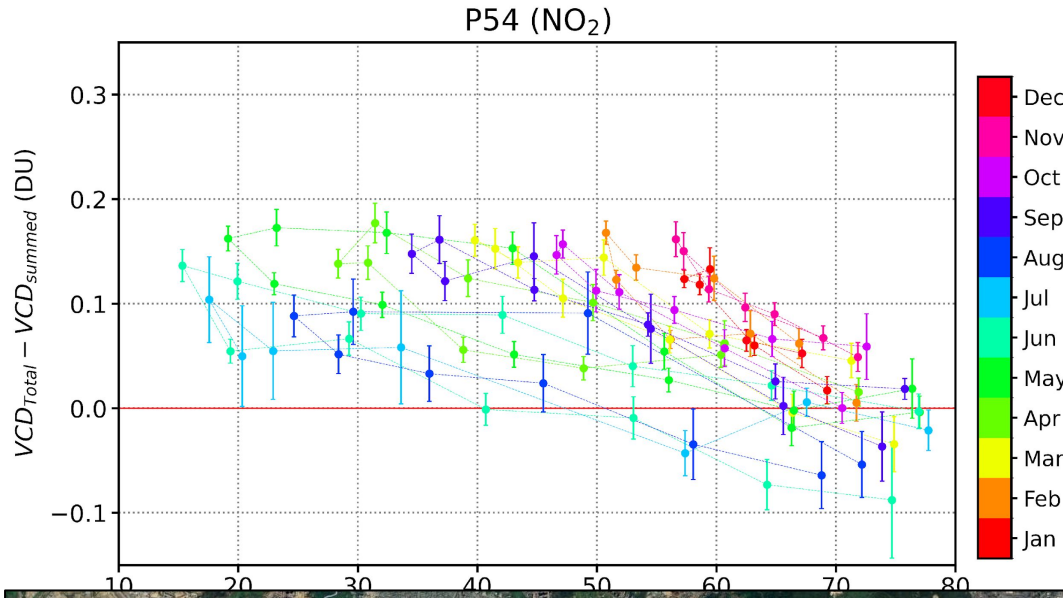
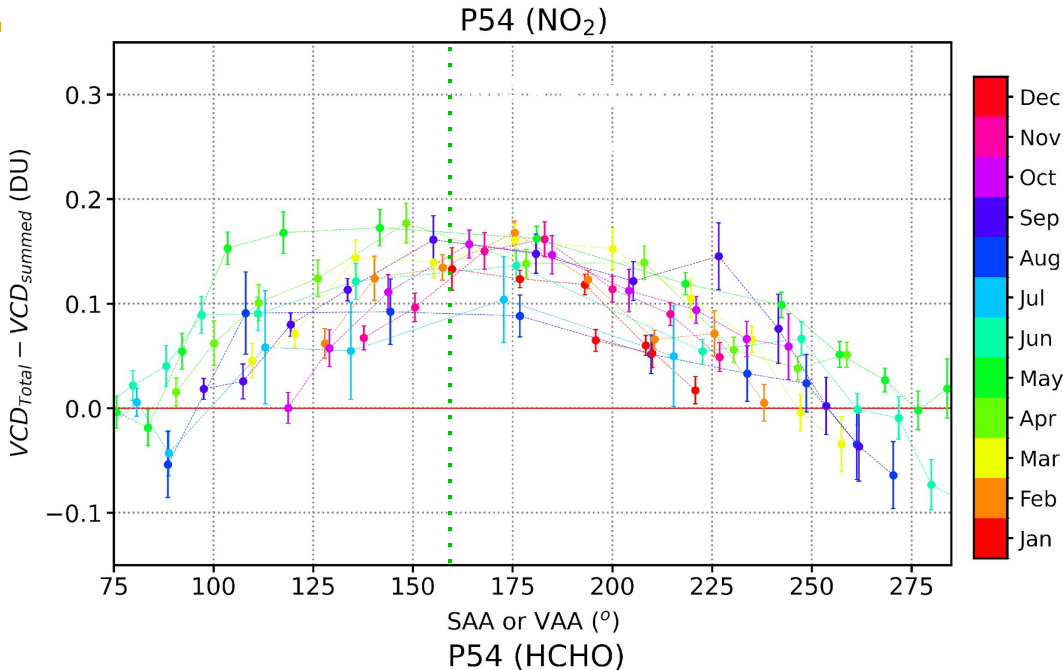


Effective light path of the ground-based instruments assuming trace gas constrained within the boundary layer ranging from surface to 1 km a.g.l.

