

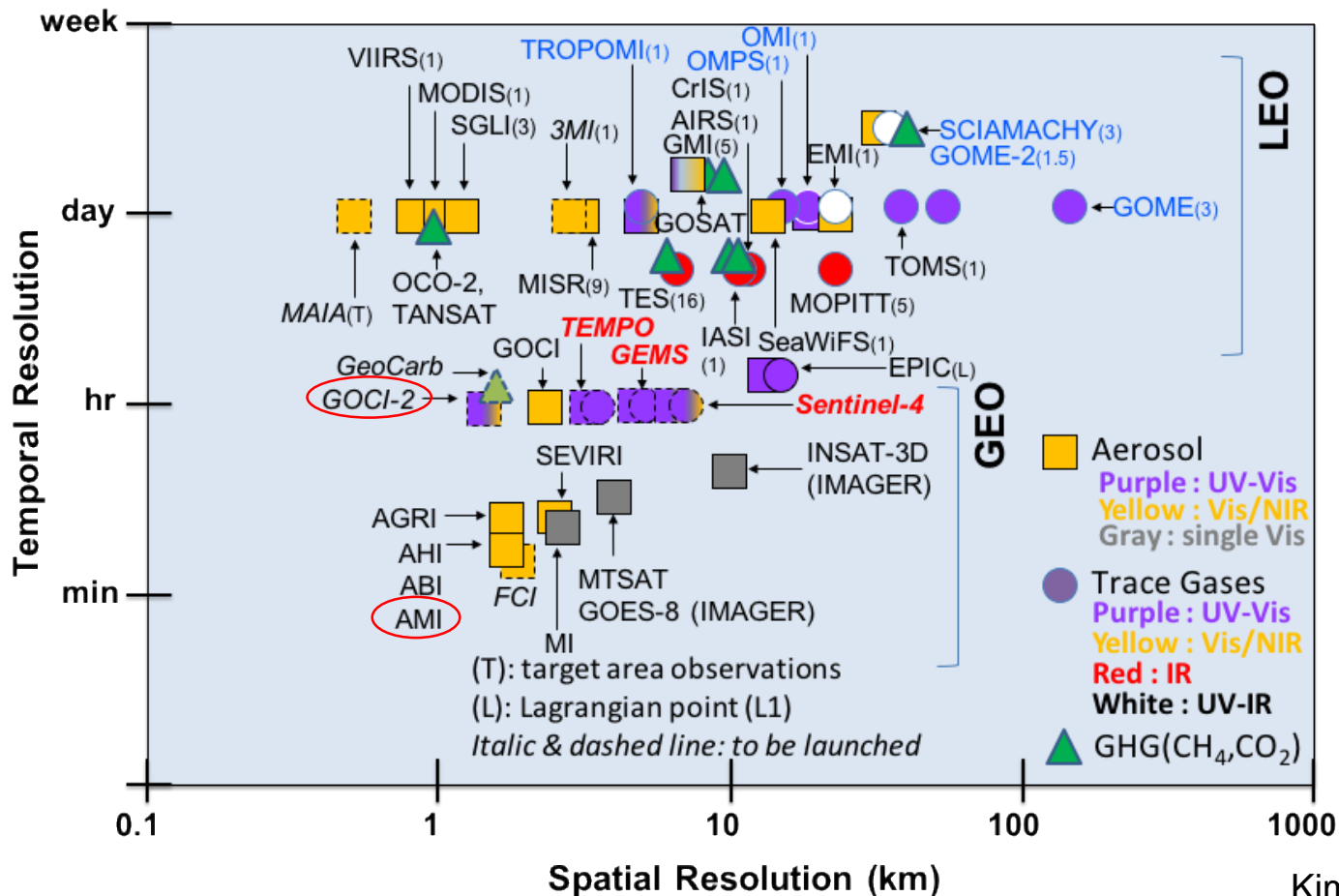
GEMS Algorithm Status



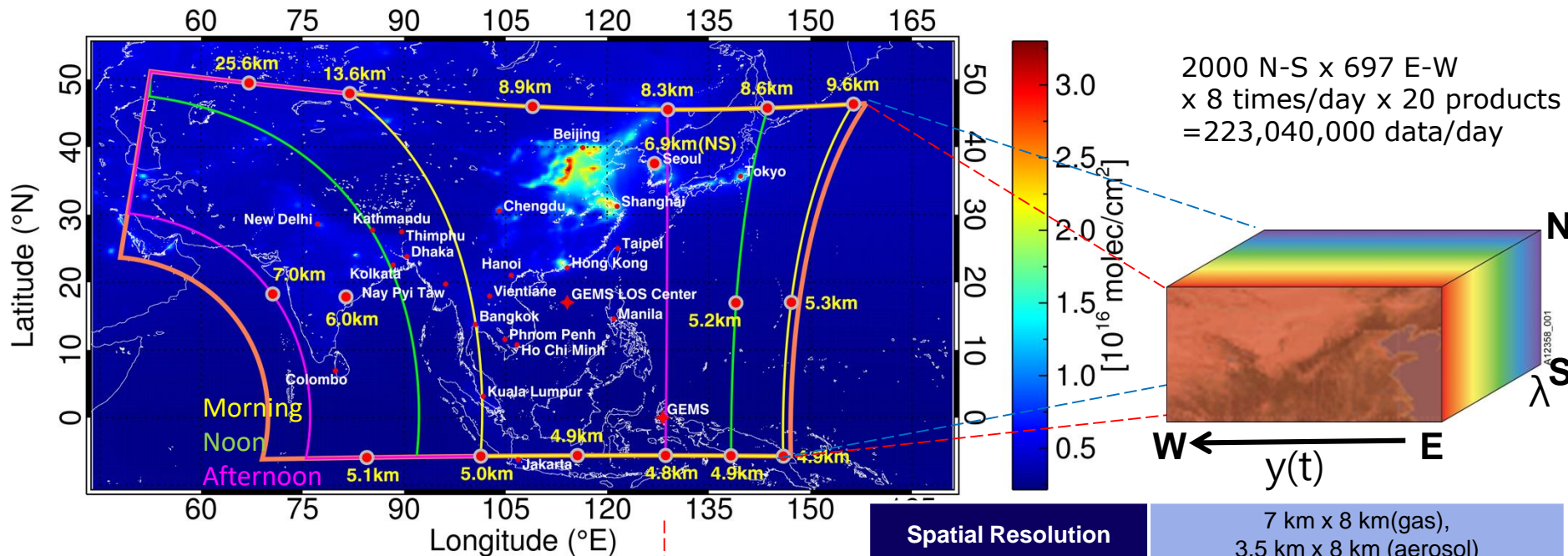
Jhoon Kim*, GEMS Science Team, NIER Team

*P.I., GEMS ; Yonsei University, Seoul, Korea

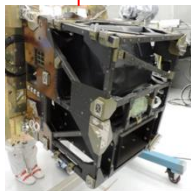
Development of Satellite RS for Aerosols & Gases



GEMS E-W SCAN SCENARIO



Launch: Feb 19th, 2020



Spatial Resolution	7 km x 8 km(gas), 3.5 km x 8 km (aerosol)
Spectral Range	300-500 nm
Spectral Resolution	0.6 nm (3 samples/band)
Products	Aerosols (AOD, SSA, ALH), O ₃ ,(Total, Trop. Profile) NO ₂ , SO ₂ , HCHO, CHOCHO, UVI, Surface Ref., CRF, CCH

Kim et al. (BAMS 2020)

In Orbit Test (IOT)

Instrument Activation and Commissioning Timeline

Activity	Duration (months)	L0	L0+1m	L0+2m	L0+3m	L0+4m	L0+5m	L0+6m	L0+7m	L0+8m	-L0+12m
LEOP (GTO to GEO)	1										
BUS IOT (start from drift orbit)	0.5										
GOCI-II Activation	0.5										
GEMS Activation	1		3/8								
GOCI-II/GEMS INR Test	4										
GEMS INR	2										
GEMS Science Test	4										

