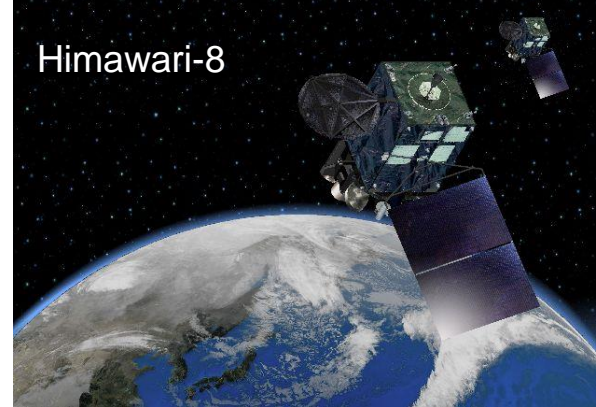




GEMS



Himawari-8

Comparison and validation of aerosol products between GEMS and with Himawari-8

Yasuko KASAI¹, Mayuko Yoshikawa¹ and GnGval team^{*1,2,3,4...}

¹NICT, ²JAMSTEC, ³NIES, ⁴University of Chiba...

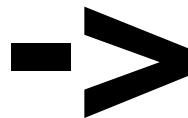
*PI of GnGval team is Yugo Kanaya

Purpose

- 1 year comparisons between GEMS and Himawari-8 in **the area where Himawari-8 aerosol retrieved.**

→ Himawari-8 has a problem to produce aerosol over China land
→ That is the problem for weather forecasting of air pollutions, such as yellow dust, from the area main land China.

- Conform the GEMS aerosol observation in particular Himawari-aerosol retrieval did not work.



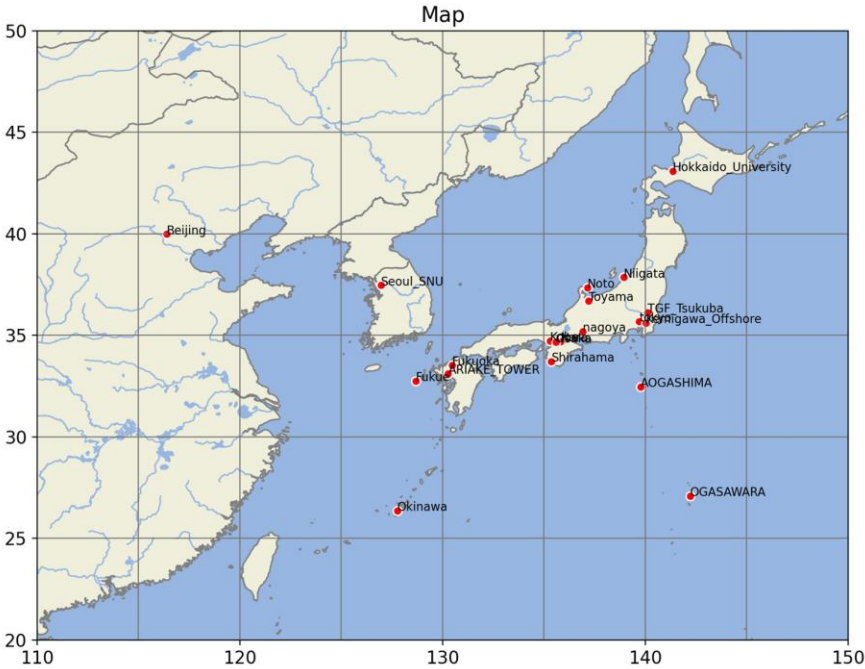
Better weather
forecasting of
Air pollution

Imager specifications of Himawari-8

Wave length [μm]	Himawari-8/9			
	Band number	Spatial resolution at SSP [km]	Central wave length [μm]	
			AHI 8 (Himawari 8)	AHI 9 (Himawari 9)
0.47	1	1	0.47063	0.47059
0.51	2	1	0.51000	0.50993
0.64	3	0.5	0.63914	0.63972
0.86	4	1	0.85670	0.85668
1.6	5	2	1.6101	1.6065
2.3	6	2	2.2568	2.2570
3.9	7	2	3.8853	3.8289
6.2	8	2	6.2429	6.2479
6.9	9	2	6.9410	6.9555
7.3	10	2	7.3467	7.3437
8.6	11	2	8.5926	8.5936
9.6	12	2	9.6372	9.6274
10.4	13	2	10.4073	10.4074
11.2	14	2	11.2395	11.2080
12.4	15	2	12.3806	12.3648
13.3	16	2	13.2807	13.3107

Comparison points were picked up (well validated area)

Name	Longitude(deg)	Latitude(deg)
ARIAKE_TOWER	130.27195	33.103617
Fukue	128.682	32.752
Fukuoka	130.475	33.524
Hokkaido_University	141.3407	43.0755
Kemigawa_Offshore	140.02333	35.610833
Kobe	135.291	34.72
Nara	135.828	34.688
Niigata	138.942	37.846
Noto	137.136944	37.334444
Okinawa	127.768333	26.356667
Osaka	135.590633	34.650933
Shirahama	135.356917	33.69345
TGF_Tsukuba	140.096	36.113889
Toyama	137.187	36.699
AOGASHIMA	139.769022	32.450719
OGASAWARA	142.213271	27.087917
Beijing	116.38137	39.97689
Seoul_SNU	126.951111	37.458056