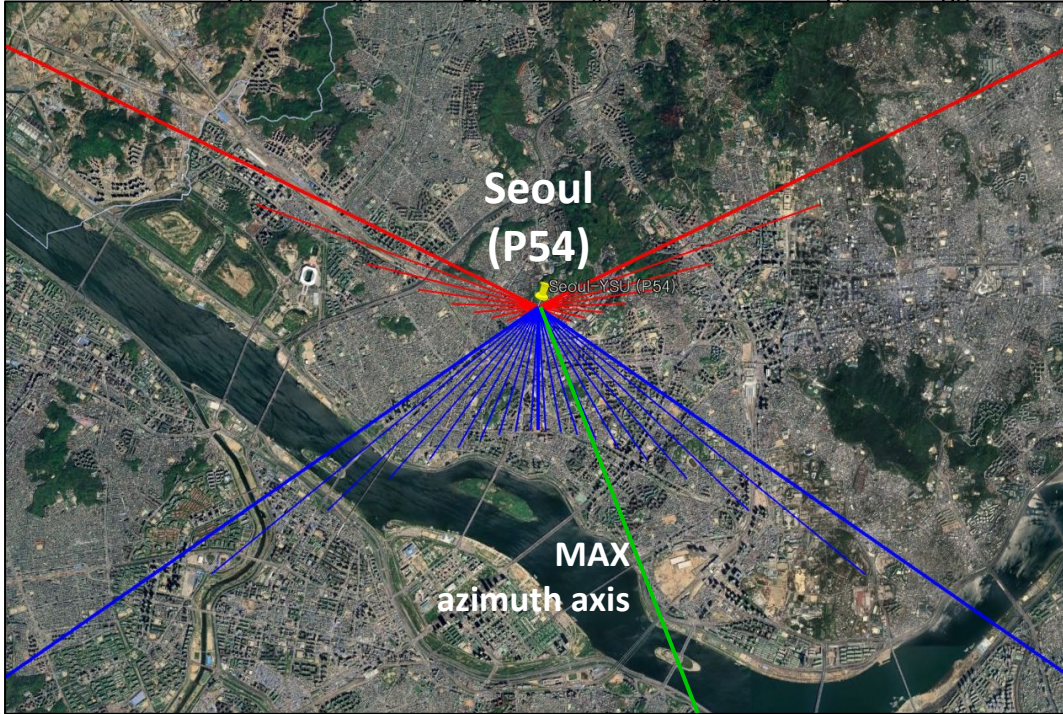
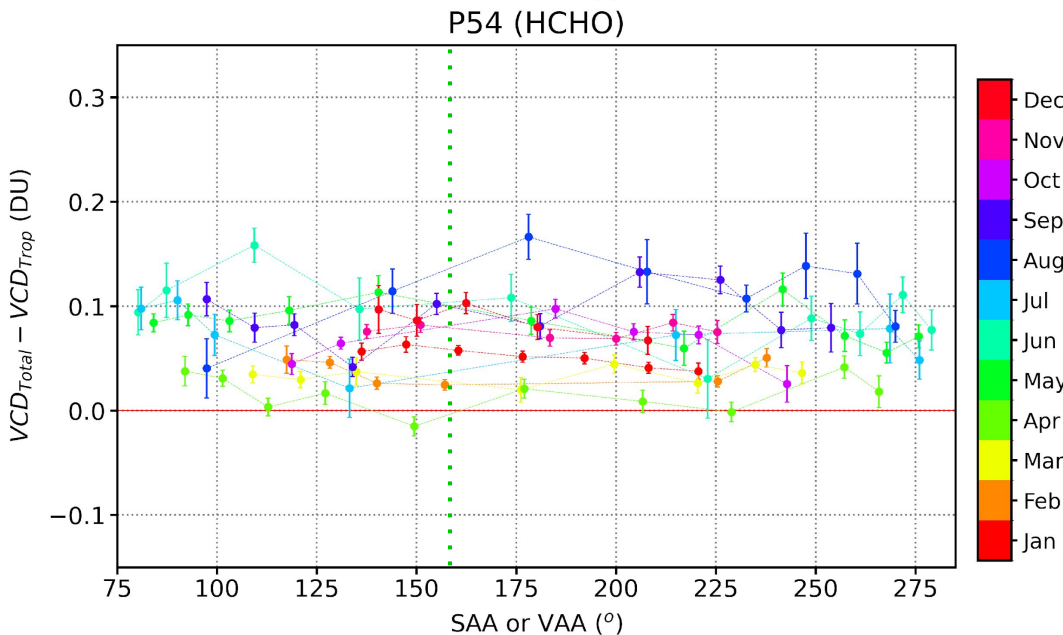
NO₂ and HCHO VCDs from Pandora DS and MAX observations: Urban site

