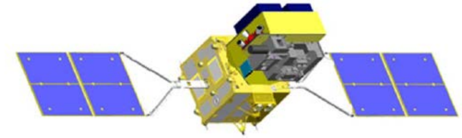


Utilizing SKYNET toward validation for GCOM-C products

Hitoshi Irie

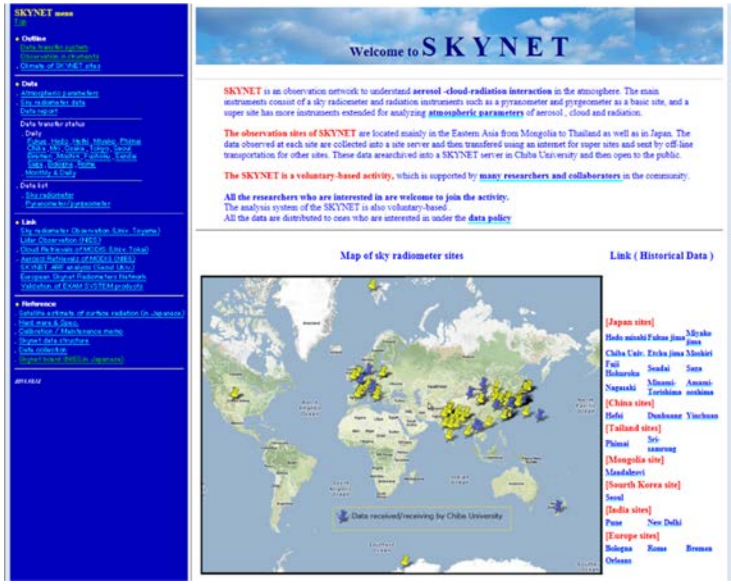
Chiba University

T. Takamura[1], T. Takano[1], K. Aoki[2], A. Higurashi[3]
A. Shimizu[3], P. Katri[1], T. Nakajima[4], T. Nagao[4], and SKYNET community

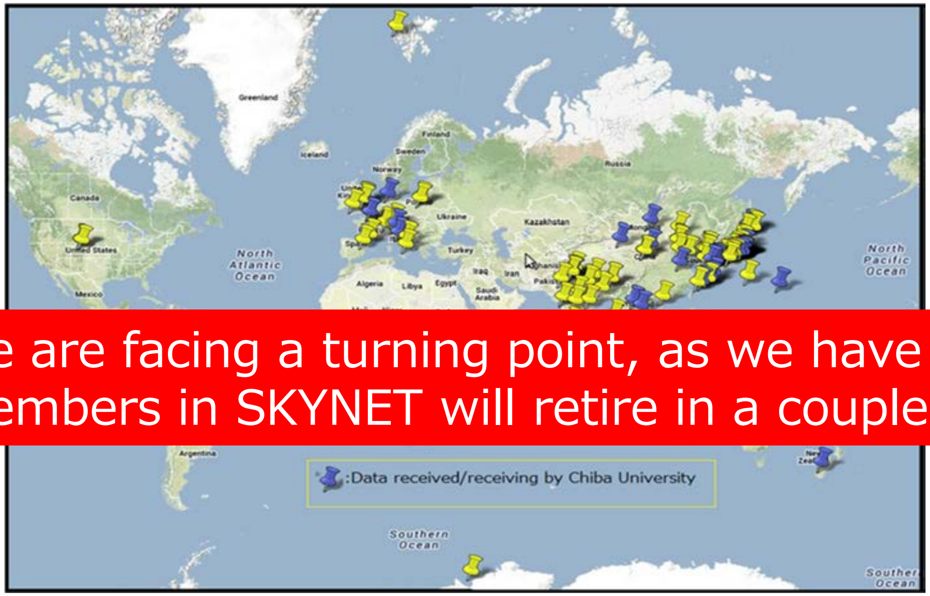
[1]Chiba Univ., [2]Univ. of Toyama, [3]NIES, [4]Tokai Univ.

SKYNET

- An observation network dedicated for aerosol-cloud-radiation interaction researches (e.g., Takamura et al., 2004; Nakajima et al., 2007).
- Initiated under the WCRP/GAME project and expanded focusing on East Asia as GLI validation activity.
- A growing network linking more than 60 sites (as of 2013) all over the world.



http://atmos.cr.chiba-u.ac.jp/



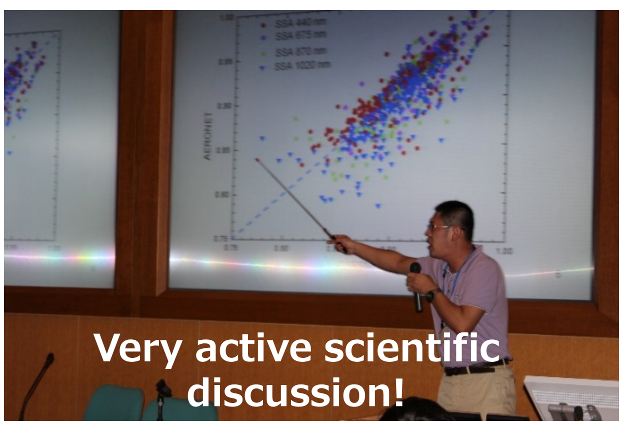
We are facing a turning point, as we have many sites and some honorable members in SKYNET will retire in a couple of years (or maybe not??).