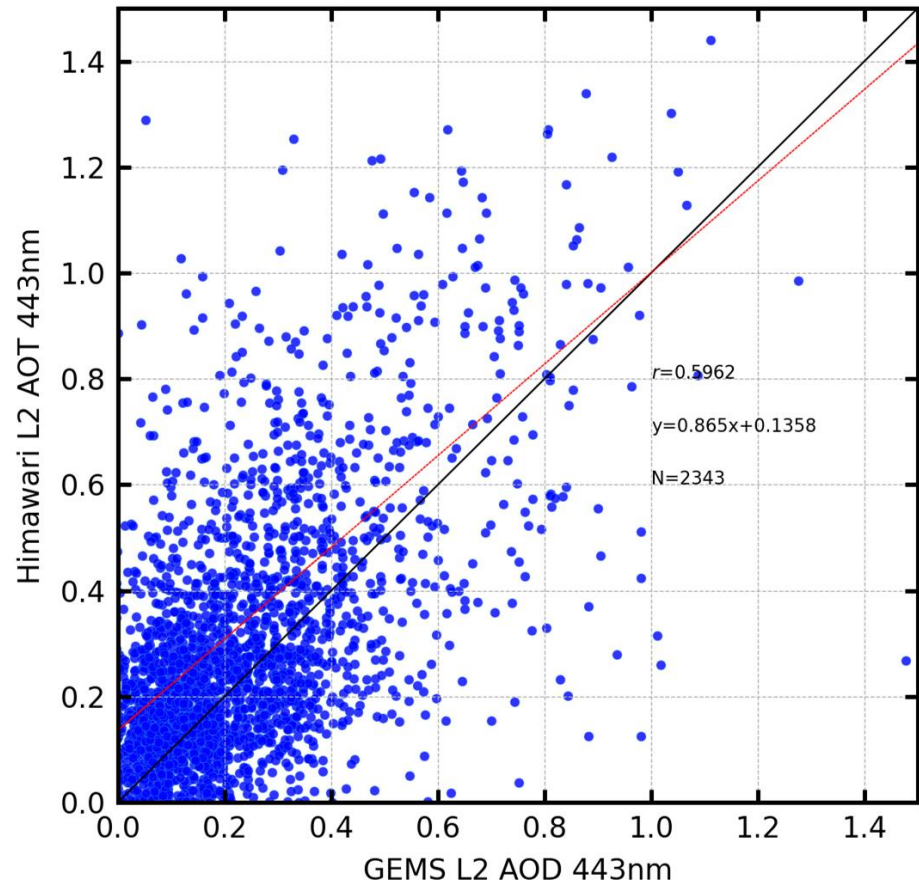


Data pre-processing

	Himawari 8 L2	GEMS L2 AOD
coordinate system	latitude-longitude	Satellite coordinates
Horizontal resolution	0.05 deg x 0.05 deg	7km x 4.5km
Observation time	Every 10 min interpolate 35min data using data 40min and 50min.	Every 45min
Wave length	500nm => 433nm transform	443nm



In order to match the spatial resolutions of Himawari-8 and GEMS, the spatial resolution of Himawari-8 L2 was transformed into the satellite coordinate system of GEMS. Since GEMS is observed at 45 minutes every hour, the Himawari-8 40-minute and 50-minute observation values were linearly interpolated to create data for the 45-minute observation time.

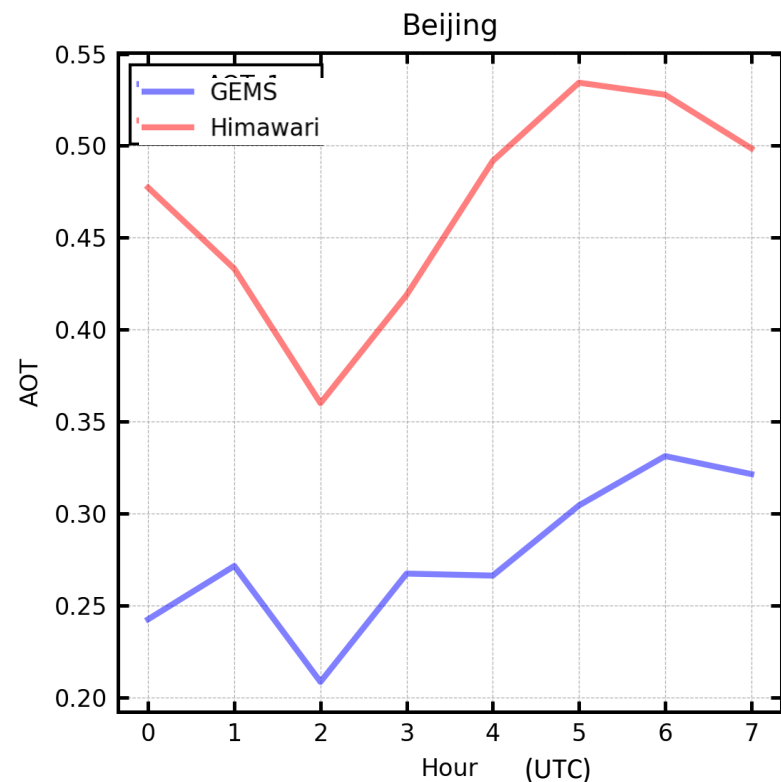
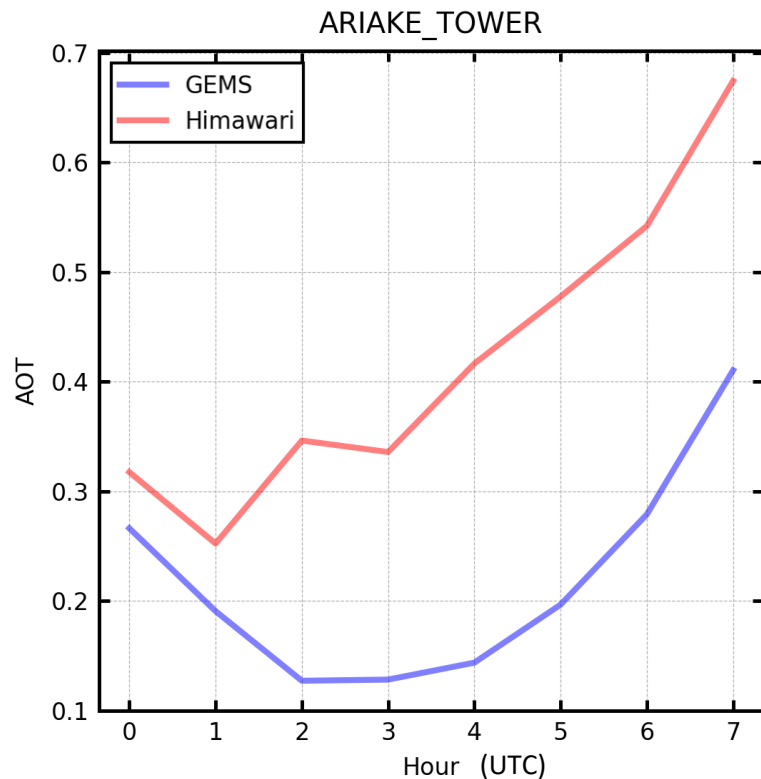


