

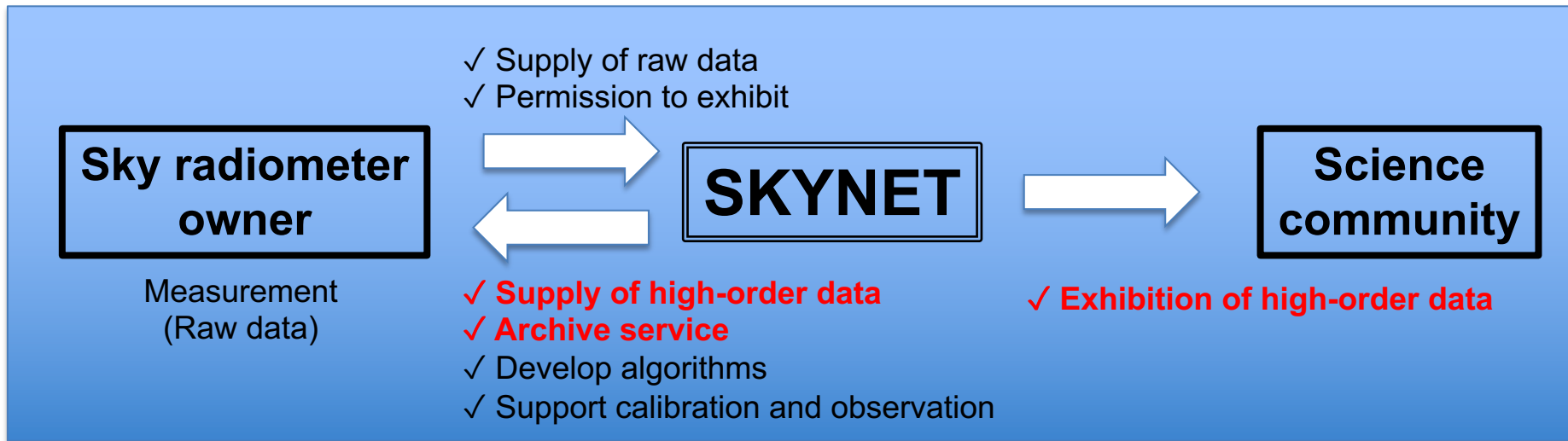
Current status and progress on International SKYNET Data Center (ISDC)

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National Institute for Environmental Studies (NIES)

What does ISDC do?

(International SKYNET Data Center)



✓ **ISDC produces standard products on aerosol optical properties using raw data by sky radiometer**, using standard algorithms approved by the International SKYNET committee (ISC); **ISDC distributes the standard products via web**.