(Seoul-P54)

NO₂



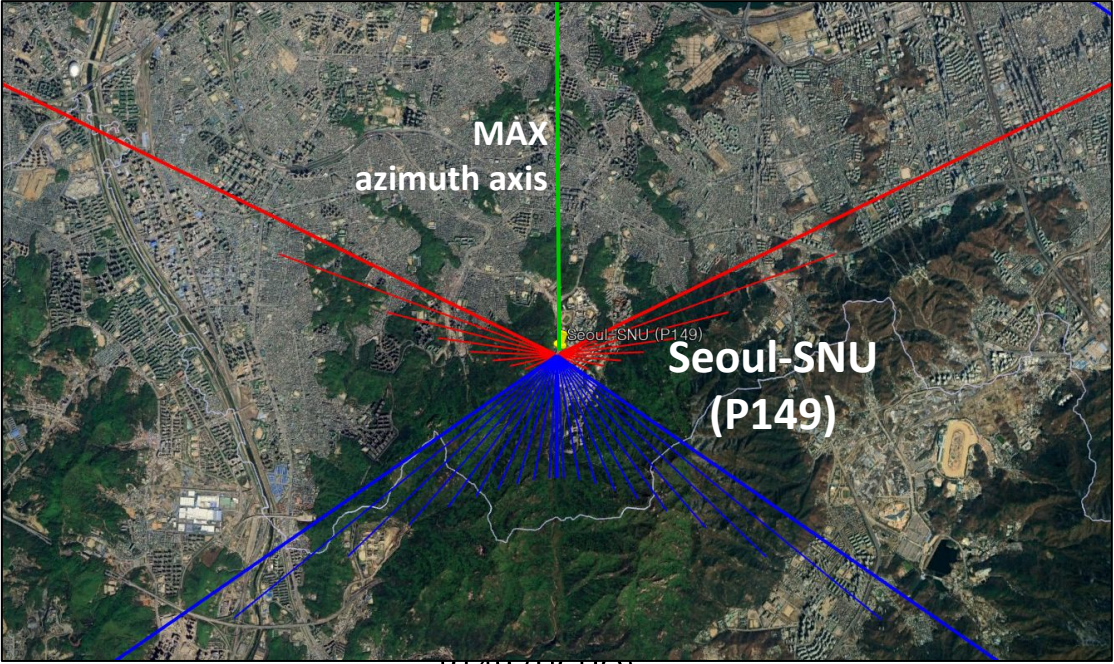
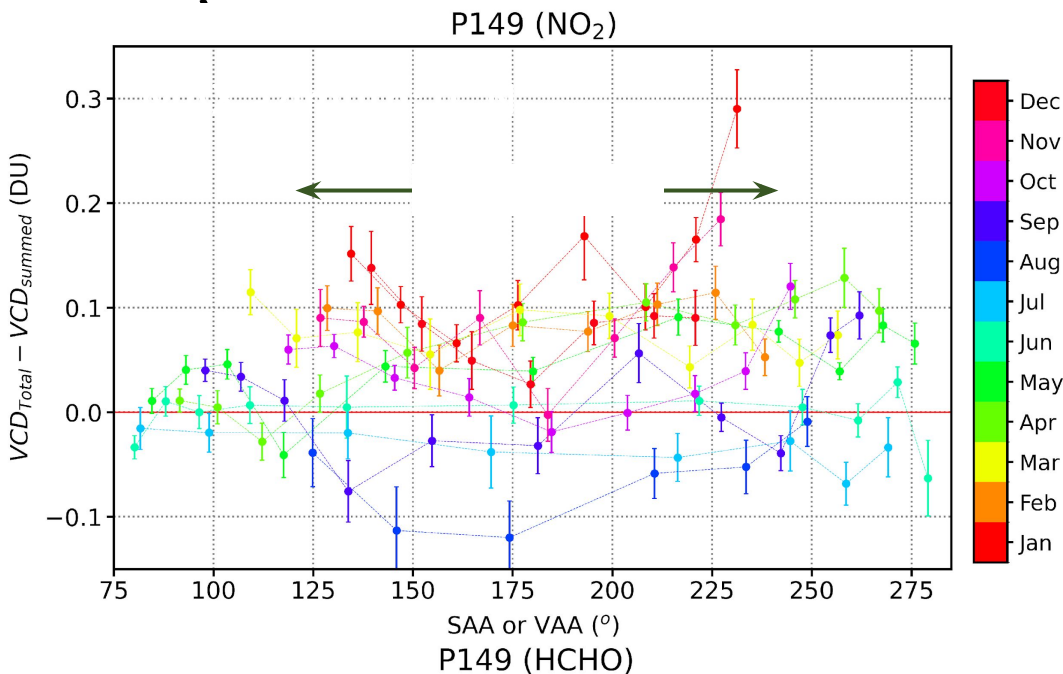
HCHO



