

Comparison of aerosol properties between GOSAT-2/TANSO-CAI-2 and ground-based observations and other satellites

3-P10

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GOSAT-2/TANSO-CAI-2



Band	FORWARD					BACKWARD				
	1	2	3	4	5	6	7	8	9	10
Center of wavelength [nm]	339	441	672	865	1630	377	546	672	865	1630
Line of sight [degree]	+20					-20				
IFOV [m]	460					920				
Swath [km]	~920 km									

Aerosol algorithm (MWPM)

Multi-wavelength and -pixel method (Hashimoto and Nakajima, 2017)
 Good for spatially heterogeneous Ag area like urban area

$$R_1 = R_{1,a} + R_{1,g} = A_{1,g} + \tau \cdot [c \cdot \omega P(\Theta) - c_s \cdot A_{1,g}] \rightarrow R = f(u) + e$$

$$R_2 = R_{2,a} + R_{2,g} = A_{2,g} + \tau \cdot [c_s \cdot \omega P(\Theta) - c_s \cdot A_{2,g}]$$

= 0 (Independent of AOT*)

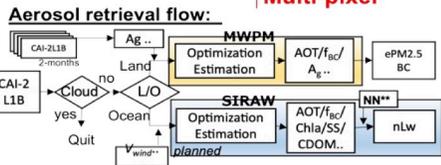
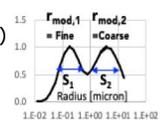
R : Reflectance, τ : AOT, ω : SSA, $P(\Theta)$: Phase function, $A_{1,g}$: Surface albedo

Cost function (φ): Optimal method + Smoothing constraint

$$\varphi = [R - f(u)]^T S_e^{-1} [R - f(u)] + (u - u_a)^T S_u^{-1} (u - u_a) + \sum_{j=1}^n \gamma_j \cdot (B_j + D_j u)^T (B_j + D_j u)$$

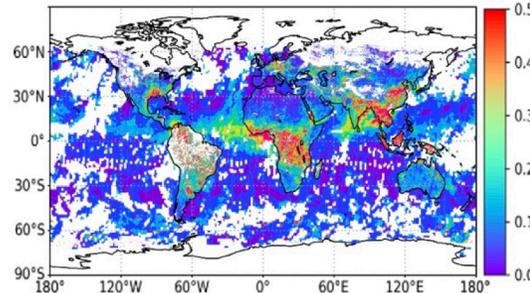
Aerosol model:

Log-normal size distribution (SDV)
 Fine: $75\% \text{H}_2\text{SO}_4 + \text{BC}$
 Coarse: Yellow sand



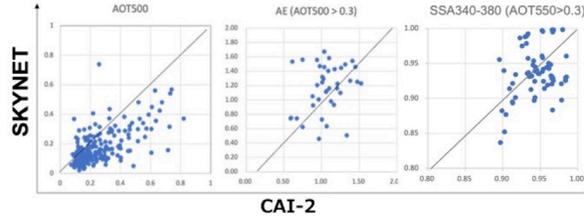
CAI-2 AOT

Mean values of fine mode aerosol optical thickness at wavelength 550nm (AOD550 fine) in Feb. and March 2019 by MWPM.



CAI-2 vs SKYNET

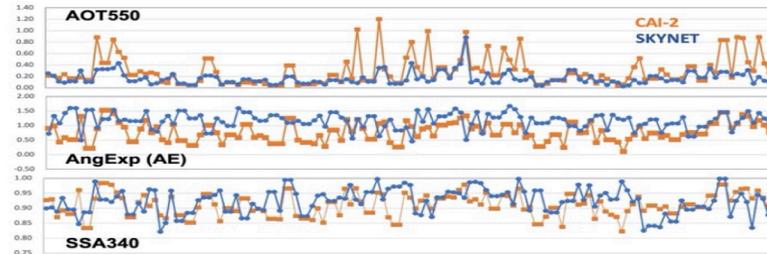
- CAI-2 5x5pixs averaged data, Period : 2019/03 – 2020/05
- QC: rmsd <= 7%, cv(5x5) < 0.1 Time diff. < 1h