International SKYNET Workshop 2013

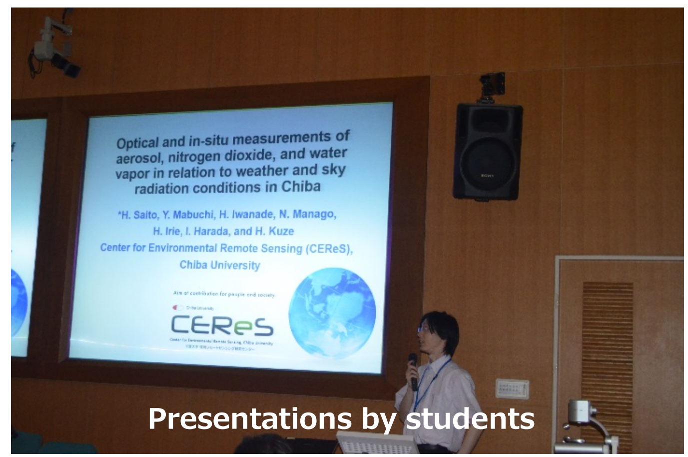
(and the 19th CEReS International Symposium on Remote Sensing)

July 4th (Thu) and 5th (Fri), 2013
Nishi-Chiba Campus, Chiba Univ.


More than 50 participants from all over the world


Very active scientific discussion!