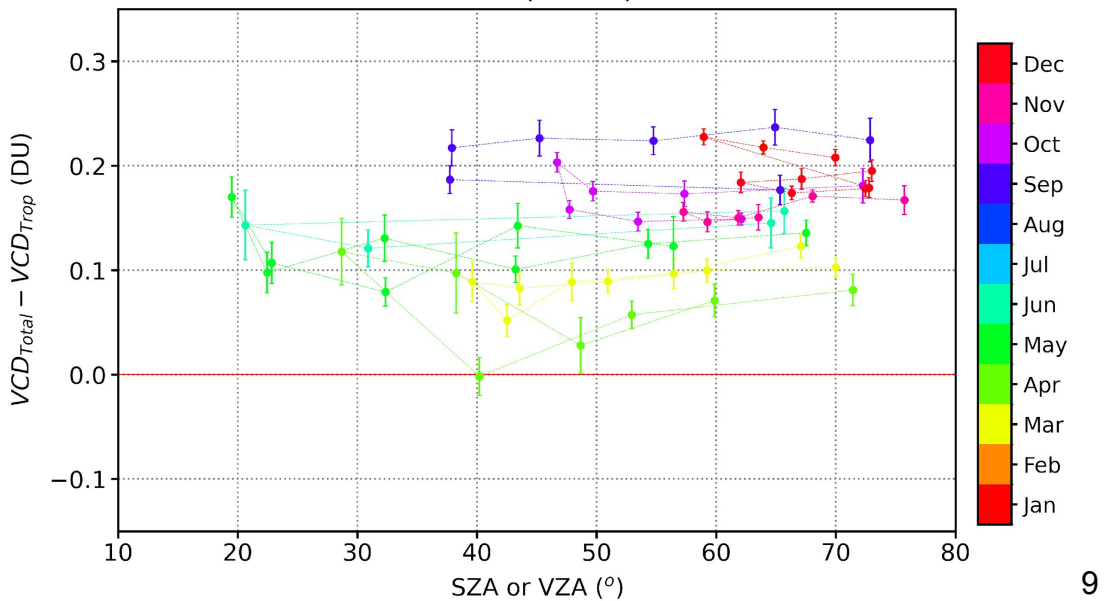
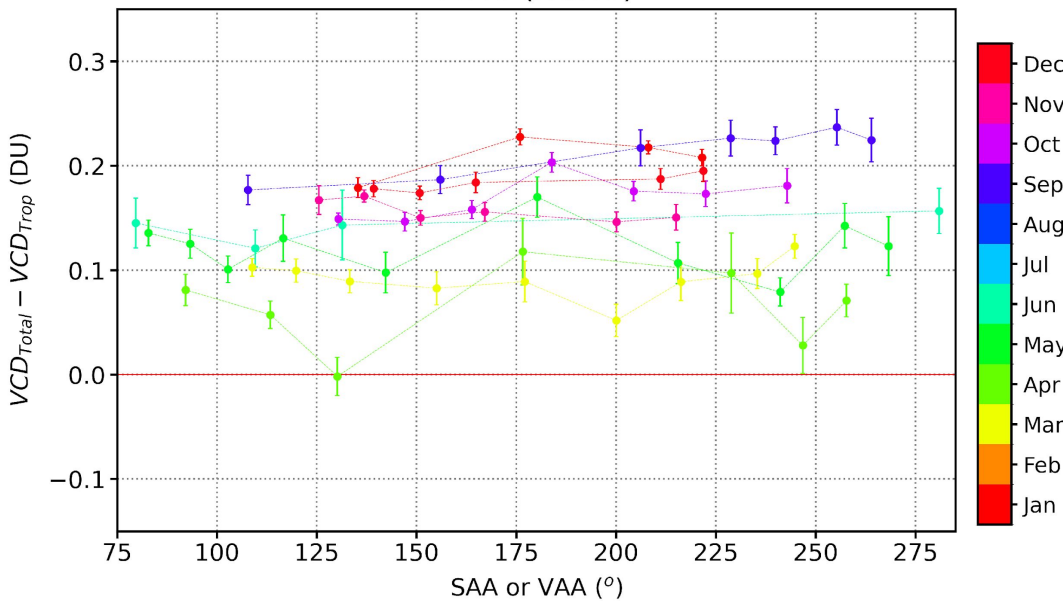
NO₂ and HCHO VCDs from Pandora DS and MAX observations: Urban site