AOT550 : CAI-2 overestimate
 AE, SSA : Correlation are found when AOT550 > 0.3

- Timeseries of CAI-2 and SKYNET AOT550, AE, SSA340

AOT in Winter season looks lower than in Summer season



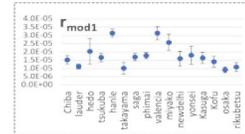
CAI-2 AOT550 looks overestimated when Ag is relatively large



- AE bias up to -0.5 might be occurred by aerosol model
- A different size distribution are observed in each SKYNET site

MWPM aerosol model and SKYNET SDV at Chiba

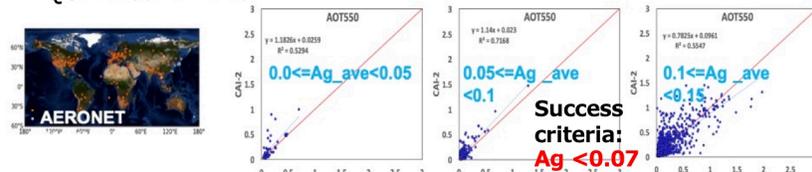
	τ_{mod1}	S_1	τ_{mod2}	S_2	AE (Min.)	AE (Max.)
CAI-2	1.75E-05	2.24	4.00E-04	3.00	-0.02	1.40
5year average	1.25E-05	1.90	2.10E-04	2.40	-0.08	1.84



CAI-2 vs AERONET

- CAI-2 5x5pixs averaged data
- Period : 2019/03 – 2020/02
- QC: rmsd <= 7%

Ag_ave	RMSD	R
0.0 ~ 0.05	0.1642	0.7276
0.05 ~ 0.1	0.09782	0.8466
0.1 ~ 0.15	0.1946	0.7448



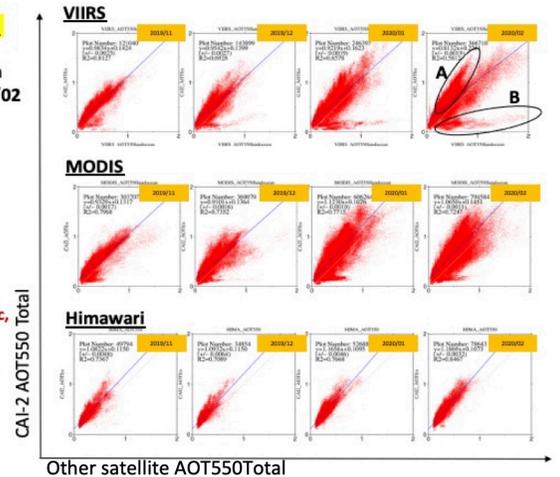
CAI-2 vs VIIRS, MODIS and Himawari

CAI-3 vs VIIRS, MODIS, Himawari

- Comp. of AOT@550nm
- Period: 2019/11-2020/02
- Match up condition:
 - Time diff. < 1.2h
 - cv < 0.1
 - CAI2 QualityFlag = 0

Correlation coefficient, R > 0.8

- CAI-2 AOT is slightly overestimated.
- Algorithm characteristic, Wavelength choice or Radiance calibration???
- Over ocean: CAI-2 AOT is overestimated (A)
- High surface reflectance region such as Arabian peninsula: CAI-2 AOT is underestimated (B)



Summary and Future work

- AE and SSA(UV) have correlation with SKYNET when AOT550 > 0.3
- AE is underestimate tendency (Up to -0.5 bias can be occurred)
- There are characteristic differences (underestimation and overestimation) over land (at high reflectance area like desert) and ocean (due to using UV-VIS WL).
- Future work : Improve the algorithm (Land: select wavelengths, Ocean: Change algorithm MWPM to SIRAW).