Group photo

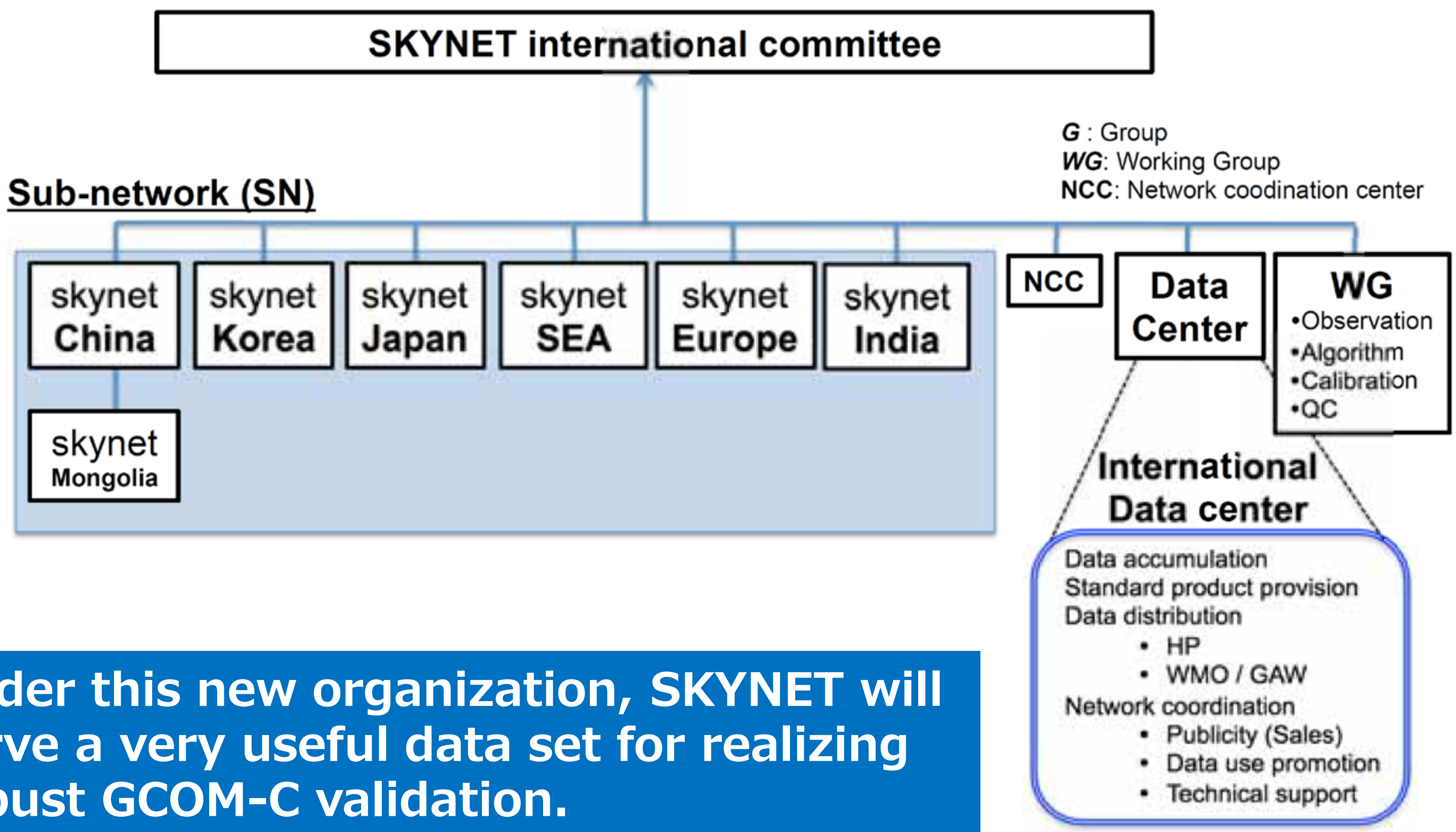


Presentations by students


Exhibition by Japanese companies

The agreed new organization

SKYNET International Organization / Role



Under this new organization, SKYNET will serve a very useful data set for realizing robust GCOM-C validation.
For its preparation, ...

Our RA research plan

- As a preliminary research before the launch of GCOM-C, MODIS aerosol and cloud products are analyzed as proxies and compared with SKYNET data.

- On the basis of the results, we arrange SKYNET for sufficient GCOM-C validation comparisons to be conducted.

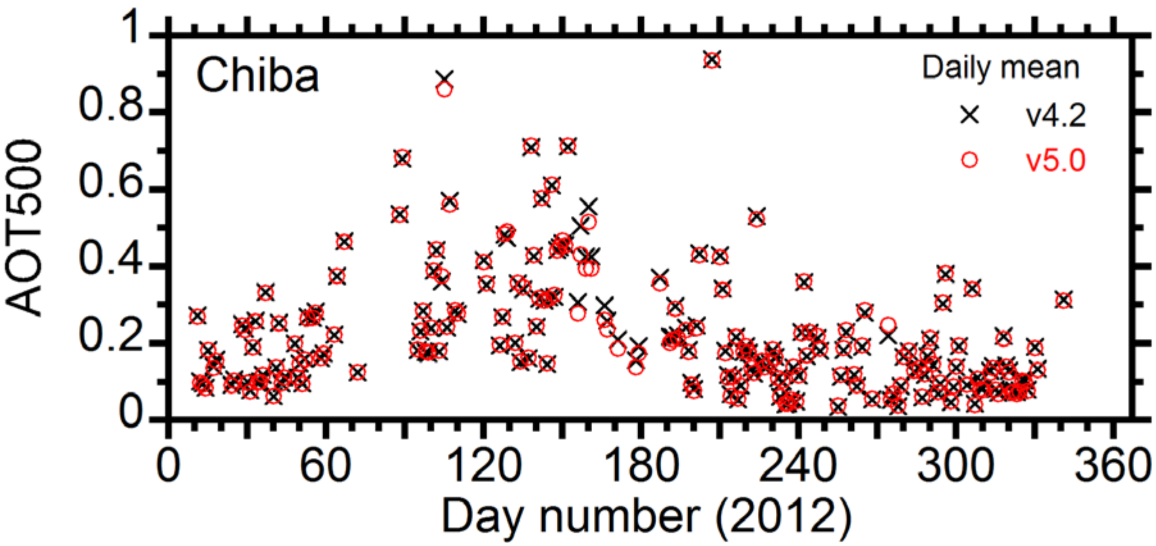
(*in relation to tasks for new SKYNET organization)

