



# Status of GEMS Synthetic Data Generation

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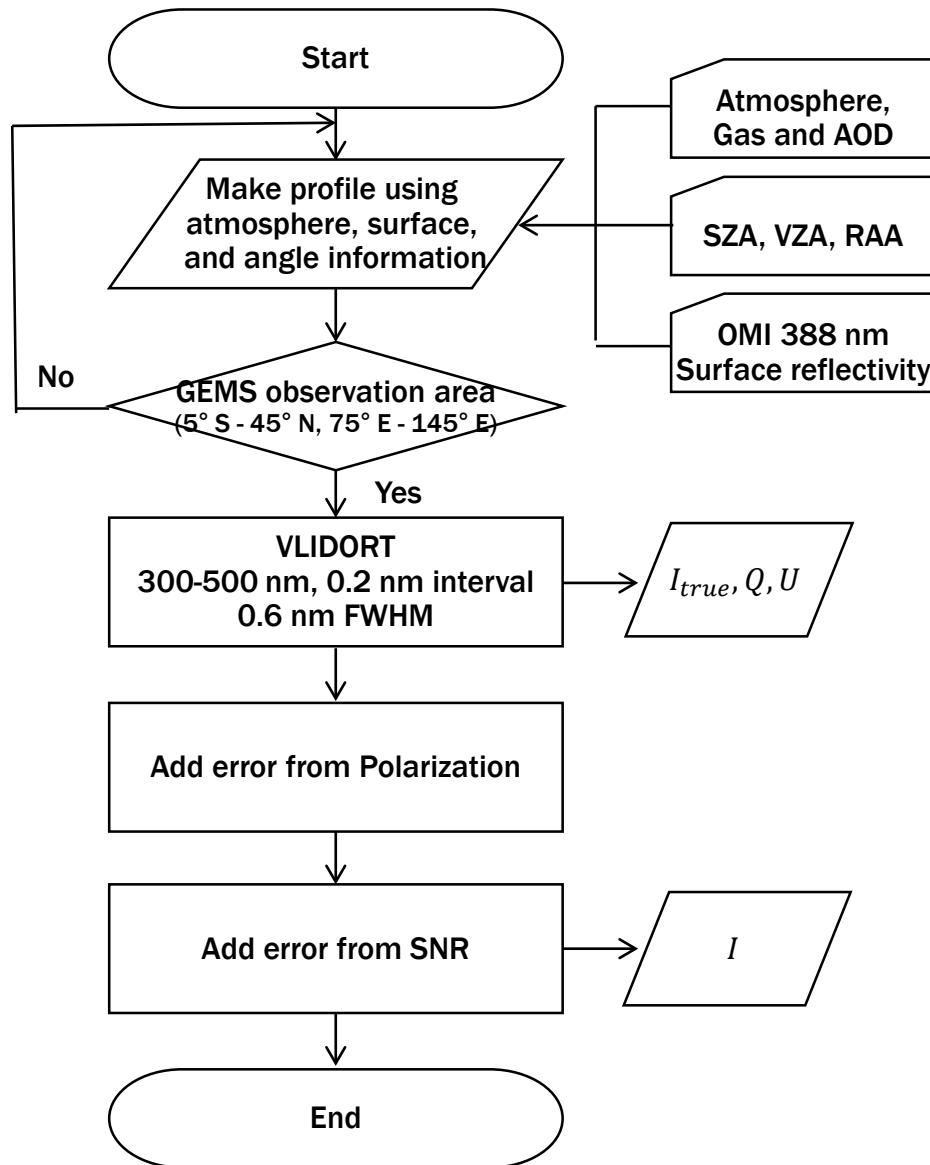
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2018. 10. 2. GEMS Science Meeting