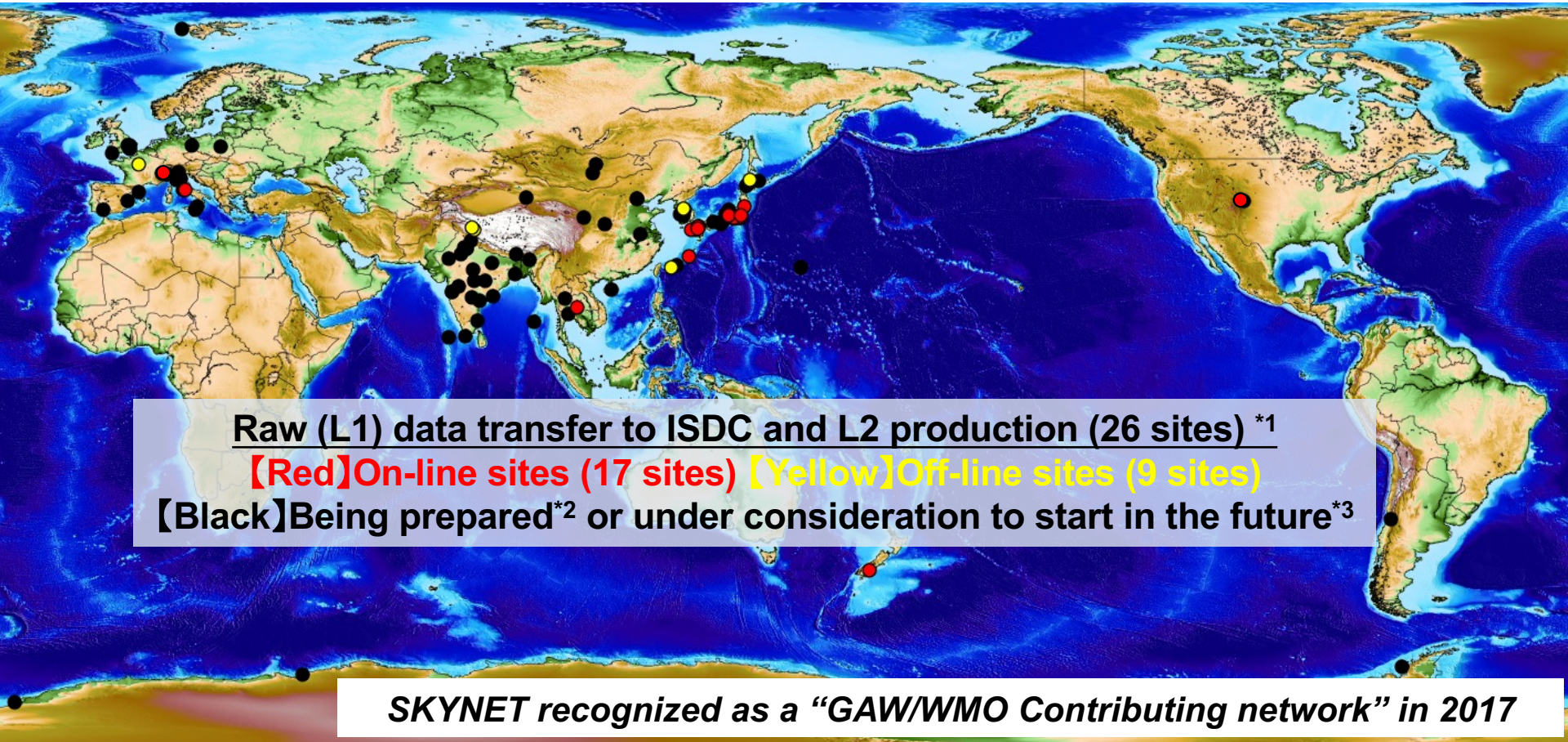
✓ Measured raw data are transferred to *ISDC data server* established at NIES, Japan, for a unified data archive and distribution.

✓ *ISDC* was established in 2014, by a joint effort of National Institute for Environmental Studies (NIES) and Center for Environmental Remote Sensing (CEReS), Chiba University.

Progress of SKYNET related to ISDC

- The international SKYNET committee (ISC) decided to update the standard products of SKYNET released by ISDC.
 - It was also determined that these standard products should be generated from two different analysis schemes. One uses the skyrapack 5.0-based program (SR-CEReS) developed at Chiba University, and the other is the program developed at the European SKYNE (ESR) and the Meteorological Research Institute (MRI). It is an analysis scheme (ESR-MRI) that uses the programs together. As a result, the standard products should be generated by each scheme.
 - With this update, the data policy has also been reviewed and revised.
- ➡ ISDC implemented these algorithms and updated the website that provides standard products.

Sky radiometer sites (~100 sites)



Hedo, Okinawa, Japan



*1 L2 product: Optical and microphysical properties (AOT, dV/dr...)

*2 MOU agreements between instrument owners and ISDC are underway.

*3 High-order organization agreements are considered to realize L1 data sharing with ISDC.