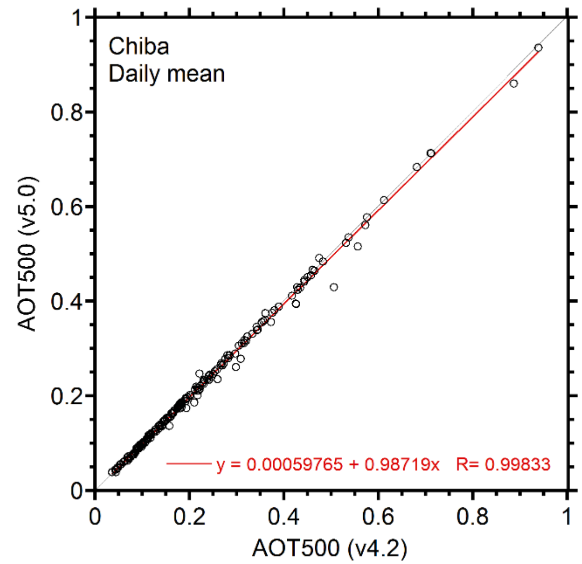
Sky radiometer aerosol products

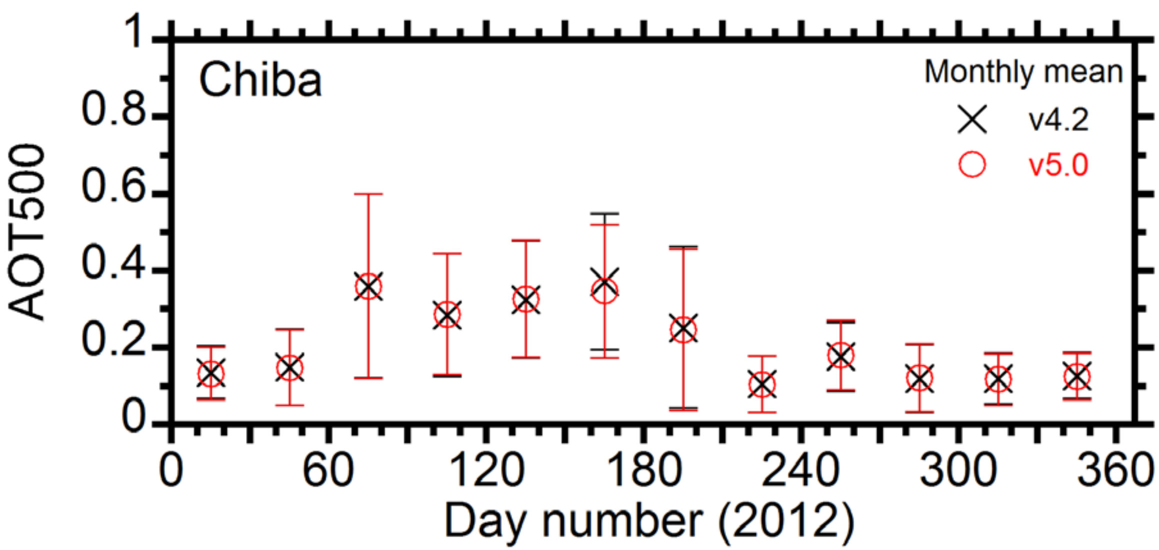
Sky radiometer is a scanning sun-sky photometer measuring direct and diffuse solar irradiances.

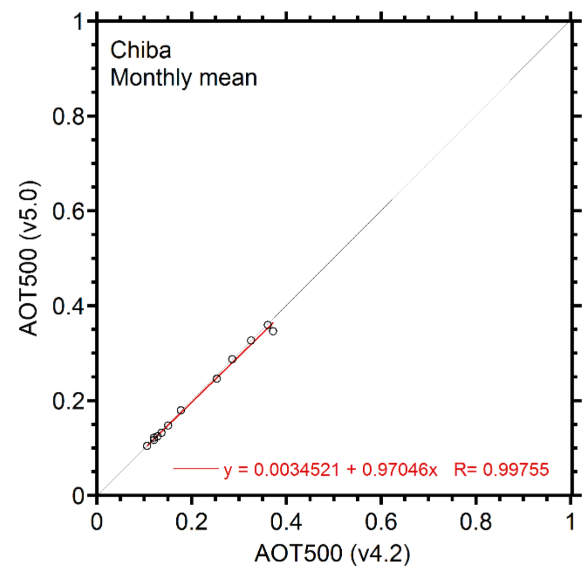
- **Aerosol Optical Depth (AOD)**
  - Products retrieved with SKYRAD.pack version 4.2 (Nakajima et al., 1996)
  - Products retrieved with SKYRAD.pack version 5.0 (Hashimoto et al., 2012)

