Retrieval and validation of cloud geometrical properties

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at SGLI PI Workshop, Tokyo
on January 16, 2014

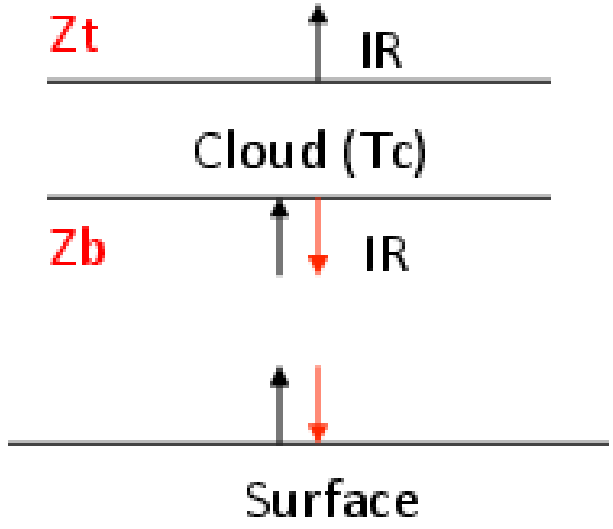
Scientific background

Surface radiation budget (solar and earth radiation)

Cloud, aerosol, and water vapor, and so on.

Cloud geometrical properties

- top and bottom heights for radiation at TOA and surface
- geometrical thickness for a cloud process study



Objectives

Retrieval of cloud top and bottom heights

- oxygen A-band of SGLI / GCOM-C1
- contribute to the **surface radiation budget** study

Validation of cloud properties

- cloud top and bottom height with
  - ground-based active observation such as lidar and radar
  - objective analysis data
- cloud fraction with
  - ground-based observation with all-sky camera as well

Current activities

ADEOS-II / GLI data analysis and validation

- algorithm development
- global data analyses
- validation with ground based cloud profiling radar
- validation with objective analysis data
  - MPL vs. radiosonde relative humidity profile

Surface radiation budget

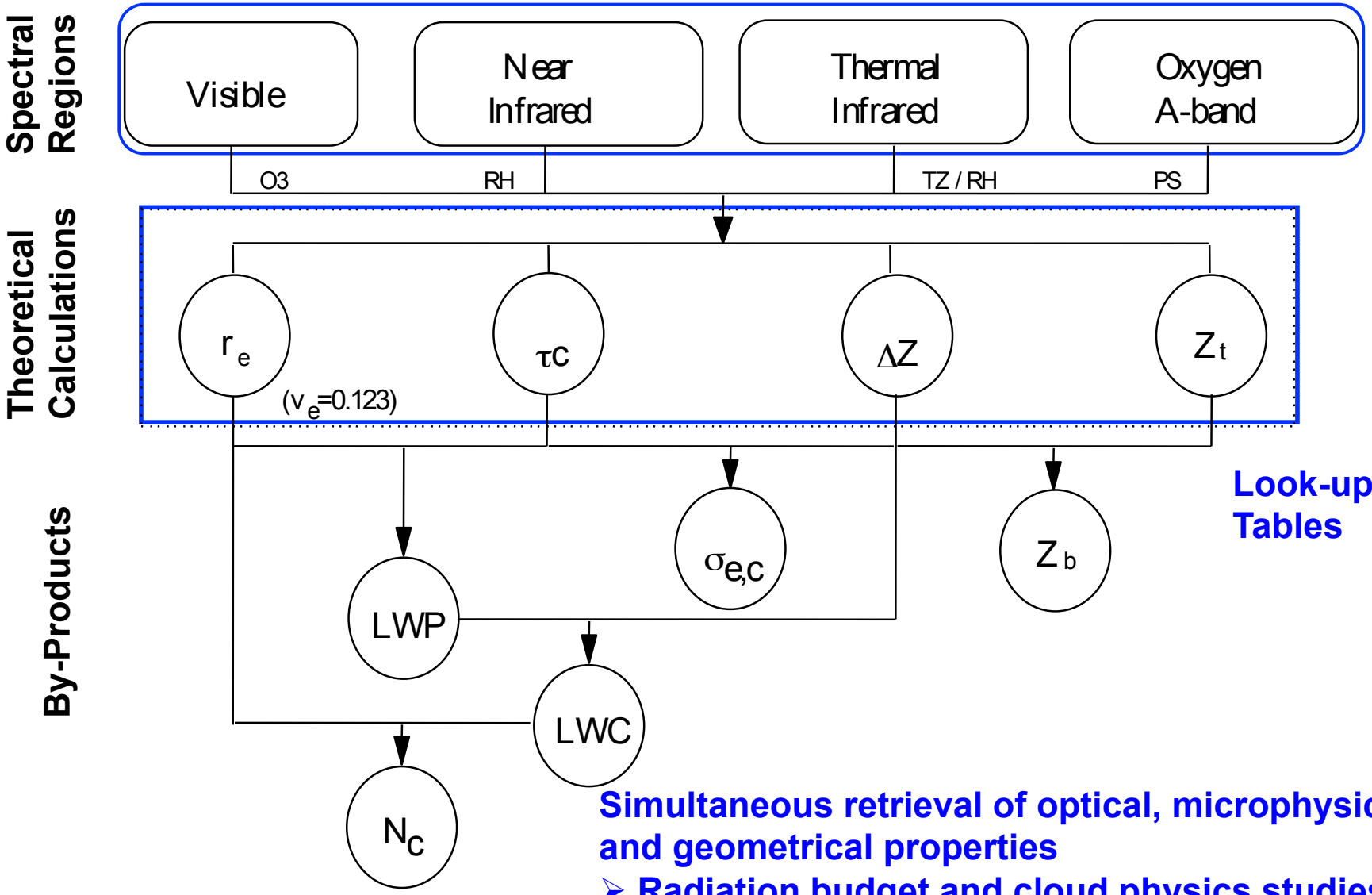
- Cloud bottom height vs. longwave downward radiation
  - MPL vs. BSRN