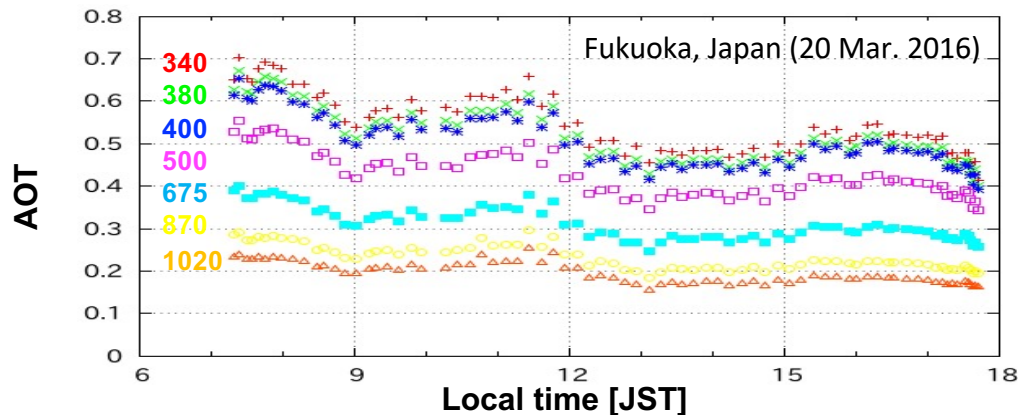
Standard product (Old system)

--- Data processing system (“Old” Chiba U. system) ---

- ✓ SKYRAD.PACK: ver4.2
- ✓ Cloud screening: ver 1.0 (Khatri and Takamura 2009)
- ✓ Calibration: Procedures implemented in this program (using “old calibration” data)
- ✓ Standard product:
 - AOT (0.315, 0.34, 0.38, 0.4, 0.5, 0.675, 0.87, 0.94, 1.02, 1.627, $2.2\mu\text{m}$)
 - Turbidity ($0.5\mu\text{m}$), Angstrom exponent (+Global irradiance)

--- Status ---

- ✓ Periods of analyzed data: From 2013 to the present (depending on observation sites)
- ✓ Standard product are downloadable from ISDC web-site (<https://www.skynet-isdc.org/>)



Standard product (New system_SR-CEReS)

Quick-look
(Chiba, Dec.31, 2020)

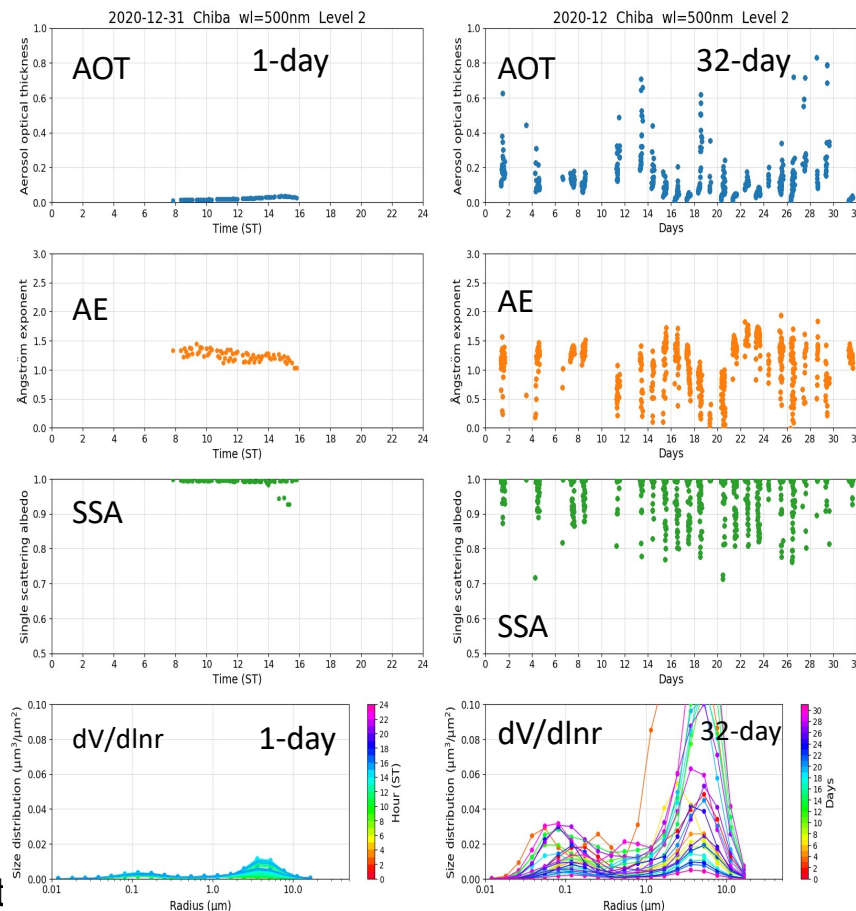
© Implementation of SR-CEReS v01.00.00
developed by Chiba U.