AOD comparison - versions 4.2 vs. 5.0

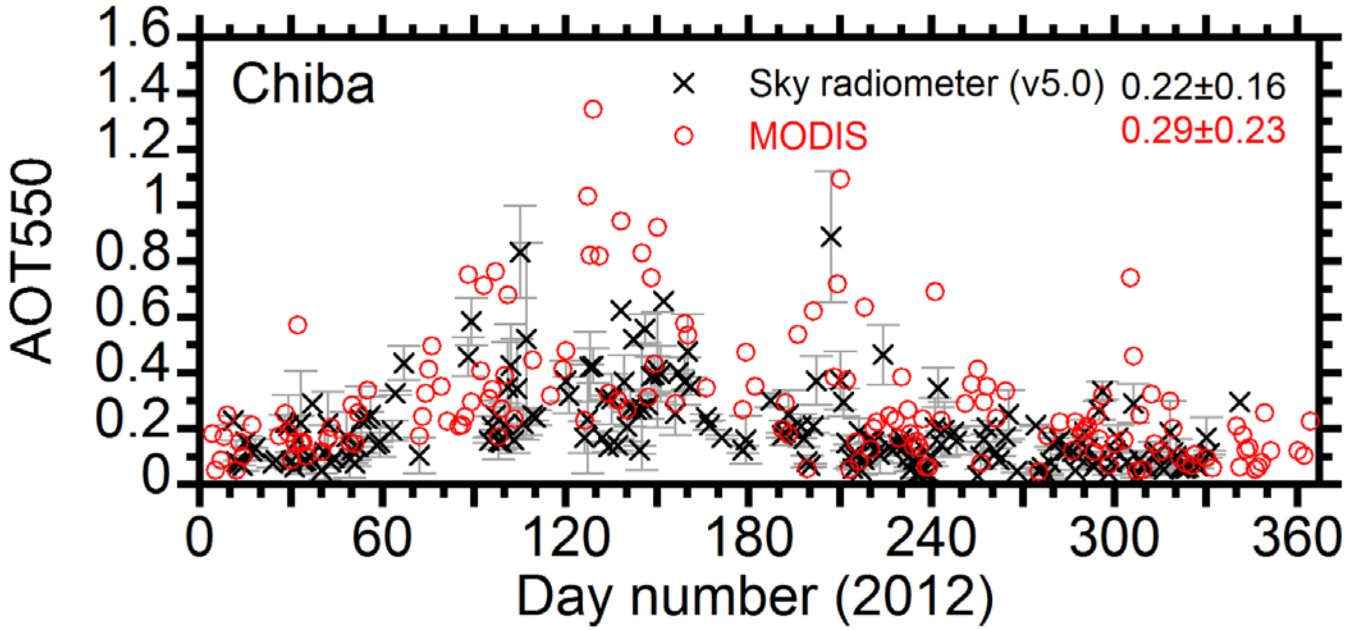








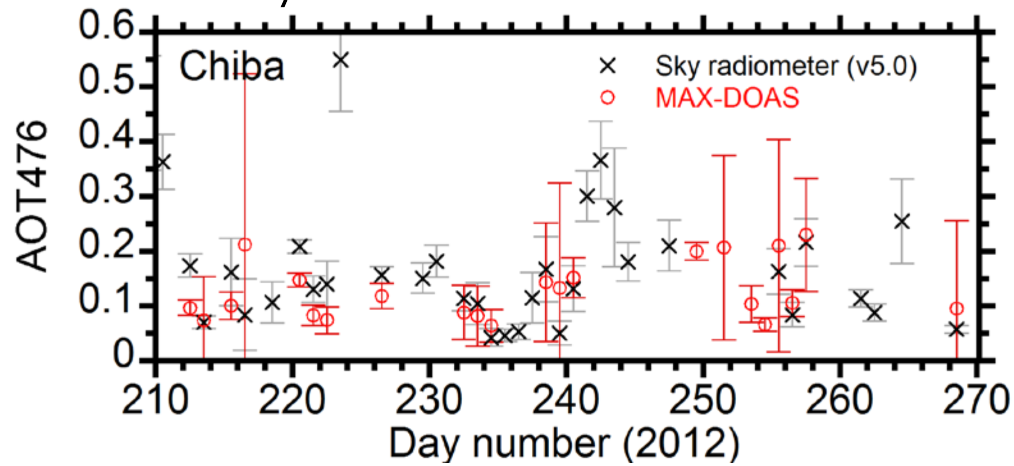
AOD comparison - MODIS vs. Sky radiometer



- MODIS AODs tend to be higher than sky radiometer AODs by ~30%. Reasons? Inadequate treatments of spatial inhomogeneity, cloud screening surface reflectance, and others?

- Sky radiometer AODs agree well with MAX-DOAS AODs -> sky radiometers will provide useful data for validation.

Sky radiometer vs. MAX-DOAS



Sky radiometer cloud products (preliminary)

■ Cloud Optical Depth (COD)

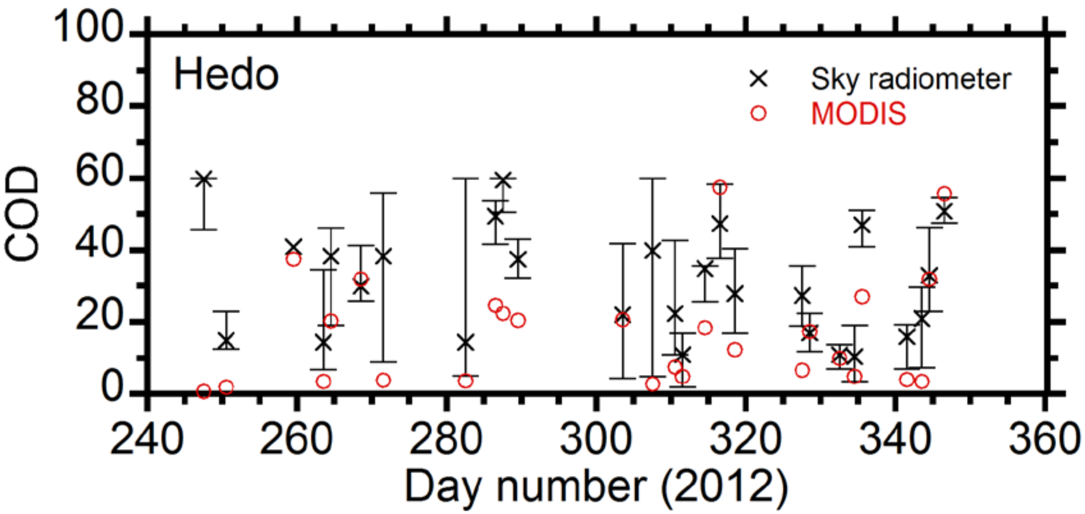
We use a RTM to create a LUT of T_{1020nm} and T_{1627nm} as functions of COD and effective radius(Re).