# Data Generation Plan

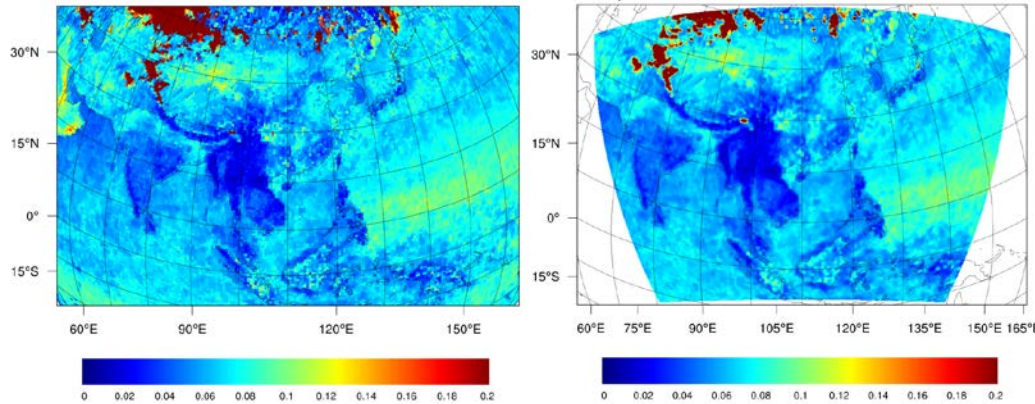
Temporal Resolution	1 day (7 hours) / Winter and Summer
Spatial Resolution	GEMS resolution (7 km × 8 km)
Spatial Coverage	GEMS coverage (5 °S – 45 °N, 75 °E- 145 °E)
Components	Aerosol, NO <sub>2</sub> , SO <sub>2</sub> , O <sub>3</sub> , HCHO
Chemical transport model (CTM)	GEOS-CHEM(Global) + CMAQ(East Asia)
Radiative transfer model (RTM)	VLIDORT
Spectral resolution	300-500 nm, 0.6 nm FWHM, 0.2 nm interval
Error Condition	SNR model, Polarization
Etc.	Vector Calculation Single LER value w/o wavelength- dependency No cloud

# Synthetic Data Generation



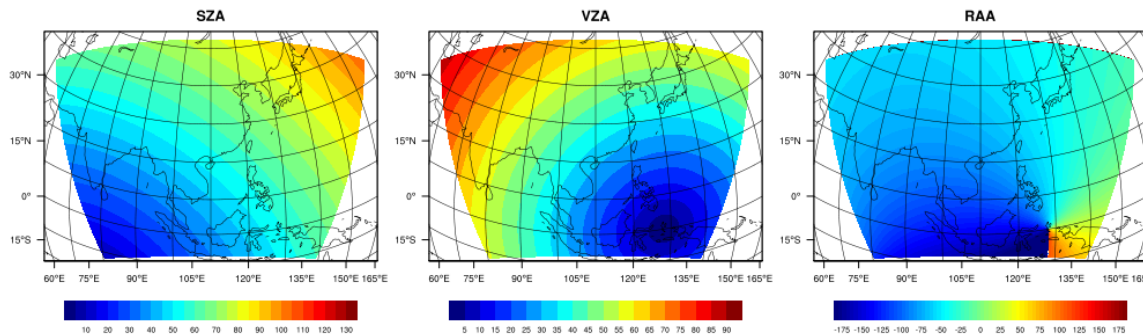
# Surface Reflectivity & Viewing Geometry

- Surface reflectivity
  - OMI/Aura Surface Reflectance Climatology Level 3 Global 0.5deg Lat/Lon Grid
  - Monthly Minimum Surface Reflectance, 388 nm
  - $0.5^\circ \times 0.5^\circ \rightarrow 7 \text{ km} \times 8 \text{ km}$



January  
Min: 0.008    Max: 0.803

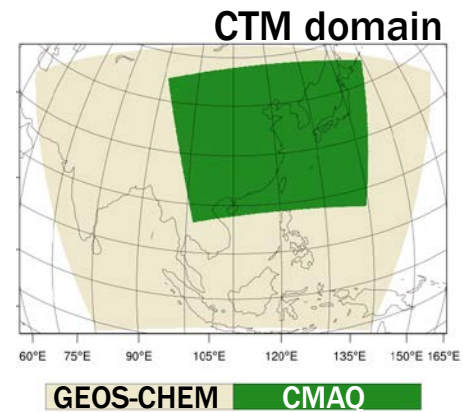
- Viewing Geometry (SZA, VZA, RAA)



Time: 2016. 01. 15. 0700

# Gas and AOD Profile

- Chemical Transport Model (CTM): GEOS-Chem ( $2^\circ \times 2.5^\circ$ ) and CMAQ ( $15 \text{ km} \times 15 \text{ km}$ )
- Re-gridding: Re-gridding CTM output similar to GEMS observation resolution ( $7 \text{ km} \times 8 \text{ km}$ )
- Variables:  $\text{O}_3$ ,  $\text{NO}_2$ ,  $\text{SO}_2$ , HCHO (ppbv), TA(K), PRES (hPa), DEL\_H (m)
- Grid:  $1199(\text{Lat}) \times 899(\text{Lon}) \times 38$  (vertical)