Simple scatter plots

$$r = 0.596$$

GEMS has negative trends for Himawari-8

Diurnal Variation in ARIAKE and Beijing

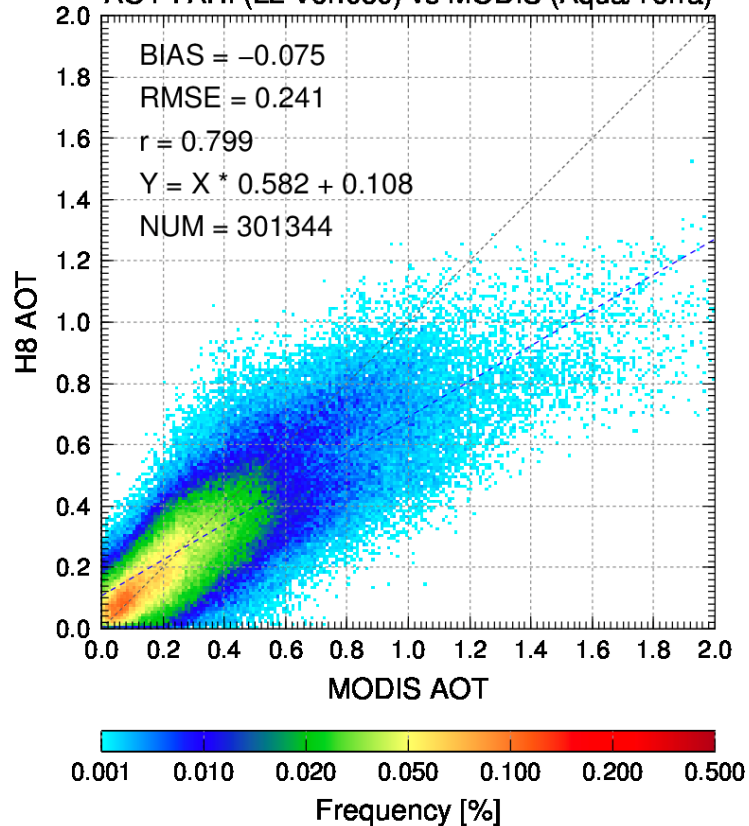


GEMS has negative trends for Himawari-8. Presentation of S. Kang from Yonsei University showed the trends
Of AOD, 354nm > 443nm > 550nm

Monthly scatter plots

Land : 2021/01

AOT : AHI (L2 Ver.030) vs MODIS (Aqua/Terra)



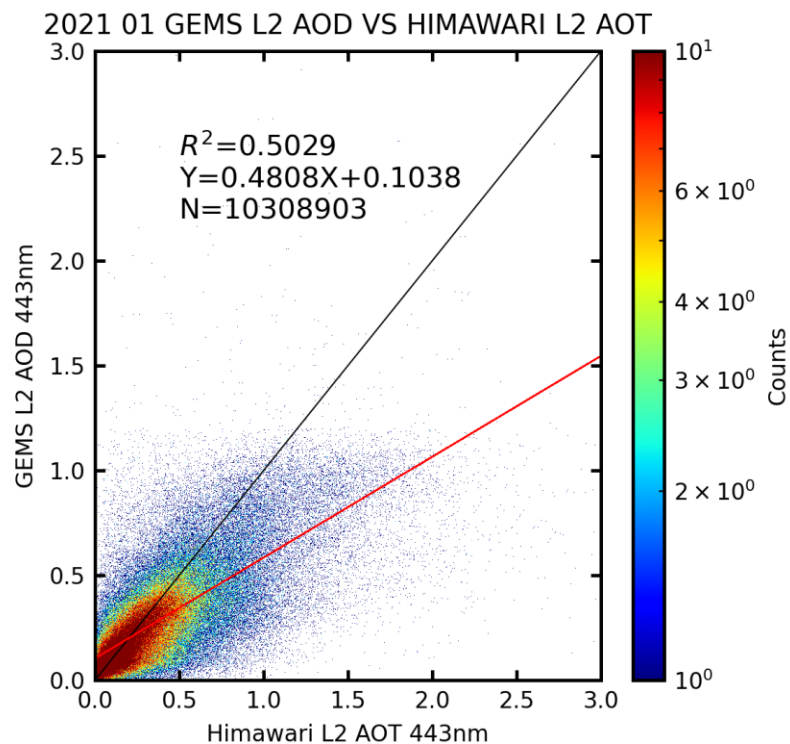
[An example between H8 vs MODIS](#)