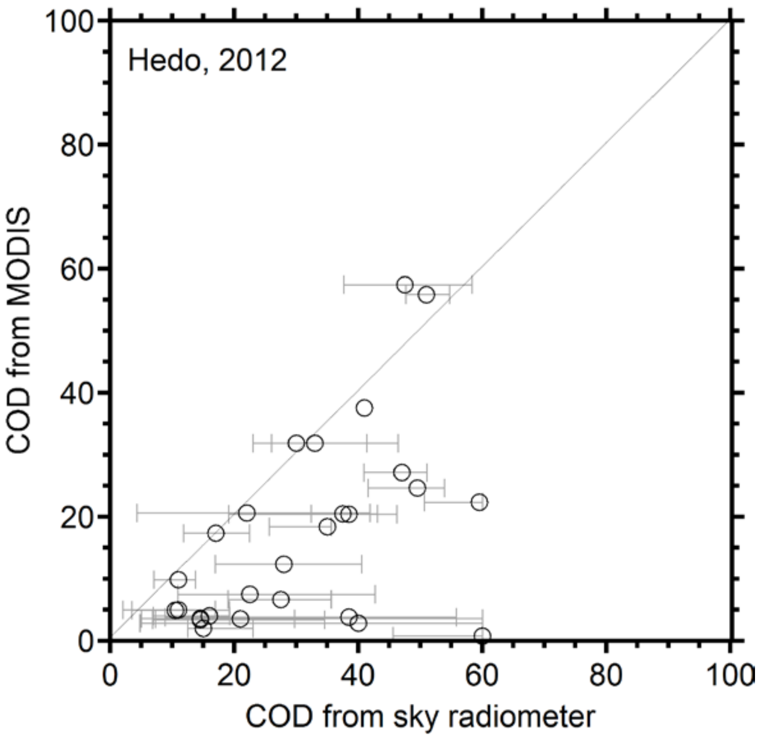
In the LUT, COD is discretely ranging from 1 to 60 and Re from 2 to 31 μm (60*30=1800 calculations for 1020 and 1627 nm channels) under conditions of actual solar position

Pick up a set of COD and Re that minimizes differences of T values from observed values.

COD comparison – MODIS vs. Sky radiometer

◎MODIS COD taken from NASA LAADS (5 km x 5 km)





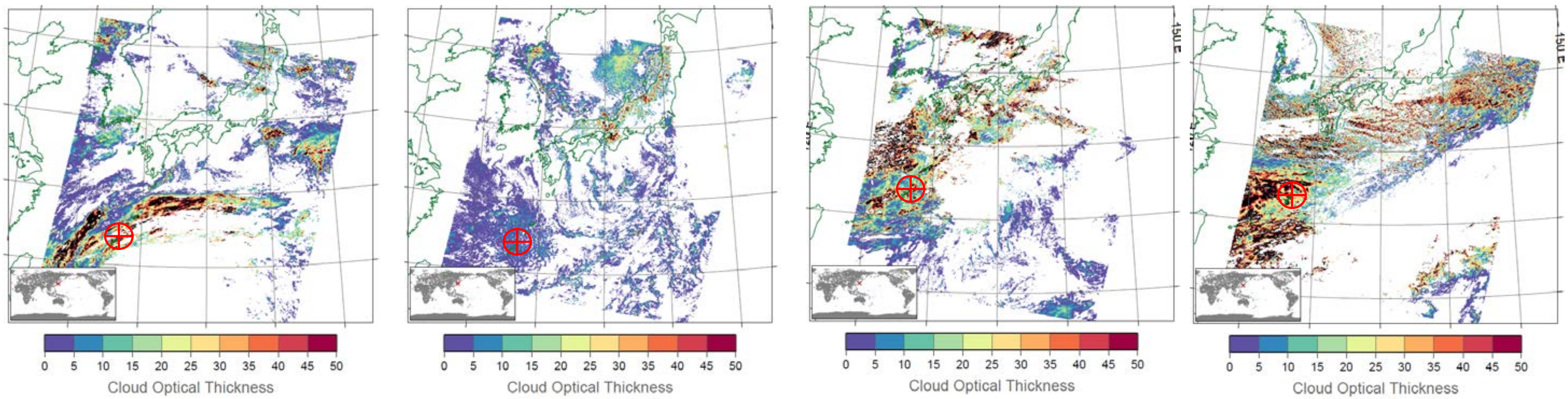
- MODIS CODs are systematically smaller than sky radiometer values.
- We will check the consistency with literature studies using MODIS COD data from NASA LAADS.