(Seoul-SN

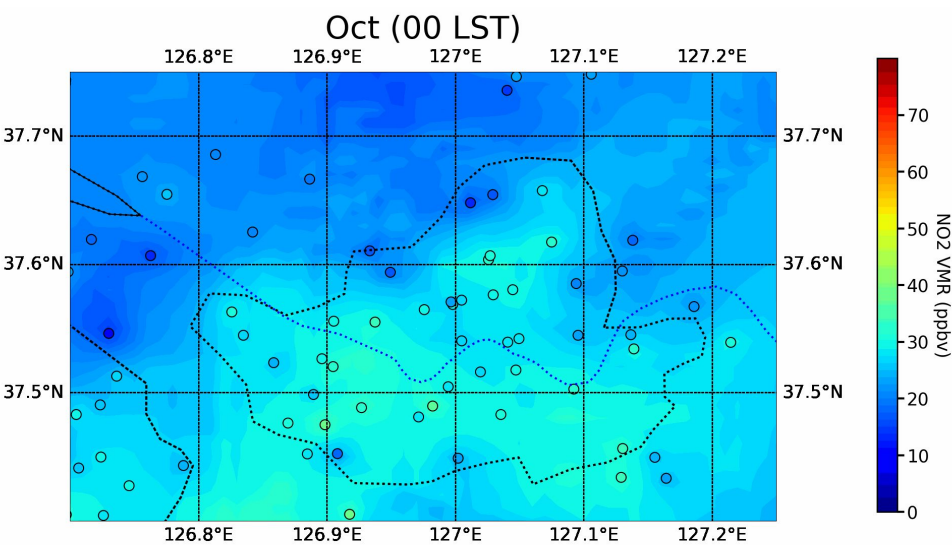
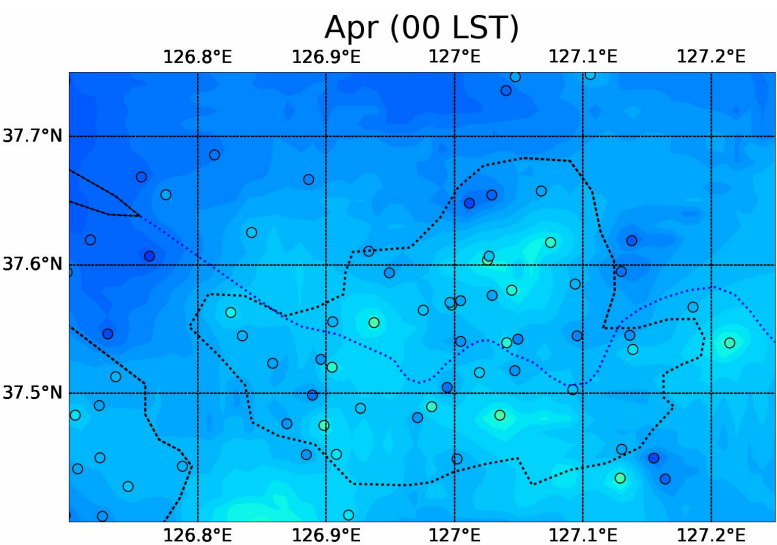