--- Data processing system ---

- ✓ Based on SKYRAD.Pack v5.0
- ✓ Cloud screening: ver 1.0
(based on Khatri and Takamura 2009)
- ✓ Calibration: Implemented in this program
- ✓ Product:
 - AOT ($0.34 \sim 1.02 \mu\text{m}$)
 - SSA ($0.34 \sim 1.02 \mu\text{m}$)
 - $m(\text{Re}, \text{Im})$ ($0.34 \sim 1.02 \mu\text{m}$)
 - Aerosol size distribution ($dV/d\ln R$)
 - Angstrom exponent, Cloud flag

--- Status ---

- ✓ Periods of analyzed data: From 2004 to the present
(depending on observation sites)
- ✓ Standard product are downloadable from ISDC web-site
(<https://www.skynet-isdc.org/>)



Local time

Standard product (New system_ESR-MRI)

Quick-look
ESR-MRI
(Rome, July 31, 2020)

© Implementation of ESR-MRI, ESR-sunrad developed
by ESR

--- Data processing system ---
ESR-MRI skyrad

- ✓ Based on SKYRAD.Pack v4.2 and MRI_v2
- ✓ Cloud screening: ver 1.0 (based on Momoi 2020)
- ✓ Calibration: Implemented in this program
- ✓ Product:

AOT ($0.34\sim 1.02\mu\text{m}$)

SSA ($0.34\sim 1.02\mu\text{m}$)

$m(\text{Re}, \text{Im})$ ($0.34\sim 1.02\mu\text{m}$)

Asymmetry factor ($0.34\sim 1.02\mu\text{m}$)

Aerosol size distribution ($dV/d\ln R$)

Phase function ($0.34\sim 1.02\mu\text{m}$)

Angstrom exponent, Error

ESR-sunrad_0.9

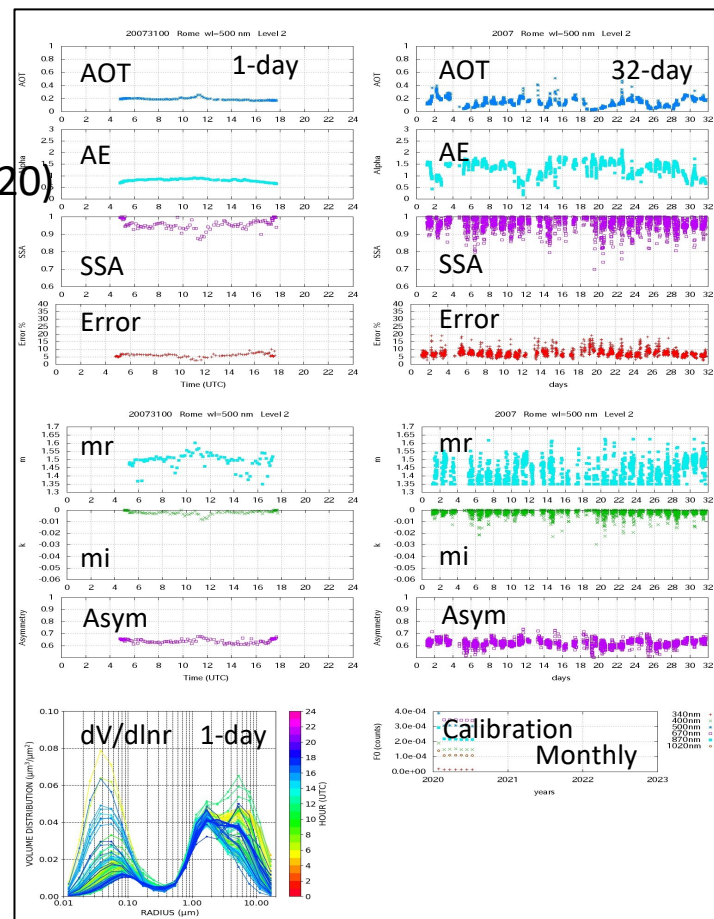
- ✓ Use only direct sun measurements
- ✓ Cloud screening: ver 1.0 (based on Smirnov 2000)
- ✓ Product:

AOT ($0.34\sim 1.02\mu\text{m}$)

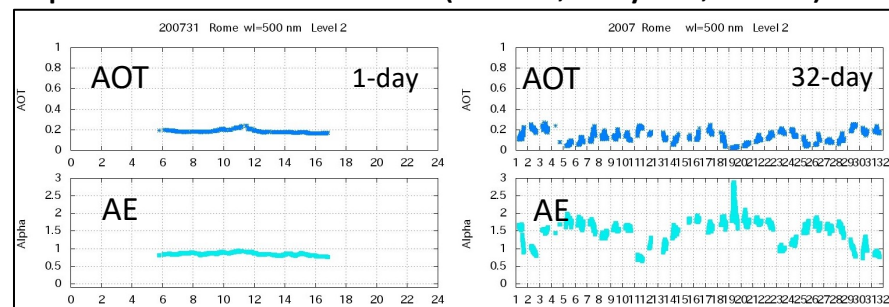
Angstrom exponent, Beta

--- Status ---

Same as SR-CEReS



quick-look ESR-sunrad (Rome, July 31, 2020)



ISDC web page

• <http://www.skynet-isdc.org/>

【Top page】

【Quick-looks】

International SKYNET DataCenter



Quicklooks: SR-CEReS

Site Lists

- China
- India
- Hanle Merak
- Aosta Rome
- Italy
- Japan
- Mongolia
- Republic of Korea
- Thailand
- France
- New Zealand

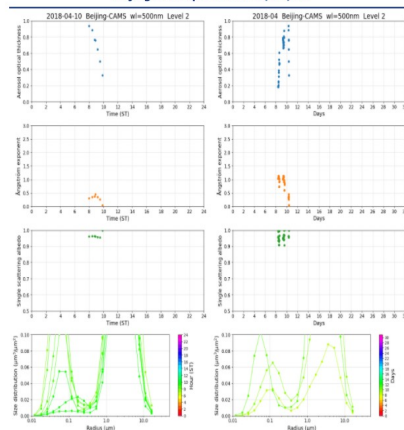
Latest observation data

- China, Asia -

Beijing-CAMS

SiteStatus: Open, Operation: Stopping, DataTransfer: Off-line

Beijing-CAMS pom02 2018/04/10



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International SKYNET DataCenter



Welcome to the International SKYNET Data Center!

The *International SKYNET Data Center (ISDC)* was established in 2014 in order to provide products by the common data analysis system. The *ISDC* produces standard products on aerosol properties using the standard algorithms approved by the International SKYNET committee and provides the products via web.

News & Notice

2021. 10. 29

The *ISDC Home Page* has been significantly revised and updated.

2021. 10. 25

The 6th *International SKYNET Workshop* will be held in Japan (online), from 9 to 11 November 2021. For details of the WS, please visit the site: <http://atmos.s.u-tokyo.ac.jp/research/skynets2021/>.

2021. 3. 10

The 5th *International SKYNET Committee meeting* has held on March 8, 2021.

2020. 8. 10

The 4th *International SKYNET Committee meeting* has held on November 27, 2018.

2019. 1. 7

The 3rd *International SKYNET Committee meeting* has held on November 27, 2018.

2018. 12. 4

The 5th *International SKYNET Workshop* will be held in New Delhi, India, from 13 to 15 February 2019. For registration and details of the WS, please visit the site: <http://www.isdcdelhi.imd.gov.in>.

2018. 9. 20

The 2nd *International SKYNET Committee meeting* has held on August 29, 2018.