<https://www.eorc.jaxa.jp/cgi-bin/ptree/validation/arp.cgi>

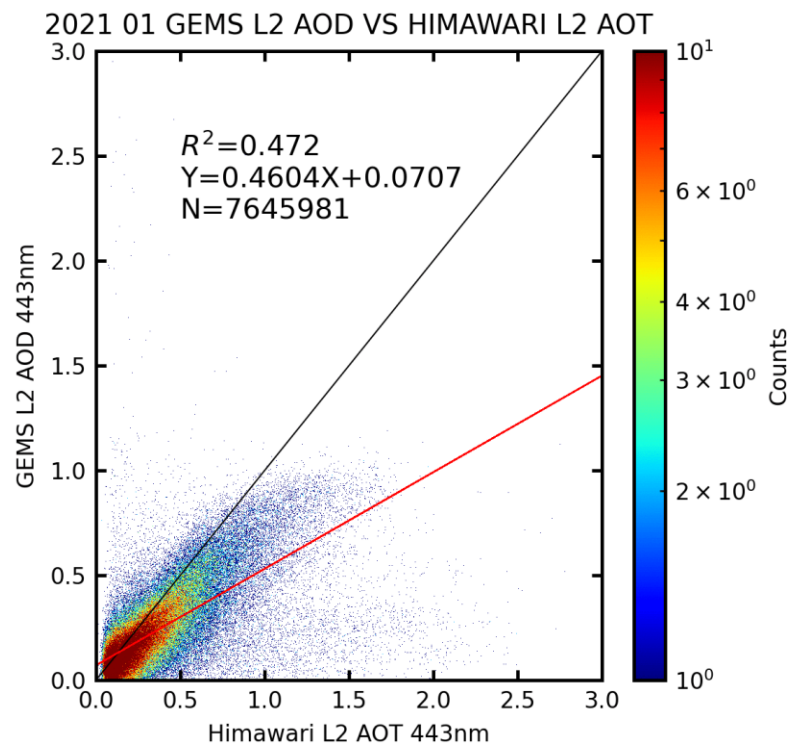
2D histogram (bin=10000,10000)

Monthly scatter plot

Over LAND



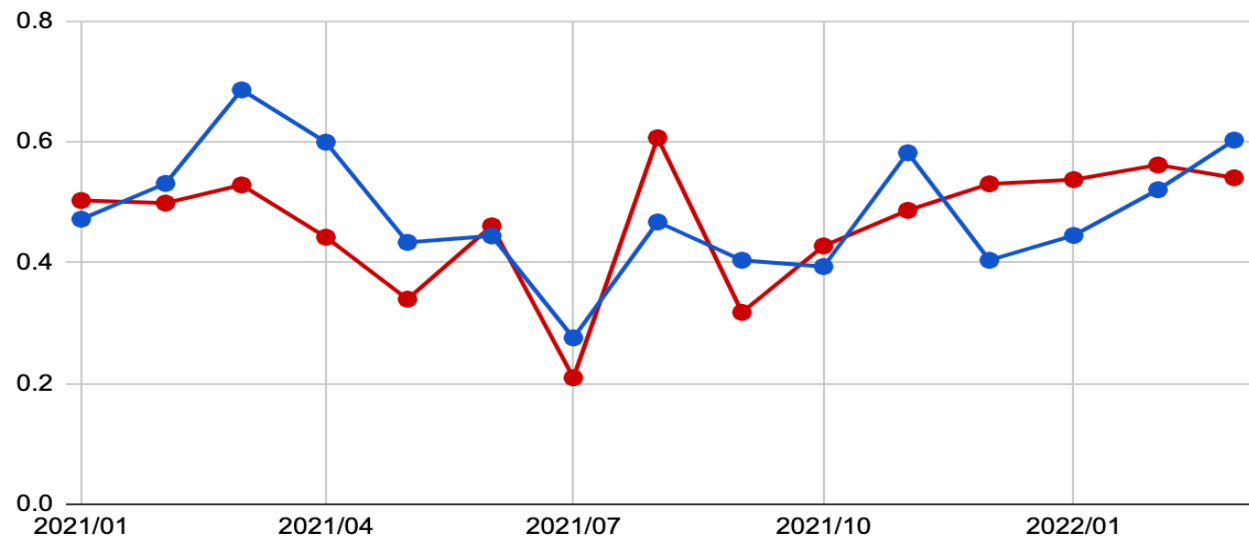
Over Ocean



Correlation coefficients dose not change so much over the period for both over the Land and ocean