2/19

3/6

3/23

2/28/21

outgassing

measurements

L2 Product validation : Oct 2020 - Jun 2021

Data distribution : June 2021-

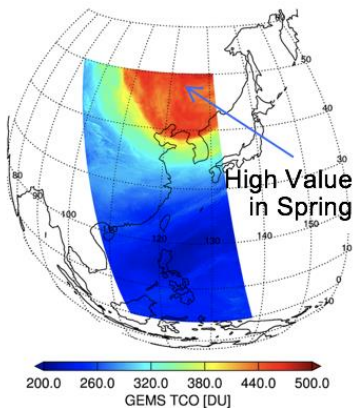
* BUS: GK-2B spacecraft (GEMS and GOCI-II)

* INR: Image Navigation and Registration



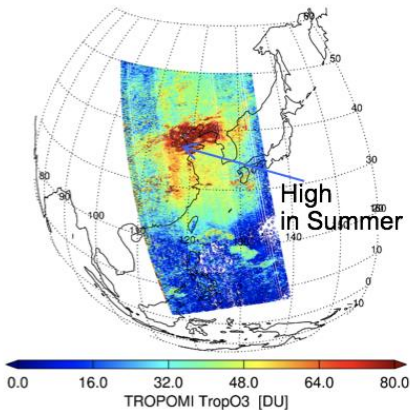
GEMS L2 Algorithm Test with TROPOMI L1b

Total Ozone
2019.03.30



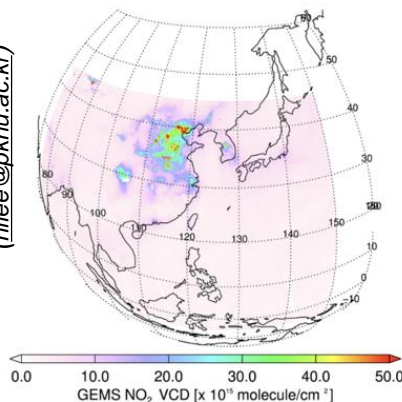
Jae H. Kim
(jaekim@pusan.ac.kr)

Trop Ozone
2018.08.08

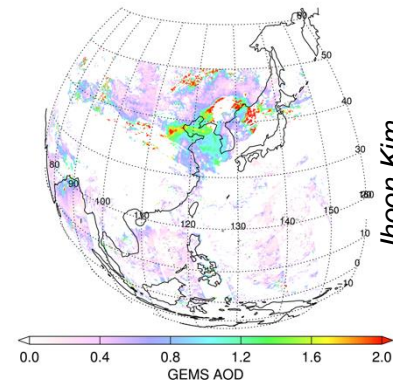


Hanlim Lee
(hilee@pknu.ac.kr)

NO₂
2018.12.14

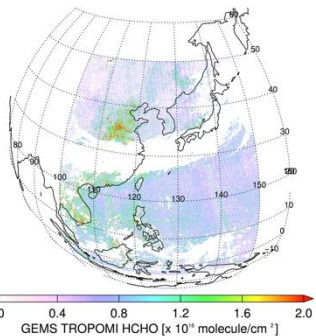


Aerosol
2019.03.4



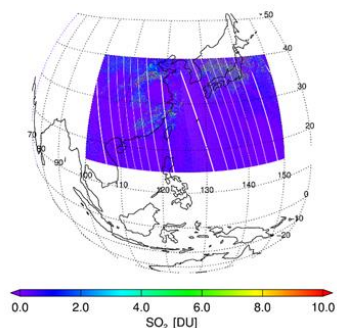
Jhoon Kim
(jkim2@yonsei.ac.kr)

HCHO
2018.5.31

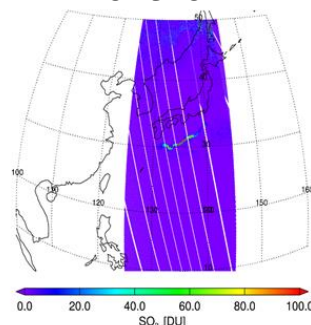


Rokjin Park
(rjpark@snu.ac.kr)