MODIS COD from CAPCOM

- **Algorithm developed by Nakajima and Nakajima (1995)**
- **Using L1B data available at NASA LAADS.**
- **Resolution at 1 km x 1 km.**
- **We show 1.6-μm COD products as it is almost similar to those retrieved from other wavelengths (2.1 and 3.7 μm).**

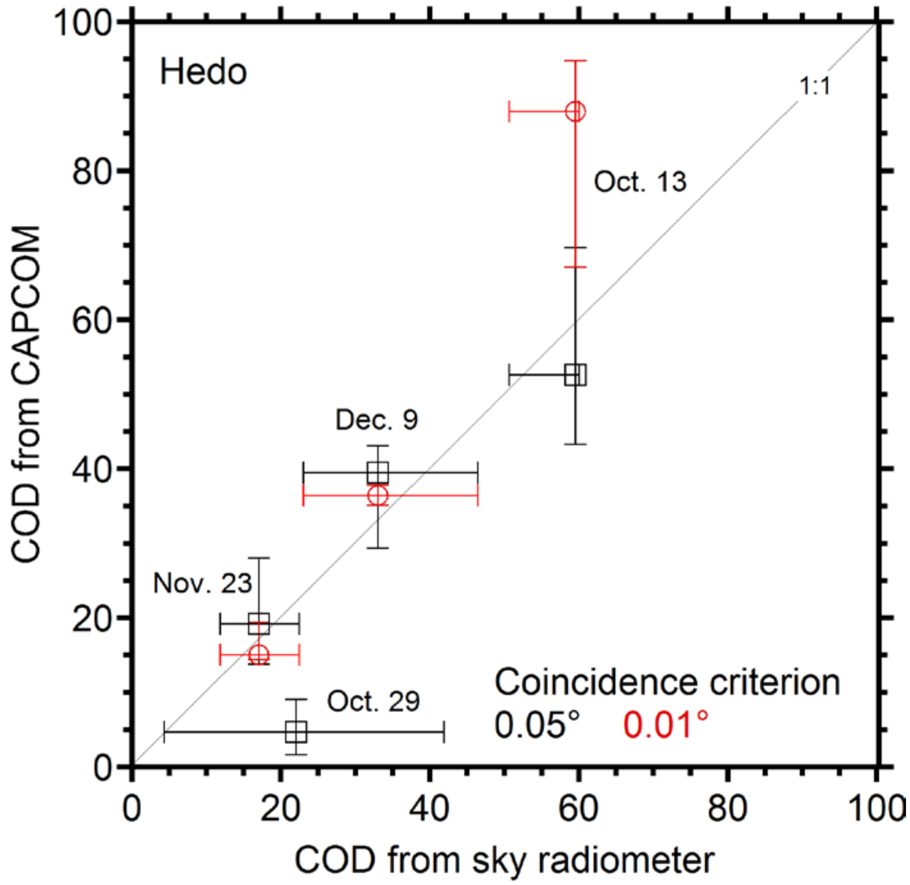
- **We use only a subset of CAPCOM products, which have been prepared for the Chiba site.**
  # It turned out that the calibration constant should be updated for Chiba.
- **The 4 cases below are compared with sky radiometer data at Hedo.**

Oct. 13 Oct. 29 Nov. 23 Dec. 9



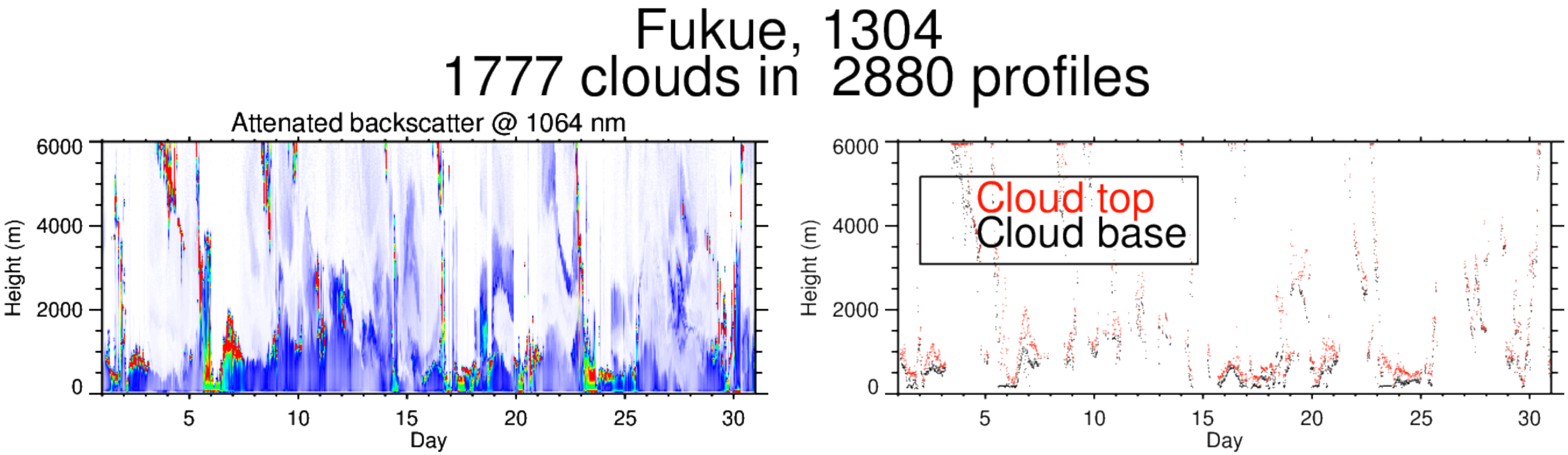
COD comparison – MODIS vs. Sky radiometer