Over Land

Over Ocean



2021/01	2021/02	2021/03	2021/04	2021/05	2021/06	2021/07	2021/08	2021/09	2021/10	2021/11	2021/12	2022/01	2022/02	2022/03
0.5029	0.4986	0.5287	0.4422	0.3396	0.4609	0.2094	0.6068	0.3177	0.4277	0.4866	0.5305	0.5375	0.5617	0.5405
0.472	0.5312	0.6861	0.5995	0.4336	0.4443	0.2755	0.4674	0.404	0.3935	0.582	0.404	0.4451	0.5208	0.6029

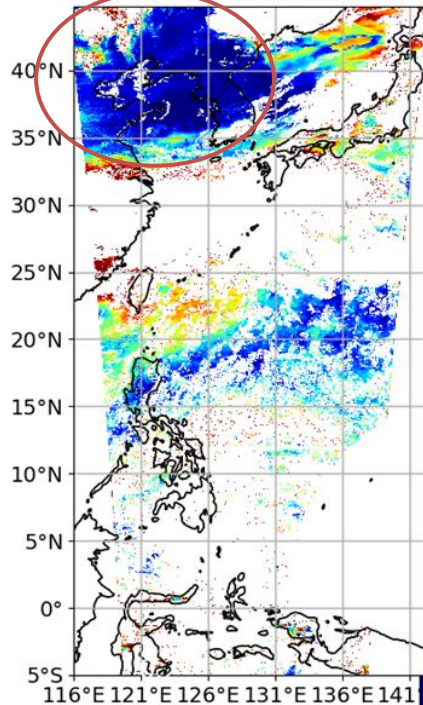
Date of Yellow Dusts fly to Japan in 2021

(11地点での統計)

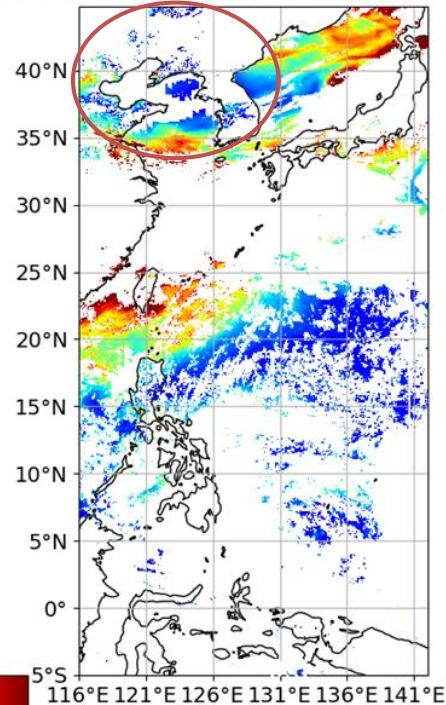
[illegible]

2021/03/30

GEMS L2 AOD 443nm 2021-03-30 00:45 (UTC)

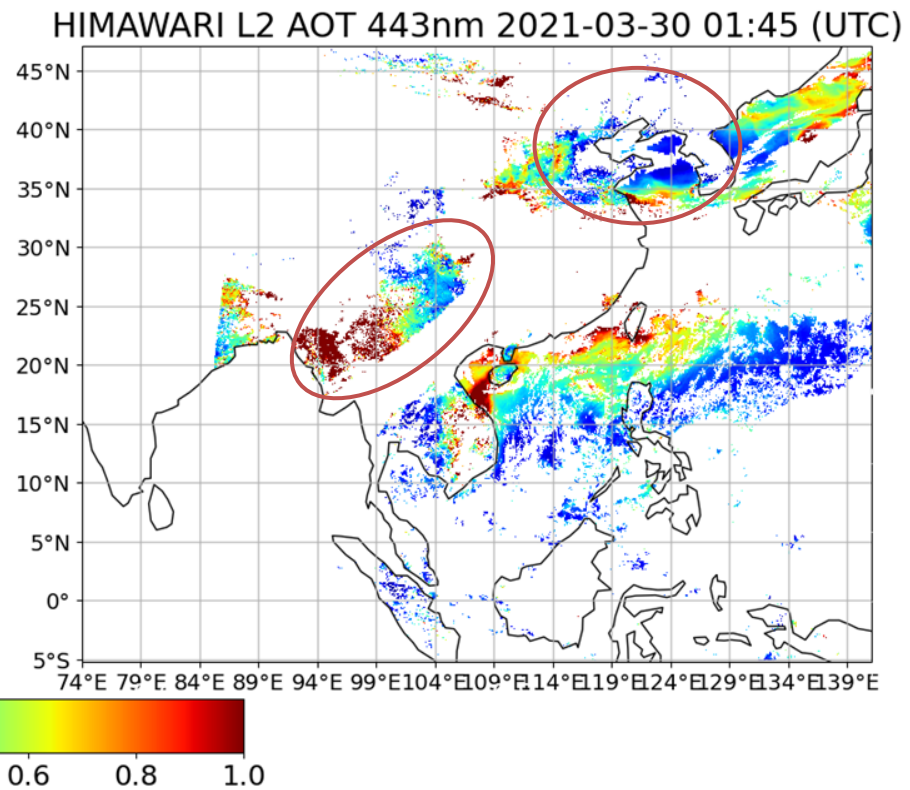
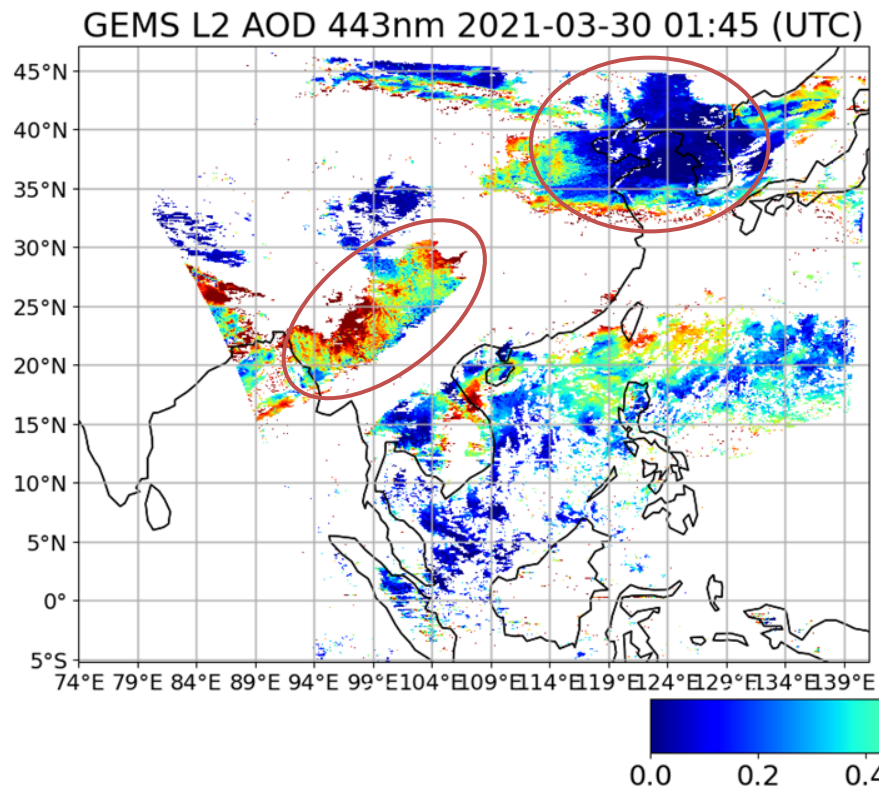