2017. 9. 27

The 1st *International SKYNET Committee meeting* has held on September 16, 2017.

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skynet-isdc

skynet-isdc.org

Mail

【Data download】

International SKYNET DataCenter



View & Download

Method	Version	Level	Area
SR-CEReS ESR-sunrad ESR-MRI	v2	L2A L2	Asia Europe North America Oceania
Country	Station	Device	Year
France Italy Spain	Aosta Rome	pom02	2021

Reset Lists

View

OR

Download

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【Product & Method】

International SKYNET DataCenter



Product & Method

Instrumentation

The standard instrument of each SKYNET site is the sun-sky radiometer Prede Co. Ltd. [model POM](#). The sun-sky radiometer is a scanning spectral radiometer able to perform routine and long-term automated measurements of direct and scattered solar radiations at seven wavelengths from 315 to 1020 nm (model POM-01) or eleven wavelengths from 315 to 2200 nm (model POM-02).

Product

ISDC implements two data analysis flows (**SR-CEReS** & **ESR-MRI**) and provides two types of standard products by the above two data analysis flows. The following are typical products provided by the two analysis flows(*1). Related information can be found [here](#).

- Aerosol optical thickness (AOT) at wavelengths of 340, 380, 400, 500, 675, 870, 1020 nm
- Single scattering albedo (SSA) of aerosols at the same wavelength of AOT
- Refractive index (RI) at the same wavelength of AOT
- Volume size distribution of aerosols(dv/dlnr)
- Angstrom exponent (AE)(*2)

You can download or view the products from [here](#).

(*1) The wavelengths and products differ slightly depending on the instruments used, analysis flow, and measurement defects. Columnar ozone and water vapor estimations, as well as cloud optical thickness using different wavelengths are under development in the Regional Sub-Networks.

(*2) The wavelengths used for AE calculation are the same wavelength of AOT for SR-CEReS; those are wavelengths of 400, 500, 675, 870, and 1020 nm for ESR-MRI.

--- Release of Standard Products---

< SR-CEReS flow >

ISDC releases the near-real time data as Level 2 (L2).

< ESR-MRI flow >

ISDC releases the following levels of data:

- L2A: provided only for ESR-MRI; obtained using the previous month calibration constants. They will be released in near-real time.
- L2: data products obtained reprocessing L2A data with the updated calibration constants. They will be released at the beginning of each month, together with the calibration constants(*3).

(*3) The calibration constants are available for the Principal Investigators (PIs) of the instruments and anyone who explicitly requests them to ISDC.

Method & Calibration

In the above two analysis flows, the products are retrieved mainly using SKYRAD.pack, a software package implemented for the POM sky radiometer (e.g., Nakajima et al., 1996) that has been previously validated and compared with other inversion algorithms (Che et al., 2008; Estelles et al., 2012a). The SKYRAD.pack and calibration methods used for each analysis flow are as follows. Related information can be found [here](#).

< SR-CEReS flow >

- Core algorithm:** SR-CEReS(version 1.00.00) which has been developed based on SKYRAD.pack(version 5.0) by CEReS/Chiba university to produce aerosol to produce aerosol products in automatic and systematic.
- Cloud screening:** using the method of Khatr and Takamura (2009) but global irradiance data from a pyranometer are not used for consistent analysis over as many observation sites as possible. It corresponds to the combination of 1) spectral variability test (Kaufman et al., 2006) and 2) statistical analysis test (same as the method of Smirnov et al. (2000) but without triplet stability criteria test), including a) check the number of data, b) diurnal stability check, c) smoothness criteria, and d) three standard deviation criteria.
- Calibration:** solar calibration constants P0 from XII Method (Nakajima et al., 2020), and solid view angles (original values from Prede company, values calculated by the disk scanning method, or the lamp method, depending on the instrument).
- Product & Download:** AOT, SSA, RI, dv/dlnr, and AE. To download the products, click [here](#) and select "SR-CEReS" in "Method".