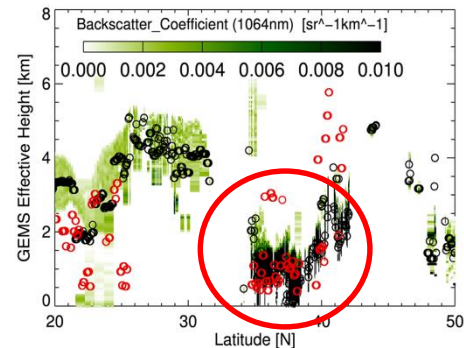
PBL SO₂
2019.02.19



Volcanic SO₂
2019.01.17

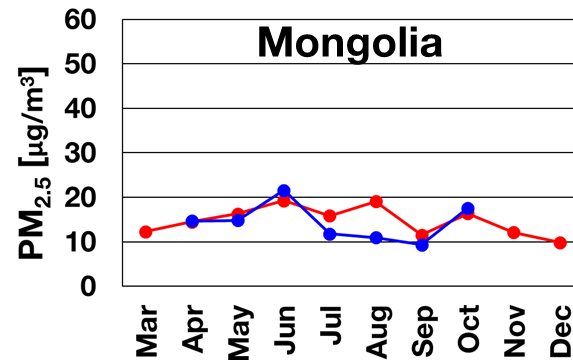
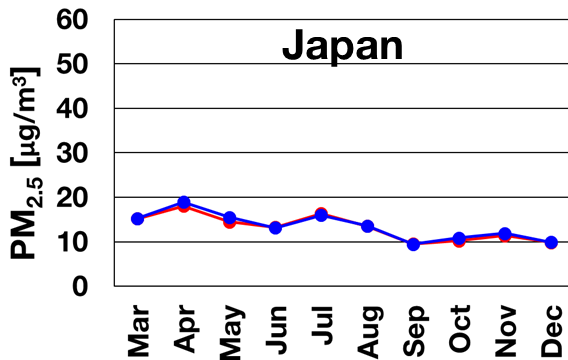
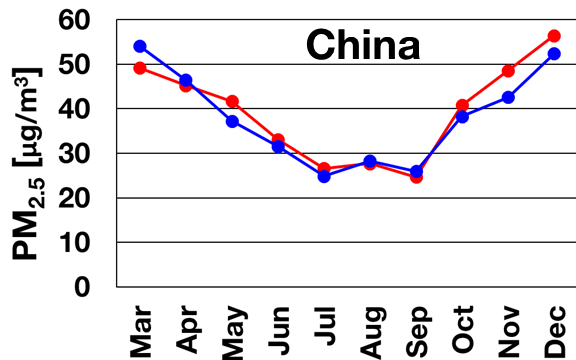


GEMS AEH (Red Circle)
CALIOP Height (Black Circle)



From Columnar Information to Surface Concentrations using Machine Learning

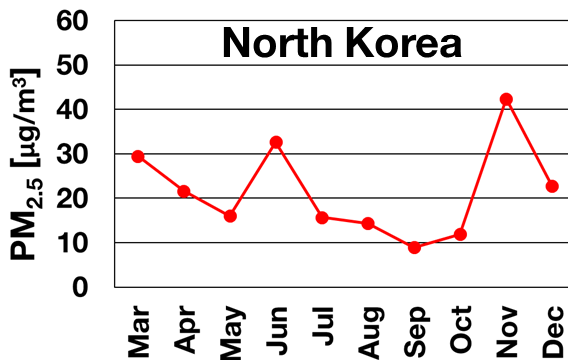
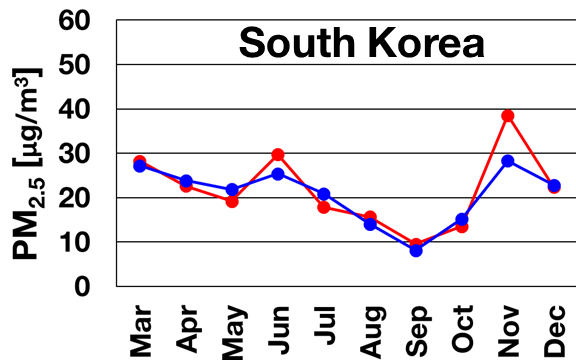
Satellite AOD + MET. data + GIS information