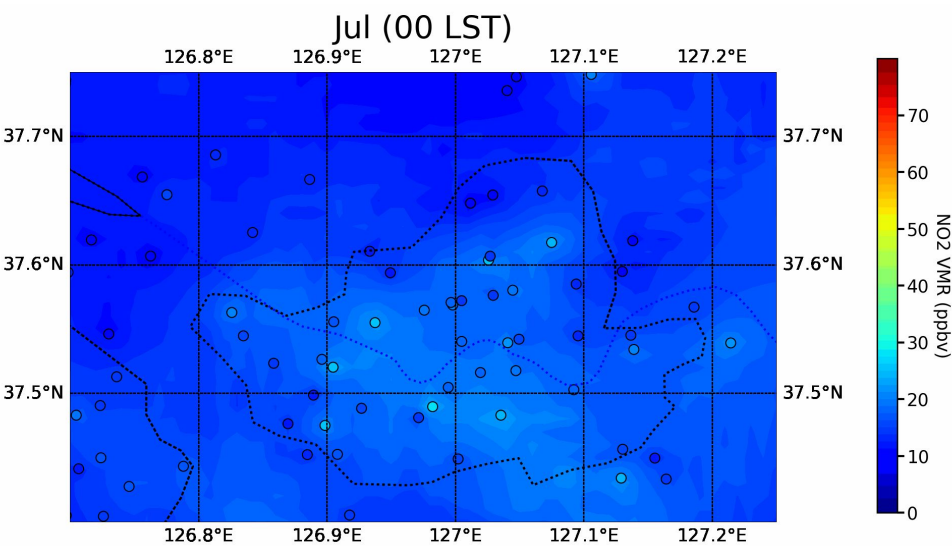
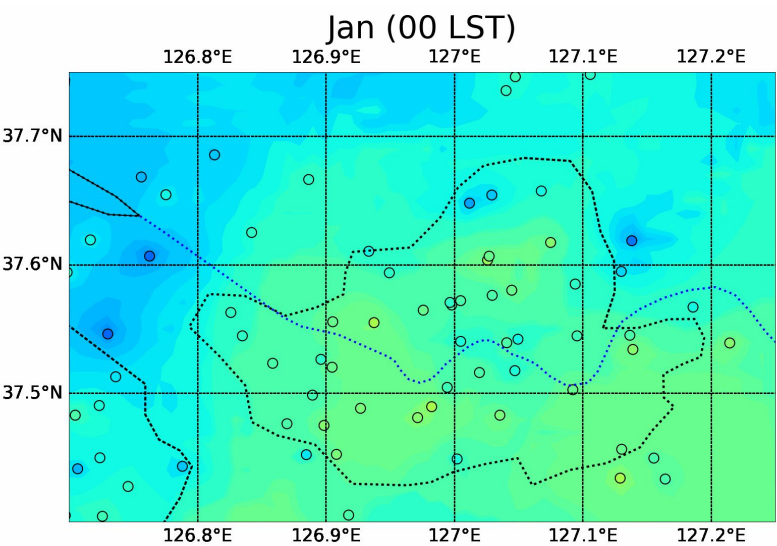
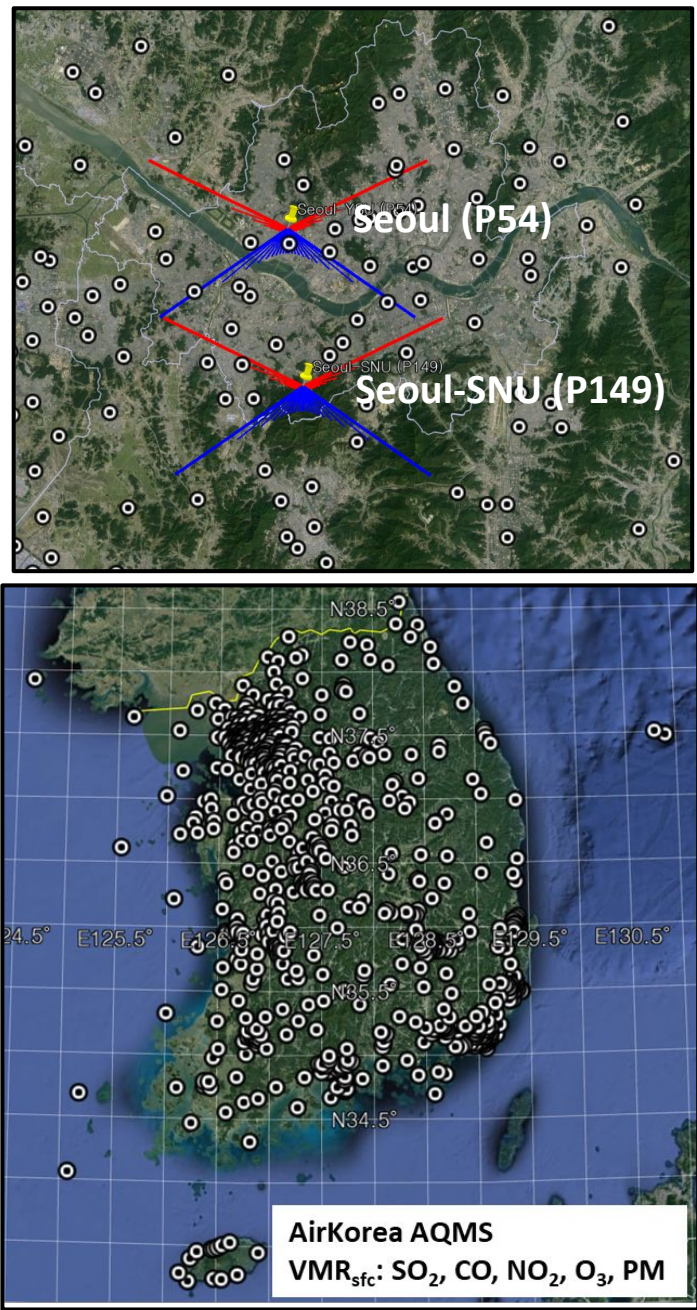
NO₂