< ESR-MRI flow >

ISDC web page

• <http://www.skynet-isdc.org/>



[Home](#) [About SKYNET](#) [Product & Method](#) [Observation sites](#) [Quicklooks](#) [Data Download](#) [Data policy](#) [Meetings](#) [Links](#)

Data policy

[Data policy for Data Providers \(PDF \)](#)

[Data policy for Data Users \(PDF \)](#)

[Template of MOU for Participation in SKYNET\(PDF , DOCX \)](#)



--- Notice to Data Users ---

The processed data you are about to download are produced by ISDC. Each site has a Principal Investigator(s) (PI), responsible for deployment and maintenance of the instrument of data collection. The PI has priority use of the data collected at the site. The PI is entitled to be informed of any other use of that site data. The PI(s) and Co-Investigator(s) of this site is displayed [in the header of the site page](#). If you intend to use the following data, please consult with him/her/them via e-mail.

--- Recommended guidelines for data use and publication ---

- **Using SKYNET data:**
Please consult with the PI(s) of the data to be used.
- **Referencing:**
Always cite the appropriate key SKYNET papers for any publications.
- **Publishing SKYNET data from a "few" sites:**
Please consider authorship for the PI(s) and/or the following acknowledgement: We thank the PI(s) for (its/their) effort in establishing and maintaining (site name(s)) sites.
- **Publishing data from "many" sites:**
A general acknowledgement is typically sufficient and may read: We thank the PI(s) and their staff for establishing and maintaining the (site names(s)) sites used in this investigation.
- If the SKYNET data are a principal component of the paper, then co-authorship to PI would be appreciated to be offered.

Data policy for Users

Agreement for International SKYNET Data Center (ISDC) data users (Data Policy).

The following document describes the data produced by the ISDC and governs their rules of use.

a) Data products

ISDC develops two data analysis flows **for all the sites**:

- **SR-CEReS** uses as core the Skyrad5.0.pack.
Aerosol Products: Aerosol optical depth (AOD), Angstrom exponent, single scattering albedo, volume size distribution, refractive index.
Gas Products: None.
Calibrations: solar calibration constants F_0 from XIL Method (Nakajima et al., 2020), and solid view angles $\Delta\Omega$ (original values from Prede company, values calculated by the disk scanning method, or the lamp method, depending on the instrument).
Cloud screening: using the method of Khatri and Takamura (2009) but global irradiance data from a pyranometer are not used for consistent analysis over as many observation sites as possible. It corresponds to the combination of 1) spectral variability test (Kaufman et al., 2006) and 2) statistical analysis test (same as the method of Smirnov et al. (2000) but without triplet stability criteria test), including a) check the number of data, b) diurnal stability check, c) smoothness criteria, and d) three standard deviation criteria.
- **ESR-MRI** uses the SUNRAD.pack, Skyrad_MRI_v2.pack and Skyrad4.2.pack.
Aerosol Products: AOD and Angstrom exponent from SUNRAD.pack; single scattering albedo, volume size distribution, refractive index, phase function, asymmetry factor from Skyrad_MRI_v2.pack.
Gas Products: None.
Calibrations: F_0 from Improved Langley Method (ILM, Campanelli et al, 2004, 2008) using as core the Skyrad4.2.pack and $\Delta\Omega$ (original values from Prede or from disk scanning depending on the instrument).
Clouds screening: performed using a procedure based on the methodology developed by Smirnov et

Data download & format

Netcdf format

(e.g., `ncdump ****yymmdd.nc`)

Observation data

Chiba pom02 [2020/01/01-2020/12/31] [download\(zip\)](#)