GEOS-CHEM CMAQ

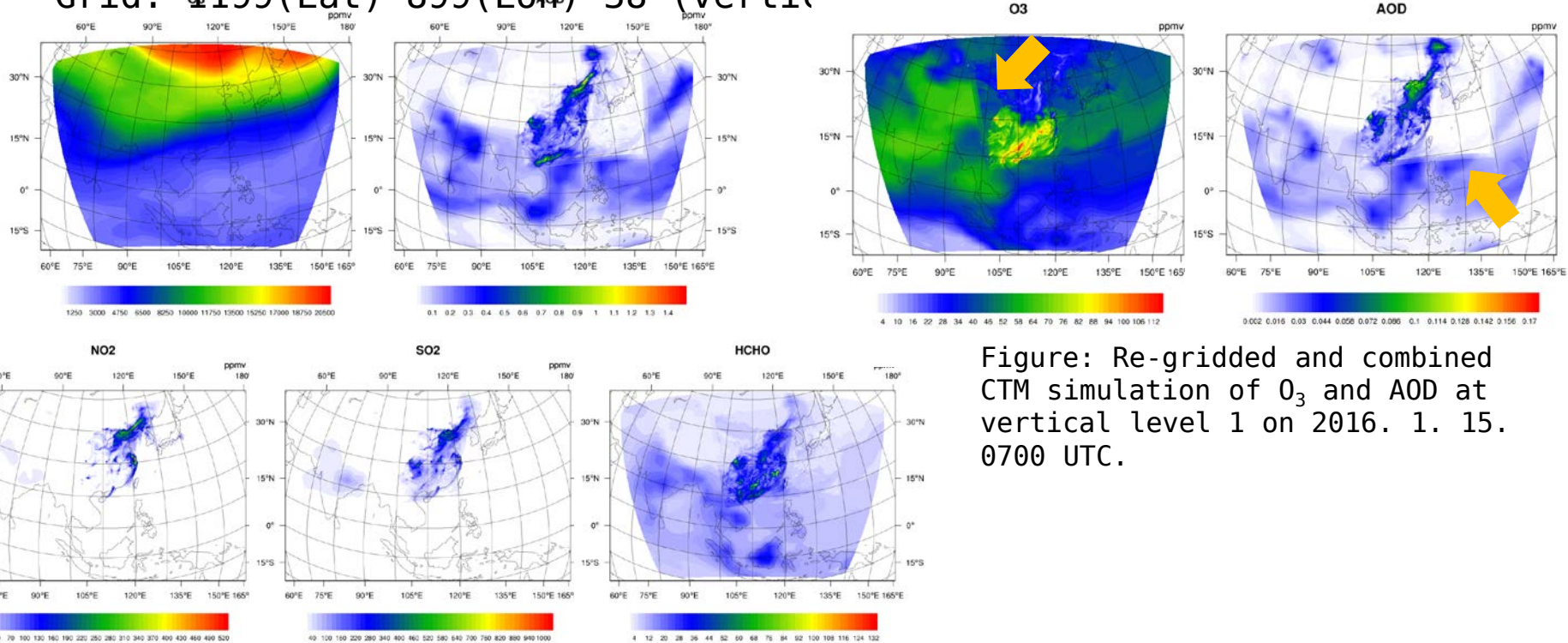
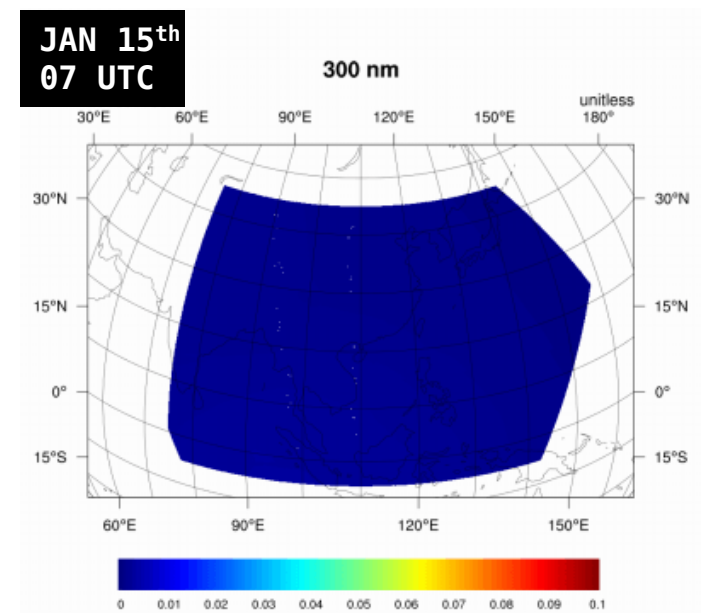