HCHO



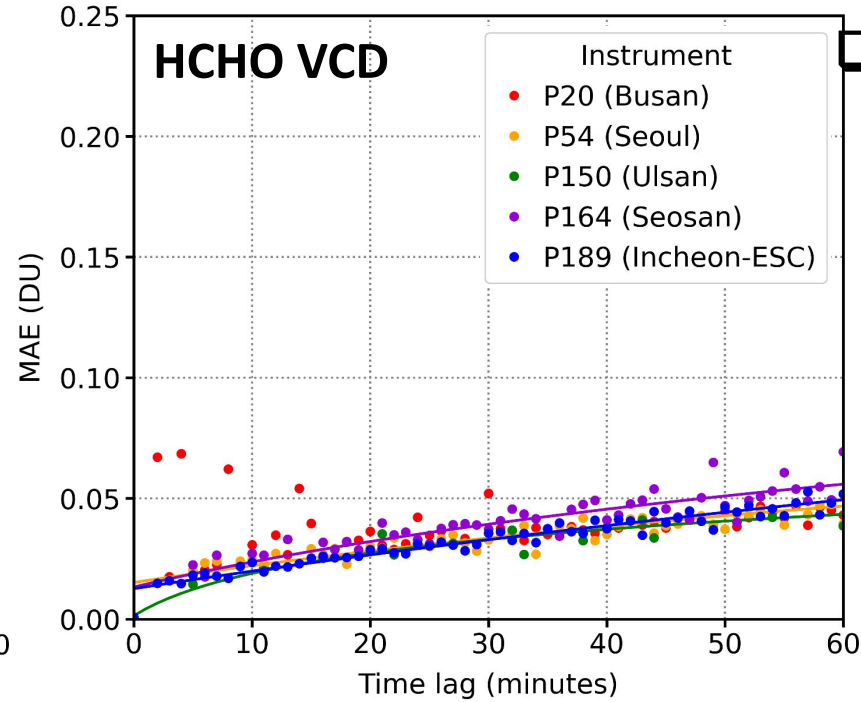
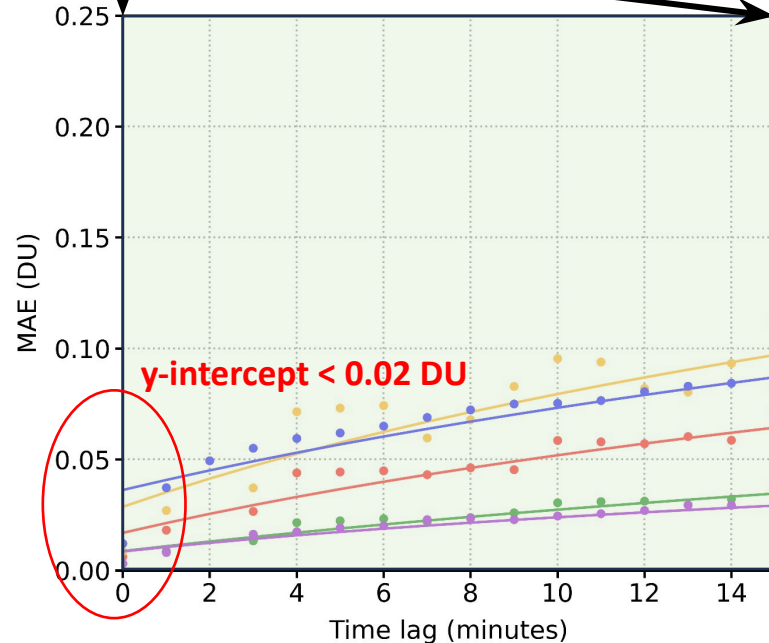
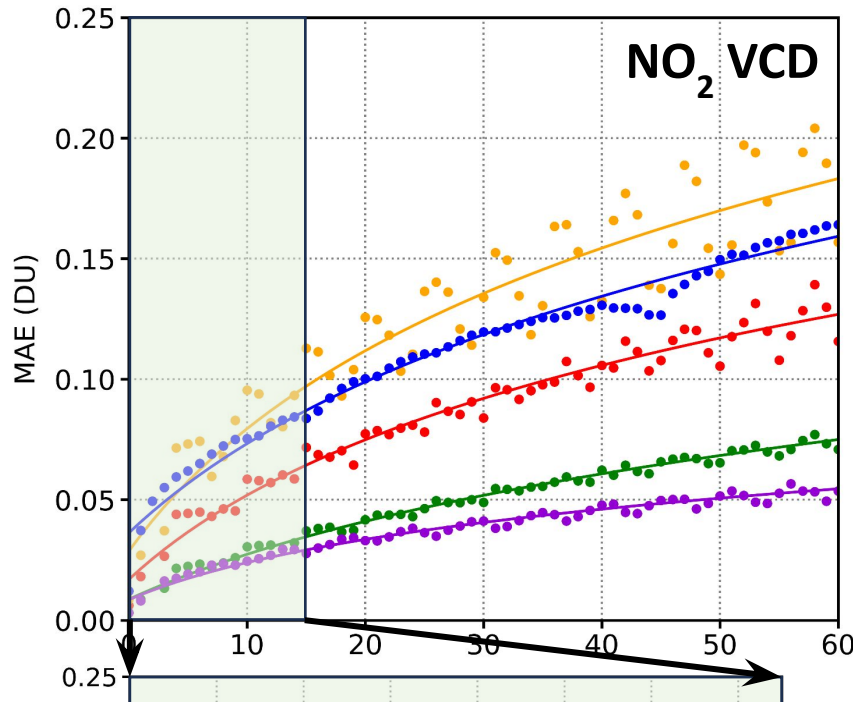
Opportunities for Pandora VMR_{sfc} evaluation using the surface in-situ



AQMS (Air Quality Monitoring Station) – Ministry of Environment, South Korea

Thank you for your attention!

NO₂ (and HCHO) VCD_{total} temporal variability assessed by autocorrelations with time lags



		Time lag	
		15 min	1 hr
NO ₂ VCD	MAE (DU)		
	Seoul	≈ 0.1	> 0.15
	Rural	≈ 0.03	> 0.05
R ²	Seoul	≈ 0.90	0.65 ~ 0.70
	Rural	≈ 0.85	0.55 ~ 0.65

MAE: Mean Absolute Error

Temporal variability

NO₂ VCD > HCHO VCD

• NO₂

Urban (P54, P189, P20) > Rural (P150, P164)

• HCHO

No clear dependency on location
(MAE < 0.05 DU within 1 hr)

NO₂ VCD temporal variability varies according to the **location**, **season**, and **time of day**

Higher temporal variability in **winter**, **around noon**, and in **urban area**