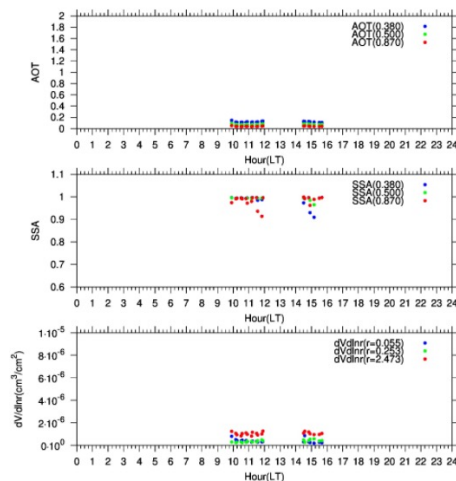
Jan	01 02 03 04 05 06 08 09 10 15 16 17 19 20 21 22 29 30 31
Feb	01 02 03 04 05 06 07 08 09 10 11 12 13 14 17 18 19 20 21 22 23 24 25 27 28 29
Mar	01 03 05 06 09 11 12 13 15 16 17 18 19 20 21 22 24 25 26 27 30
Apr	02 03 04 05 06 07 08 09 10 11 14 15 16 17 18 19 20 21 22 23 24 25 26 27 30
May	01 02 03 05 07 08 11 12 13 14 15 24 25 28 29 30
Jun	02 03 04 05 07 08 09 10 11 12 15 16 17 20 21 26 27
Jul	02 08 12 13 19 20 26 28 31
Aug	01 02 03 04 05 06

Download 1-year data

2020/01/01

[\[skyradio_Chiba_200101.nc\]](#) ← Download 1-day data

[Top](#)



2020/01/02

[\[skyradio_Chiba_200102.nc\]](#)

[Top](#)



```
netcdf skyradio_Chiba_200101 {
dimensions:
    wavelength = 7 ;
    time = 23 ;
    radius = 20 ;
variables:
    float wavelength(wavelength) ;
        wavelength:units = "micrometer" ;
    float time(time) ;
        time:units = "hour (LT)" ;
    float radius(radius) ;
        radius:units = "micrometer" ;
    float dn(time) ;
        dn:units = "day number since Jan. 1st(LT)" ;
    float aot(wavelength, time) ;
        aot:units = "(dimensionless)" ;
        aot:long_name = "aerosol optical thickness" ;
    float ssa(wavelength, time) ;
        ssa:units = "(dimensionless)" ;
        ssa:long_name = "single scattering albedo" ;
    float rr(wavelength, time) ;
        rr:units = "(dimensionless)" ;
        rr:long_name = "refractive indices(re)" ;
    float ri(wavelength, time) ;
        ri:units = "(dimensionless)" ;
        ri:long_name = "refractive indices(im)" ;
    float vol(radius, time) ;
        vol:units = "cm3/cm2" ;
        vol:long_name = "dV/dlnr" ;
    float ae(time) ;
        ae:units = "(dimensionless)" ;
        ae:long_name = "angstrom exponent" ;
    float cf(time) ;
        cf:units = "(dimensionless)" ;
        cf:long_name = "cloud flag (0:clear, 1:cloud)" ;

// global attributes:
    :location = "Chiba" ;
    :date = "20200101" ;
    :code = "SR-CEReS v01.00.00" ;

data:
```

wavelength = 0.34, 0.38, 0.4, 0.5, 0.675, 0.87, 1.02 ;

time = 9.57, 9.83, 9.9, 10.17, 10.23, 10.5, 10.57, 10.83, 10.9, 11.17, 11.23, 11.5, 11.56, 11.83, 11.9, 14.5, 14.57, 14.83, 14.91, 15.17, 15.5, 15.67, 15.83 ;

radius = 0.012, 0.018, 0.026, 0.038, 0.055, 0.081, 0.118, 0.173, 0.253, 0.37, 0.541, 0.791, 1.156, 1.691, 2.473, 3.617, 5.289, 7.734, 11.31, 16.54 ;

Summary & future work

- © ISDC implemented three algorithms that are SR-CEReS, ESR-Skyrad, and ESR-Sunrad and updated the website (<http://www.skynet-isdc.org/>).
- © Currently, data processing is being performed at about 26 sites. It is expected that the number of sites will increase in the future.
- © Updated ISDC website has been already published and you can visit there and use it.
- © As future work,
 - Support for providing data to WMO (providing and registering metadata information et c...)
 - Improve the website. Please contact me if you have any requests.

Many persons cooperated in implementing the algorithm in the ISDC system and updating the website.

ISDC would like to take this opportunity to thank you !!