HIMAWARI L2 AOT 443nm 2021-03-30 00:45 (UTC)

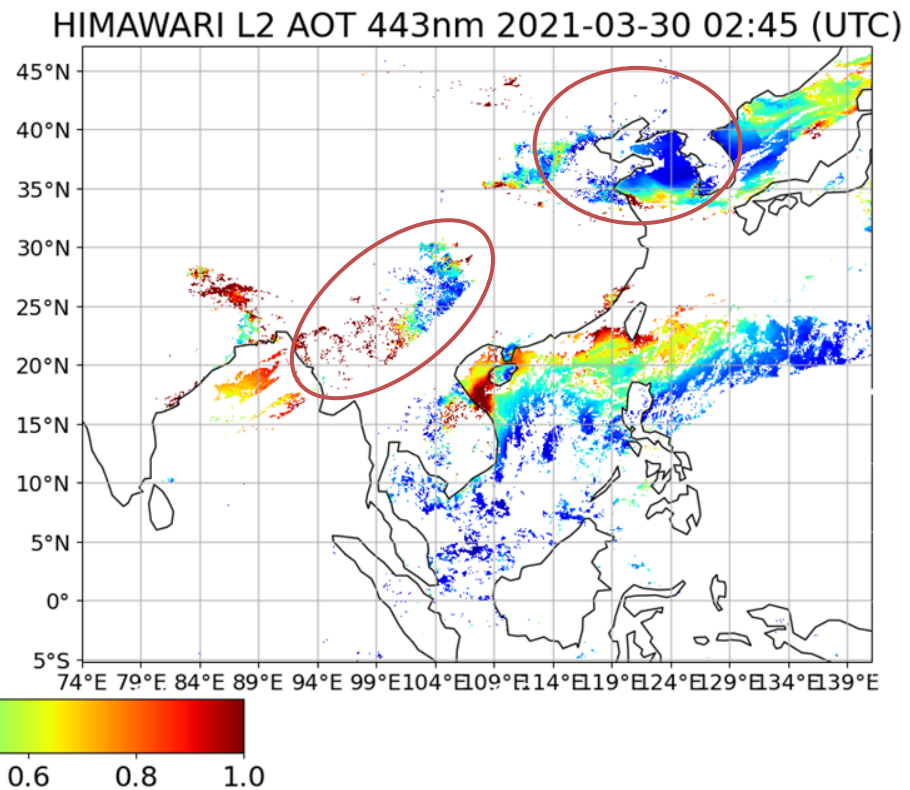
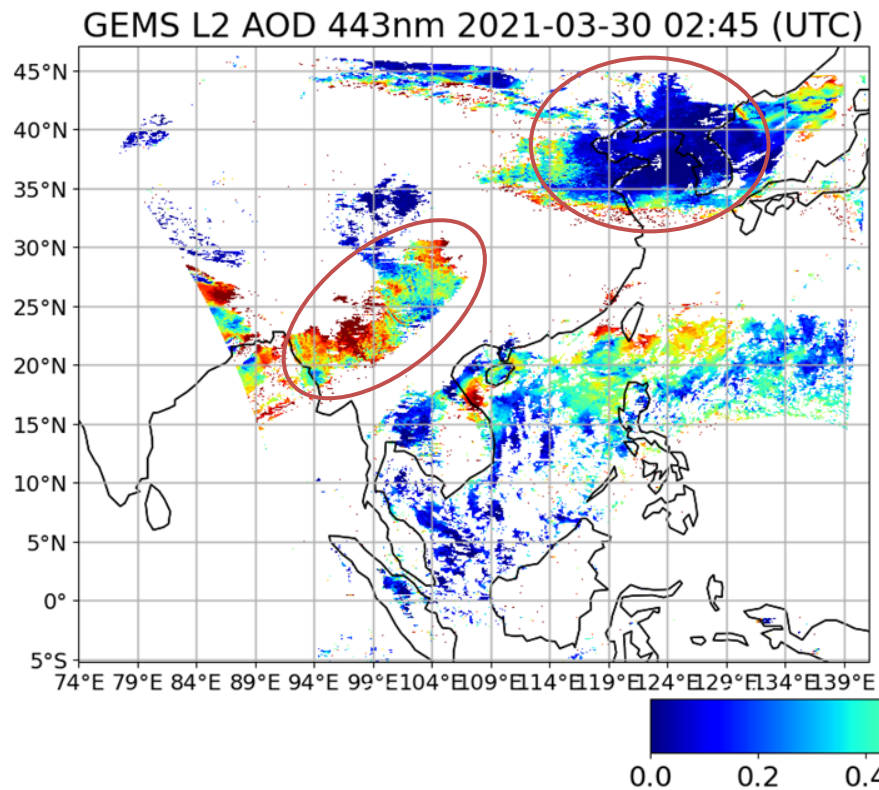