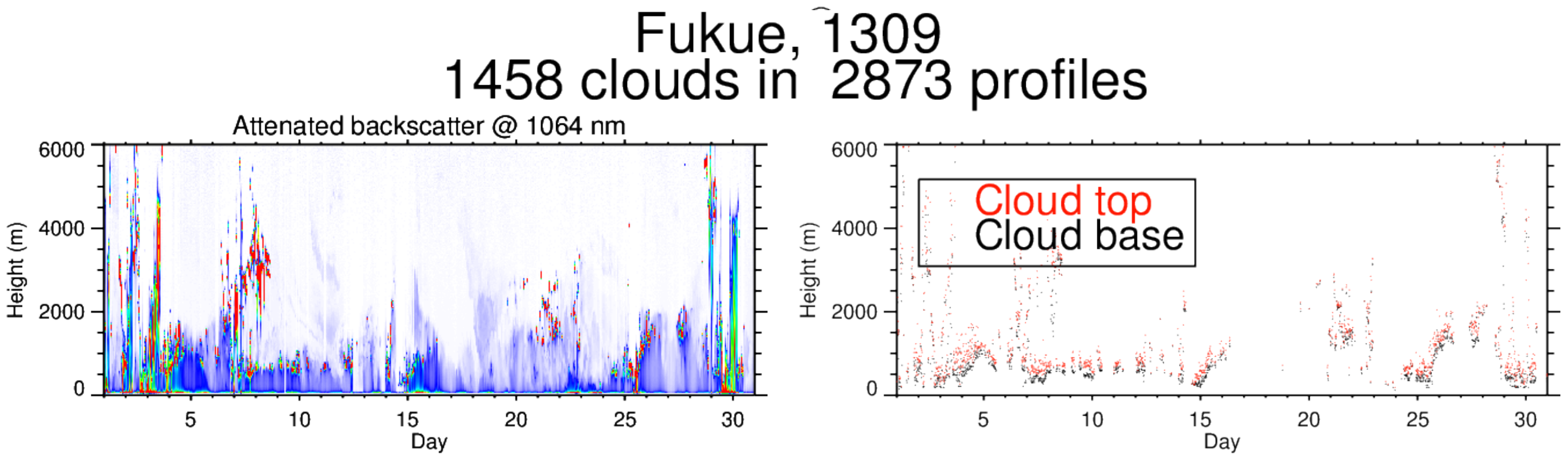
◎**MODIS COD taken from CAPCOM (1 km x 1 km)**



- We find excellent agreement for the 4 cases.
- Although a much robust comparison is desirable to validate MODIS COD products, the result supports the expected potential that the SKYNET will contribute to the validation of space-based COD products.

Cloud top and base estimates from lidar obs.





Using the estimated cloud top and base heights, we expect to provide cloud geometrical thickness data useful for the GCOM-C validation.

Summary

- As a preliminary research before the launch of GCOM-C, MODIS aerosol and cloud products are compared with SKYNET data.

- Around Chiba, MODIS AODs tend to be higher than sky radiometer AODs by ~30%. Potential causes may be inadequate treatments of spatial inhomogeneity, cloud screening, surface reflectance, or others. Need more investigation.

- MODIS CODs from NASA LAADS are systematically smaller than sky radiometer values. In contrast, we find excellent agreement between CAPCOM and sky radiometer COD products.

- Although a much robust comparison is desirable, the results support the expected potential that SKYNET will contribute to the validation of space-based AOD and COD products.

- Lidar is ready to provide data of cloud top and base heights. We expect that it provides cloud geometrical thickness data useful for the GCOM-C validation.

申請時の検証対象プロダクトのリスト

対象プロダクト	精度要求（標準，目標）	検証方法	検証観測精度
海洋上AOT[1]（670，865nm）	0.1，0.05	スカイラジオメータ	0.02
海洋上AE[2]	0.1，0.05		0.05
陸上AOT[1]（380nm）	0.15，0.1		0.02
陸上AOT[1]（偏光；670，865nm）	0.15，0.1		0.02
水雲光学的厚さ	100%，20%	マイクロ波放射計・スカイラジオメータ・雲レーダ・ライダー	20%
雲粒の有効半径	100%，20%		20%
氷晶雲光学的厚さ	70%，20%		20%
水雲の幾何学的厚さ	N/A，300m		300m
下向きの地表面短波フラックス	N/A，10W/m^2（月平均）	全天日射計	10W/m^2
下向きの地表面長波フラックス	N/A，15W/m^2（月平均）		15W/m^2

[1]エアロゾル光学的厚さ、[2]オングストローム指数