Estimated PM_{2.5} Measured PM_{2.5}

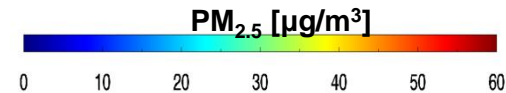
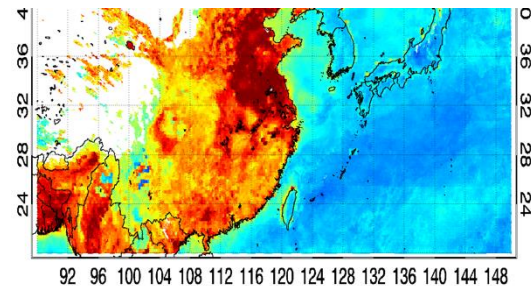
Estimated PM_{2.5} Measured PM_{2.5}

Estimated PM_{2.5} Measured PM_{2.5}



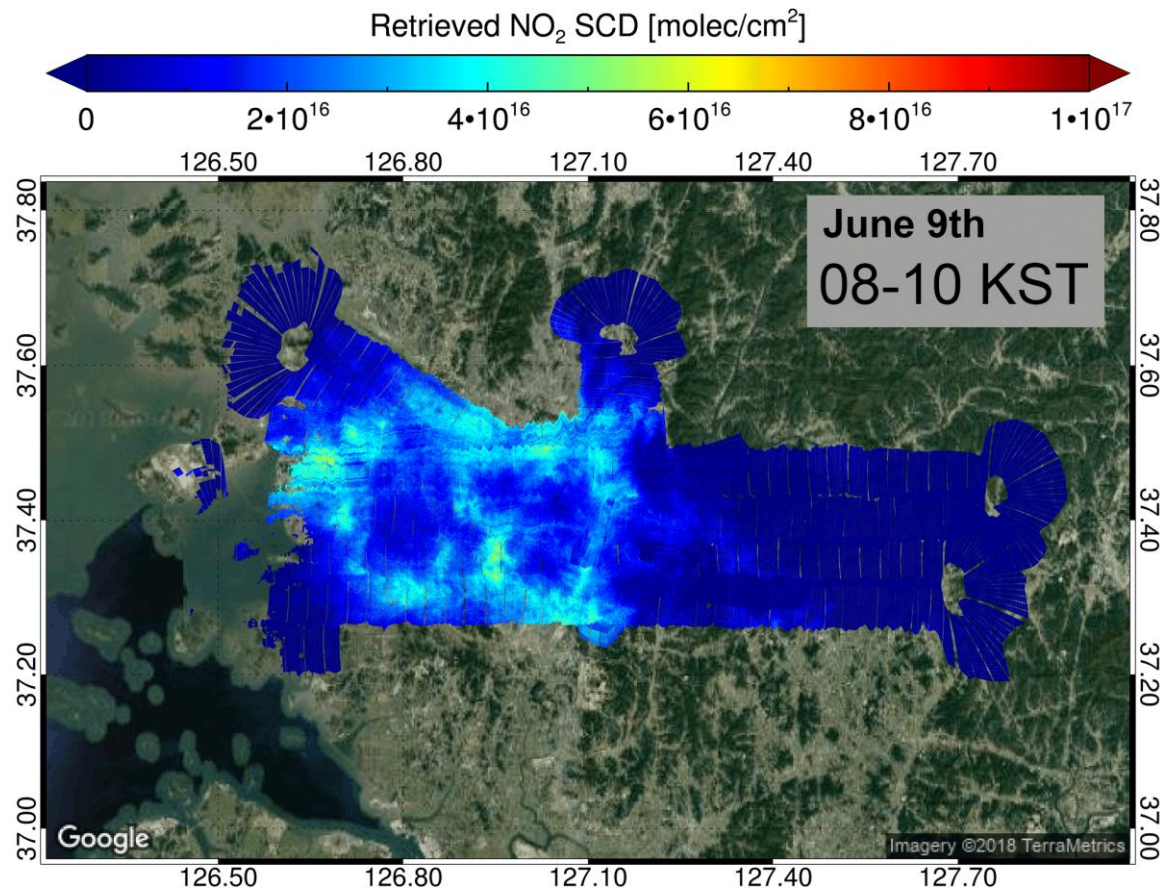