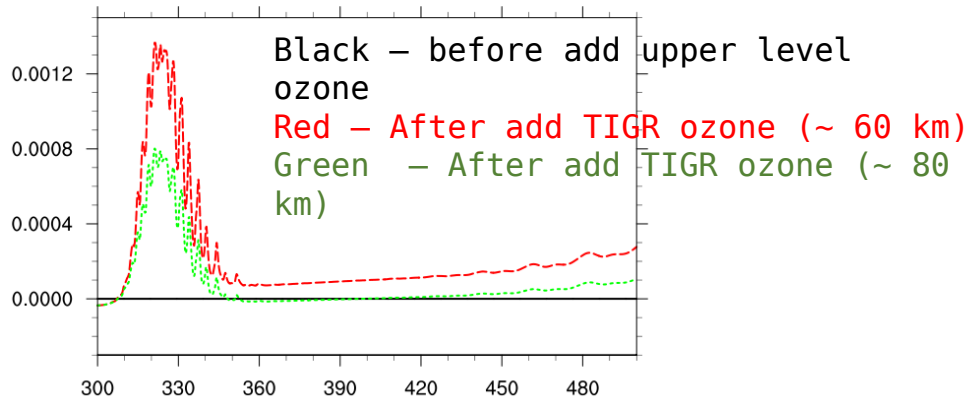
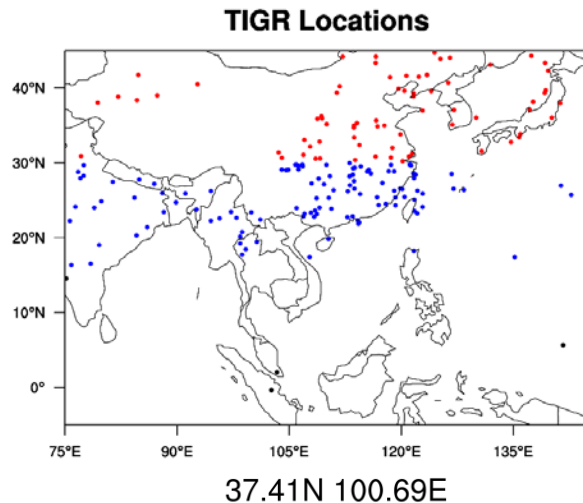