0.0 0.2 0.4 0.6 0.8 1.0

2021/03/30

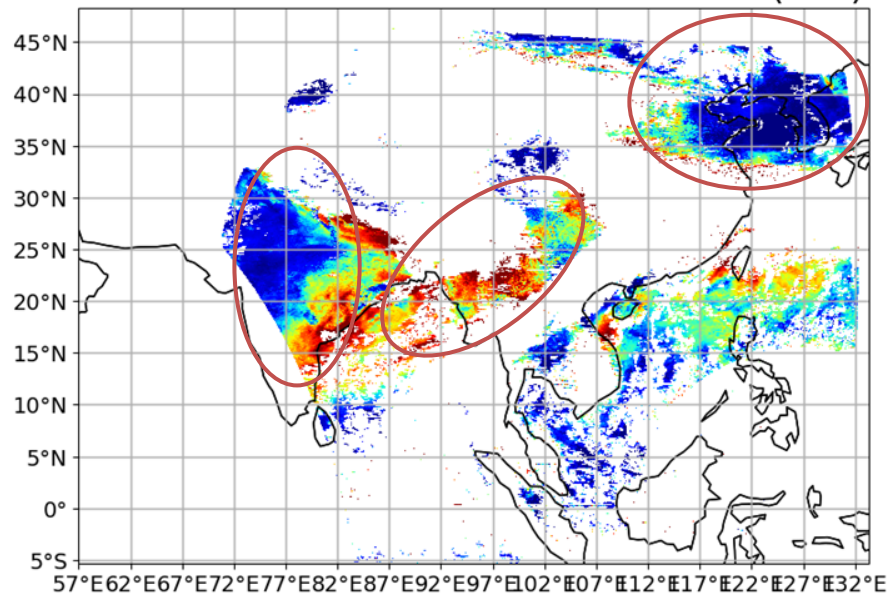


2021/03/30

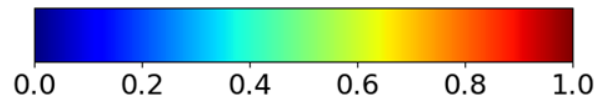
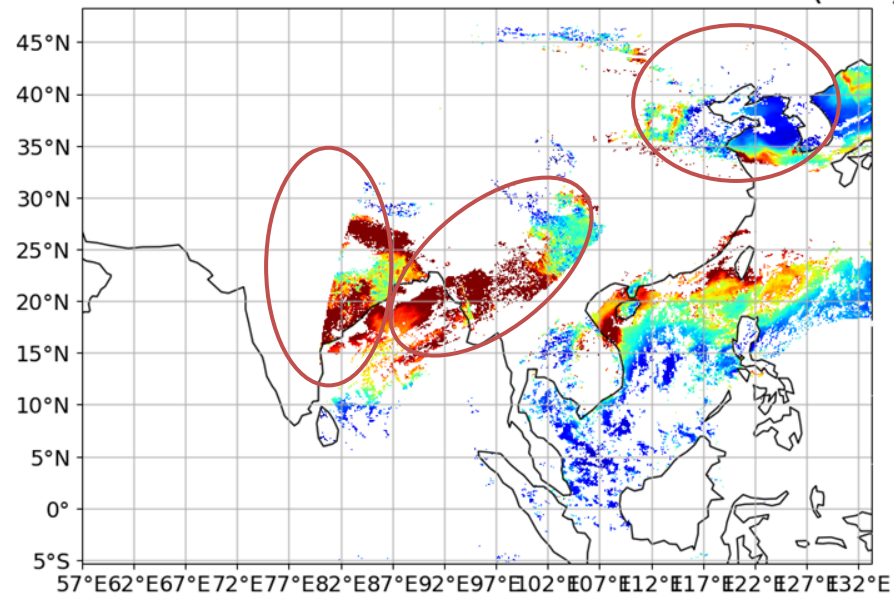


2021/03/30

GEMS L2 AOD 443nm 2021-03-30 03:45 (UTC)