Estimated PM_{2.5} Measured PM_{2.5}

Estimated PM_{2.5} Measured PM_{2.5}



NO₂ in Seoul Metropolitan Area

GeoTASO
Airborne
Measurements
KORUS→AQ



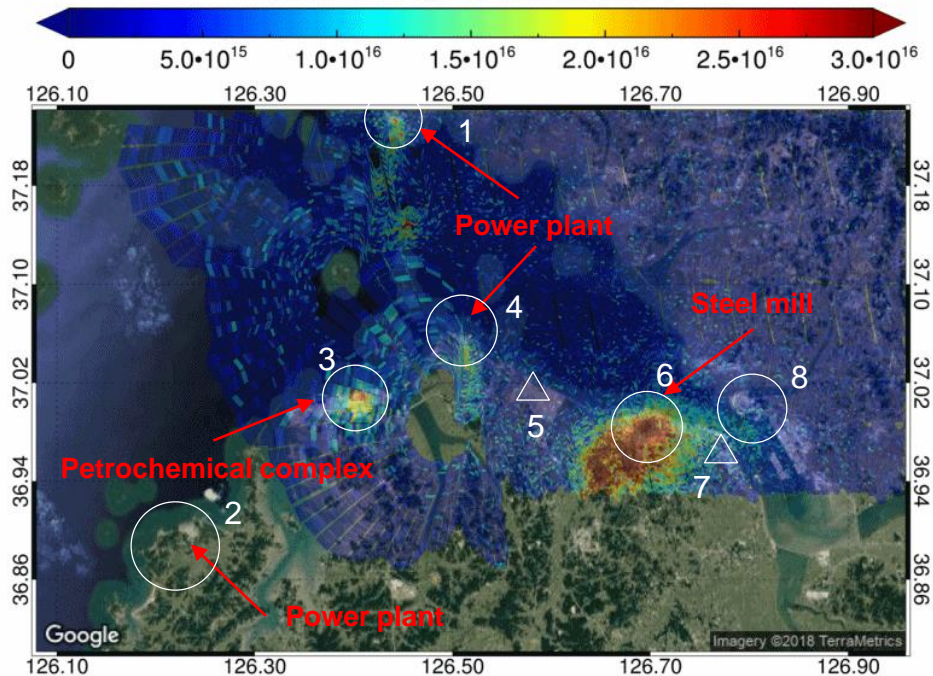
GEOTASO
Jay Al-Saadi,
Scott Janz
Matt Kowalewski
Jim Crawford