Figure: Re-gridded and combined CTM simulation of  $\text{O}_3$  and AOD at vertical level 1 on 2016. 1. 0700 UTC.

Figure. Re-gridded and combined CTM simulation on 2016. 1. 15. 0700 UTC. Gases and AOD are vertically accumulated value

# Supplement upper level Ozone

- Thermodynamic Initial Guess Retrieval (TIGR) 2000 for  $O_3$ 
  - 43 layer, 1000 ~ 0.0026 hPa
  - # Profiles in the GEMS observation area: 194

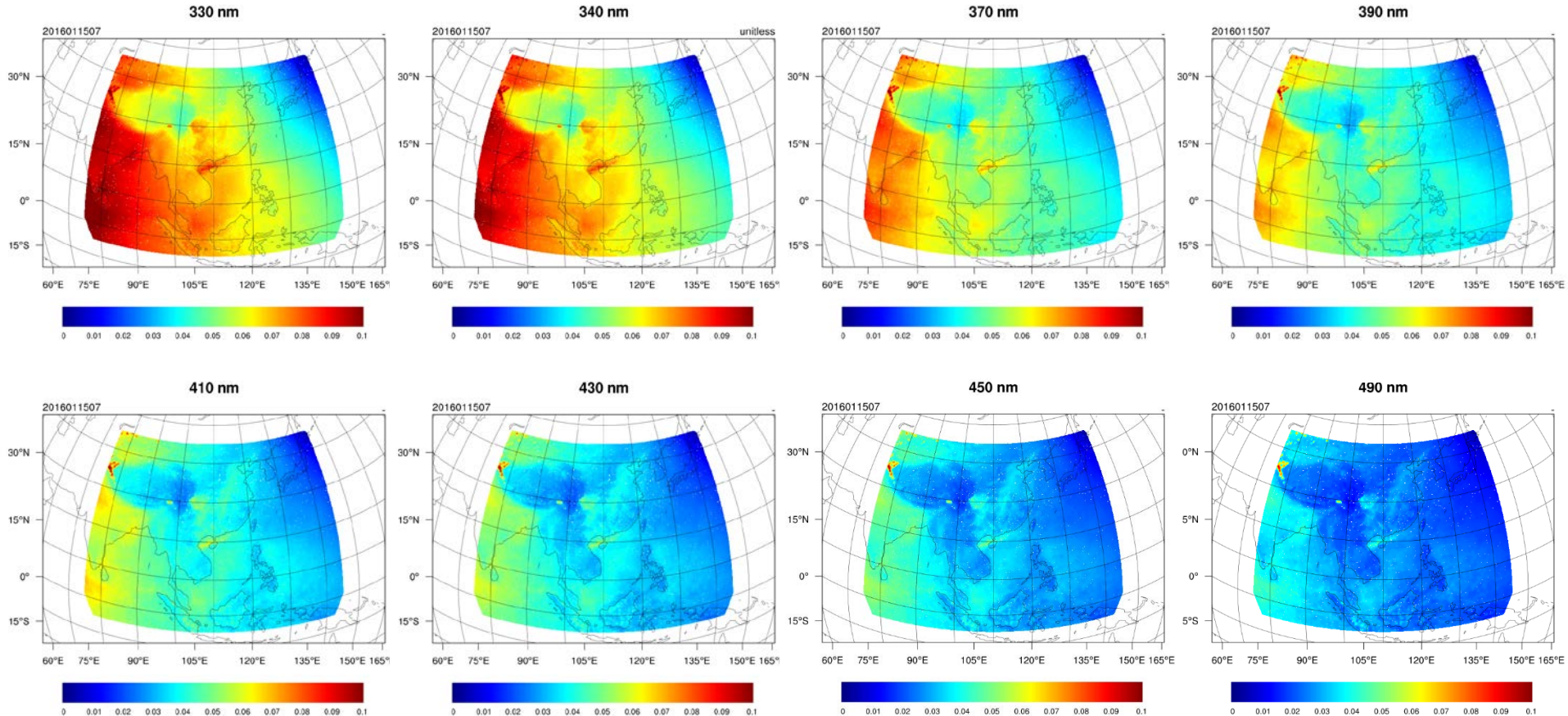


Maximum difference is 9.4 % after adding TIGR ozone

# Results of Synthetic Data

- Normalized radiance ( $I$ )
  - Simulated by RTM and add instrument polarization sensitivity and

Time: 2016. 01. 15. 0700



# Format for Synthetic Data

- NetCDF, 6 files for each time

GEMS\_yyyymmddhh\_radiance.nc (4GB)

Variable name	Dimensions	units
Wavelength	[1001]	nm
SZA	[899×1199]	-
VZA	[899×1199]	-
RAA	[899×1199]	-
Latitude	[899×1199]	-
Longitude	[899×1199]	-
Irradiance	[1001]	photons/cm2/nm/s
radiance	[1001×899×1199]	unitless

GEMS\_yyyymmddhh\_albedoPresTempInfo.nc (700MB)

Variable name	Dimensions	units
SurfaceAlbedo	[899×1199]	unitless
Pressure	[56×899×1199]	hPa
Altitude	[56×899×1199]	km
Temperature	[56×899×1199]	K
Latitude	[899×1199]	-
Longitude	[899×1199]	-

GEMS\_yyyymmddhh\_gasAodInfo.nc (1GB)

Variable name	Dimensions	units
O3	[55×899×1199]	molecules/cm2
NO2	[55×899×1199]	molecules/cm2
SO2	[55×899×1199]	molecules/cm2
HCHO	[55×899×1199]	molecules/cm2
500nmAODs	[55×899×1199]	-

GEMS\_yyyymmddhh\_stokesQ.nc (4GB)

Variable name	Dimensions	units
q	[1001×899×1199]	unitless

GEMS\_yyyymmddhh\_stokesU.nc (4GB)

Variable name	Dimensions	units
u	[1001×899×1199]	unitless

GEMS\_yyyymmddhh\_radiance\_polsnr.nc (4GB)

Variable name	Dimensions	units
radiance_pols	[1001×899×1199]	unitless
nr	[ ]	



Thank you 😊