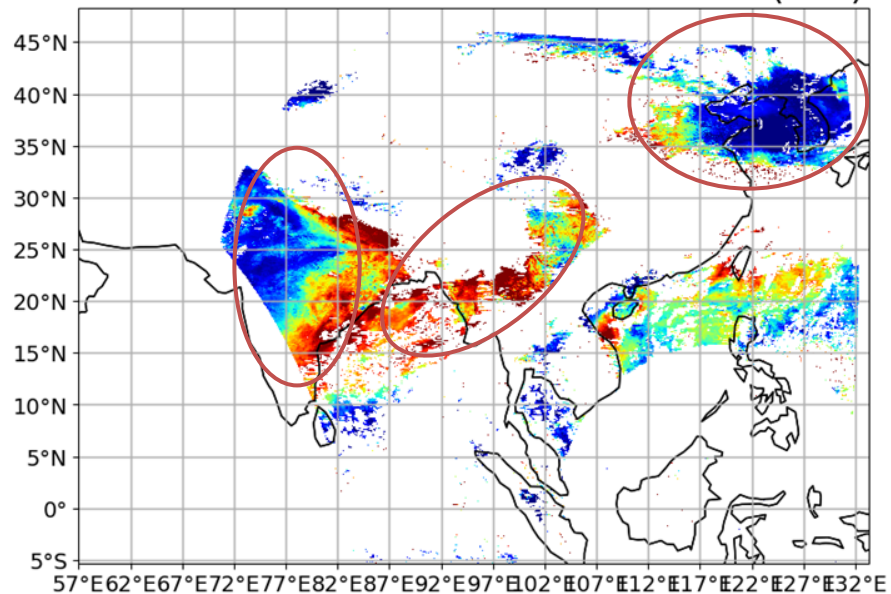


HIMAWARI L2 AOT 443nm 2021-03-30 03:45 (UTC)

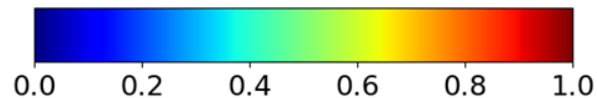
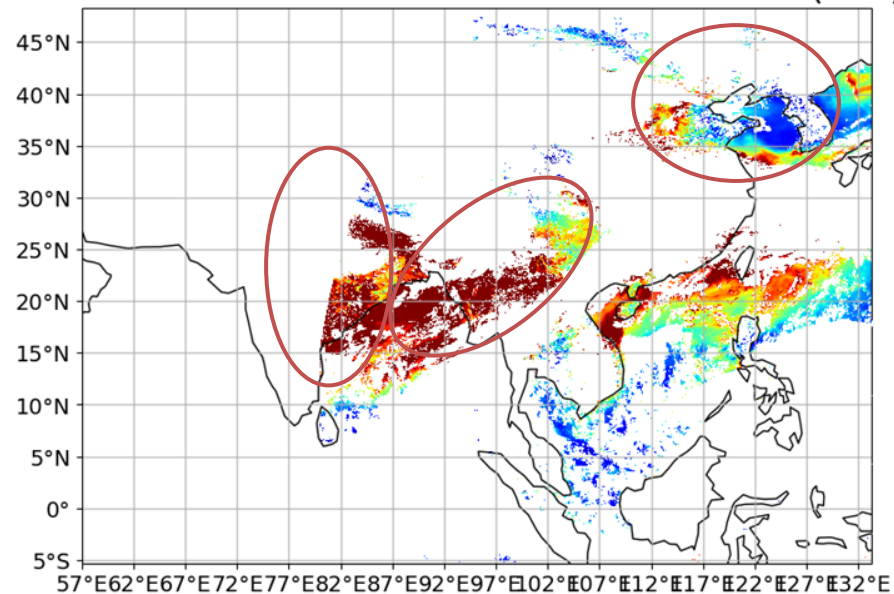


2021/03/30

GEMS L2 AOD 443nm 2021-03-30 04:45 (UTC)



HIMAWARI L2 AOT 443nm 2021-03-30 04:45 (UTC)



Summary

- GEMS L2 express AOT over China land, where area assumed yellow dust come from, better than Himawari.
- Since GEMS L2 can better capture dust particles flying from the Gobi-Mongolian desert, it is expected that the forecast accuracy will be improved by assimilating GEMS data into dust forecast.



Summary and Questions to GEMS team

- GEMS data is quite attractive for the pollution weather forecasting
 - When is the date GEMS data will be publicly available?
 - Do you have any rule for the case Japanese company would like to use?

4.1. データ前処理

4.1.2. 時空間内挿とAOT波長変換、解析手法について

Himawari-8 のAOT 波長は500nm , GEMS L2 AOD の波長は 443nm である。解析を行うには、波長を一致させる必要がある。Himawari-8 のAE を使用して、変換式(1)(Eck et al., 1999)

$$\alpha = - \frac{d \ln \tau_a}{d \ln \lambda} = - \frac{\ln\left(\frac{\tau_{a2}}{\tau_{a1}}\right)}{\ln\left(\frac{\lambda_2}{\lambda_1}\right)} \quad \cdot \cdot \cdot (1)$$

を用いて、Himawari-8 AOT(λ_1 :500nm) からAOT(λ_2 :443nm)に変換した。ここで λ は波長、 τ はAOT、 α はその波長におけるAEである。

解析は、GOCI Yonsei V2 と Himawari 8 の時空間を一致させたのち、回帰分析と正規分布へのフィッティングを実施した。また、ノイズを除去するために、GEMS の AOD_Flag ≤ 3 の場合のみのデータを使用した。