Version of L1B data: V2y

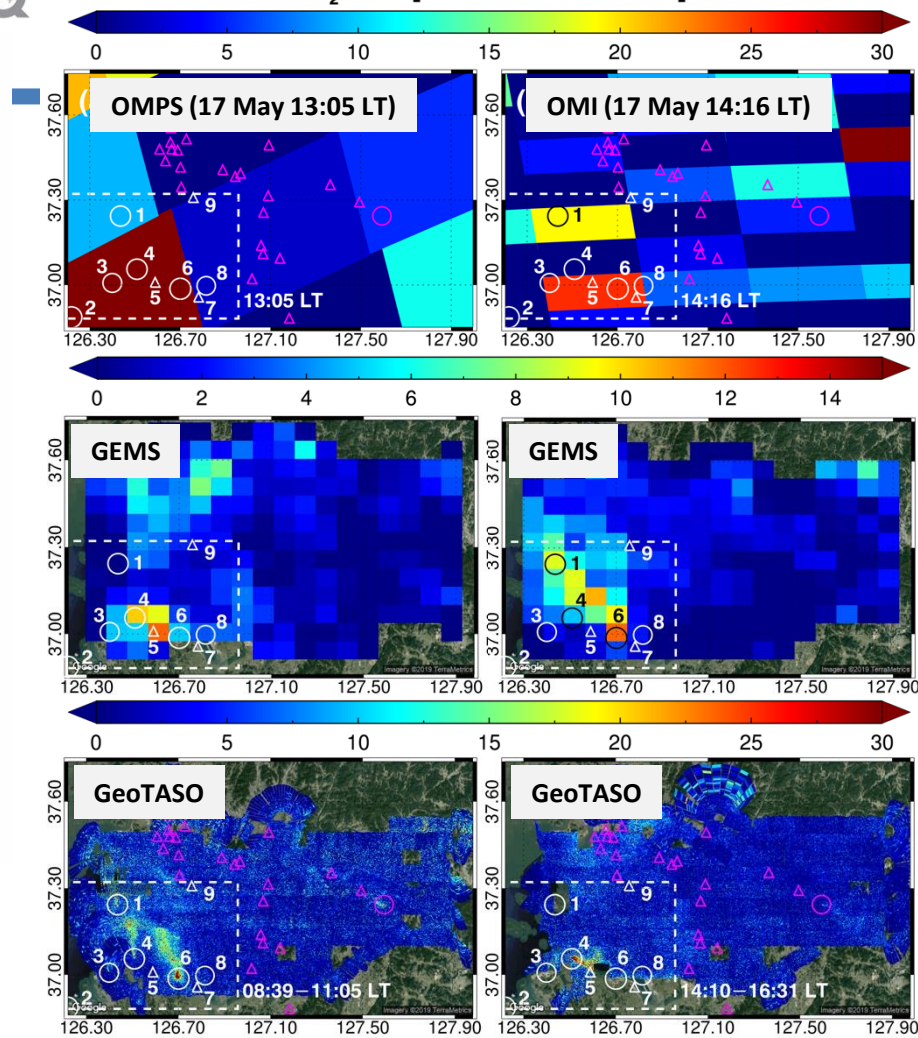


SO₂ observations from OMPS, OMI, GEMS, and GeoTASO

GeoTASO SO₂ VCD [molecules/cm²]



SO₂ VCD [10¹⁵ molecules cm⁻²]



**Source type
(Emission rate of sulfur oxides)**

- | | |
|---|--|
| 1. Power plant (5652.9 t yr ⁻¹) | 6. Steel mill (10850.4 t yr ⁻¹) |
| 2. Power plant (10507.4 t yr ⁻¹) | 7. Power plant + Waste processing plant (37.4 + 1.4 t yr ⁻¹) |
| 3. Petrochemical complex (2026.2 t yr ⁻¹) | 8. Power plant + Waste processing plant (1526.6 + 5.6 t yr ⁻¹) |
| 4. Power plant (6304.3 t yr ⁻¹) | 9. Industrial complex (476.7 t yr ⁻¹) |
| 5. Power plant (1.6 t yr ⁻¹) | |



Chong et al.
(RSE, 2020)

SUMMARY

- GEMS was launched on Feb. 19th, 2020, to form an Asian part for the GEO AQ Constellation with TEMPO and Sentinel-4 by early 2020s.
- GEMS science algorithm Ver. 1.0.0.4 was delivered to GEMS Ground Station, ESC.
- GEMS IOT activities are expected to continue till the end of this year, and data can be delivered/distributed from next year.
- Ground-based measurements by networking Pandora, TOL, MAX-DOAS, and AERONET are critical component for the data quality of GEMS.
- To interpret columnar information to surface concentrations, coordinated measurements of profiles, PBL, and surface concentrations are required.
- Calibration and validation are very important to evaluate the quality of the GEMS products during the IOT and the lifetime of GEMS. Active participation by participating countries are required for the success of the mission.