Validation of cloud fraction over ocean

- all-sky camera (JAXA) onboard R/V Shirase (NIPR)

ADEOS-II / GLI data analysis and validation

Algorithm



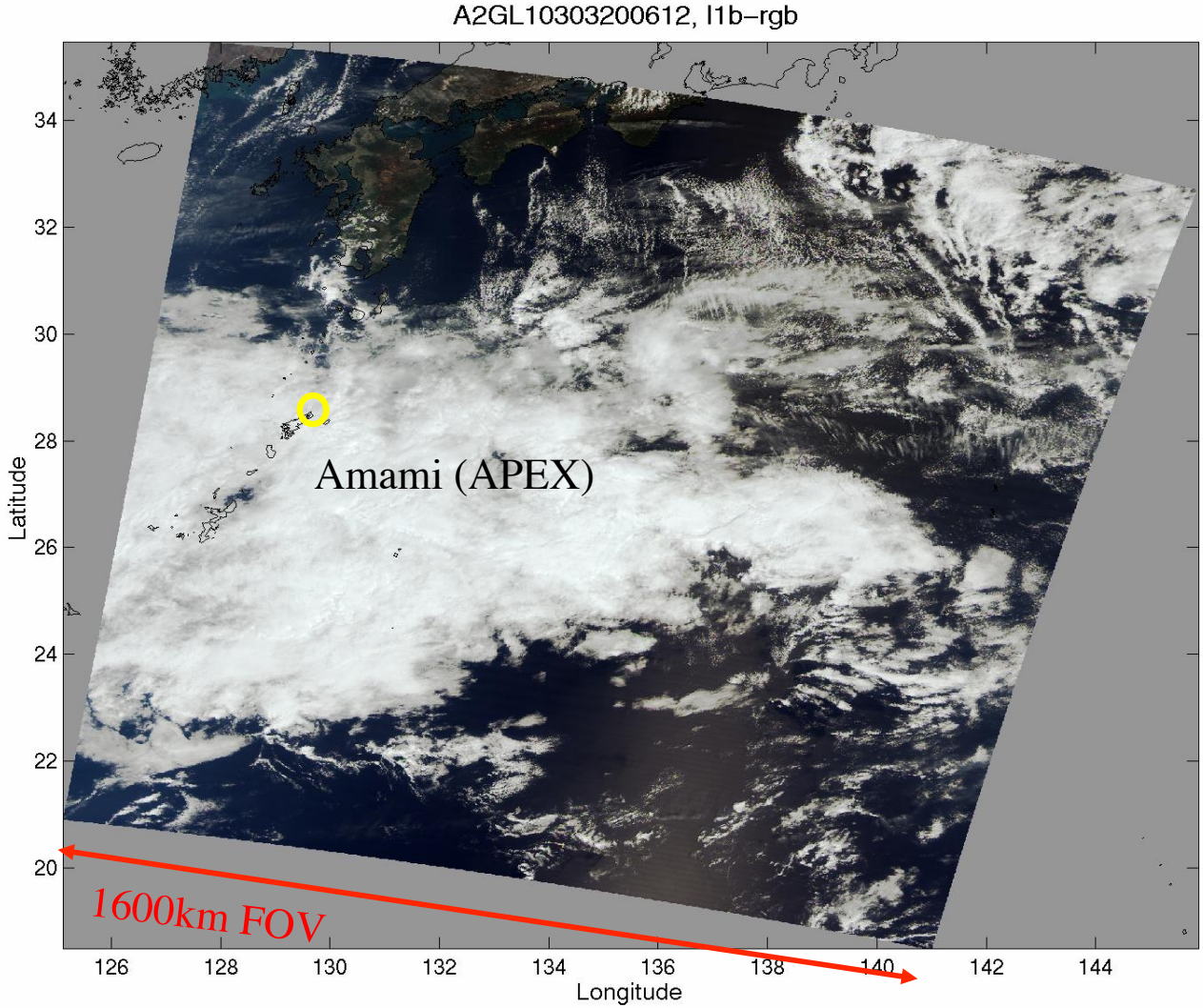
Look-up Tables

Simultaneous retrieval of optical, microphysical, and geometrical properties

- **Radiation budget and cloud physics studies**

Regional Validation of GLI (Mar. 20, 2003)

Extended cloud system at the South of Japan over north-western Pacific

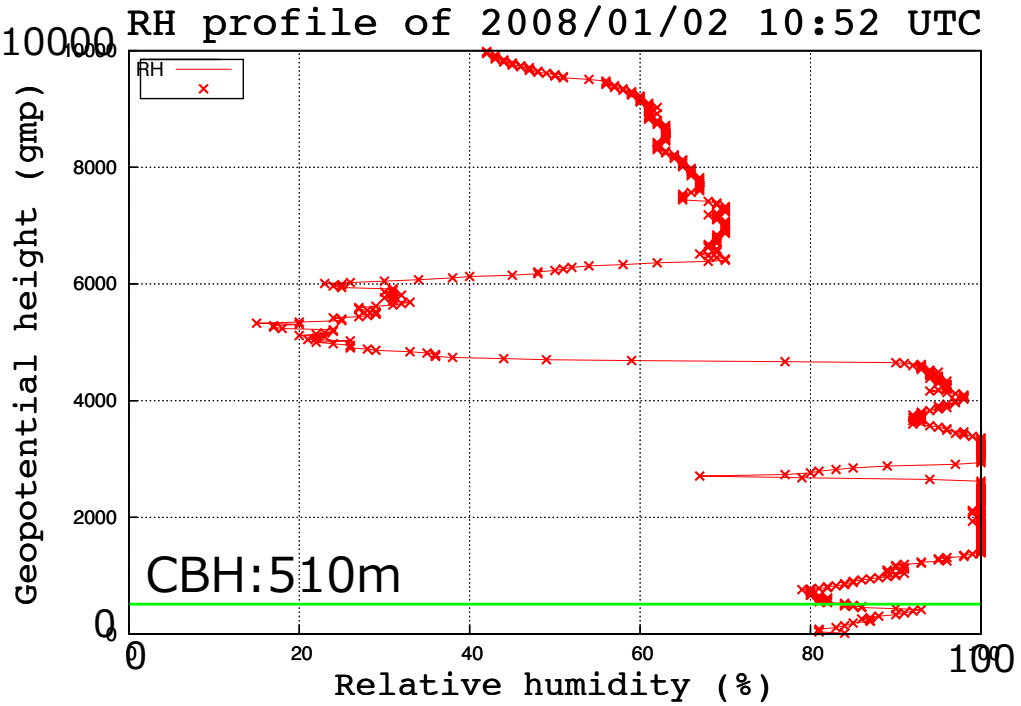


APEX IFO:

- **Ground-based obs.**
  - **LIDAR**
  - **RADAR**
  - **MWR**
  - **skyradiometery**
- **Airborne obs.**
  - **cloud microphys.**
  - **radiation**

*** by courtesy of EORC/JAXA**

Relative humidity threshold at cloud bottom height



MM/DD	RH at bottom
01/02	84.0%
01/04	100%
01/13	100%
01/25	89.8%

- **Comparison between radiosonde and micro pulse lidar profiles**
- **To determine the relative humidity threshold at the cloud bottom height**
- **Application to objective analysis data to determine cloud layer height on a global scale**

Validation of cloud fraction over ocean

Outline

Validation of cloud properties such as

- fraction (amount) and bottom height
- over ocean
- with shipborne observation

R/V Shirase, an ice breaker travels

- around Japan in autumn, and
- from Japan to Antarctica from Nov. to Mar.
- every year

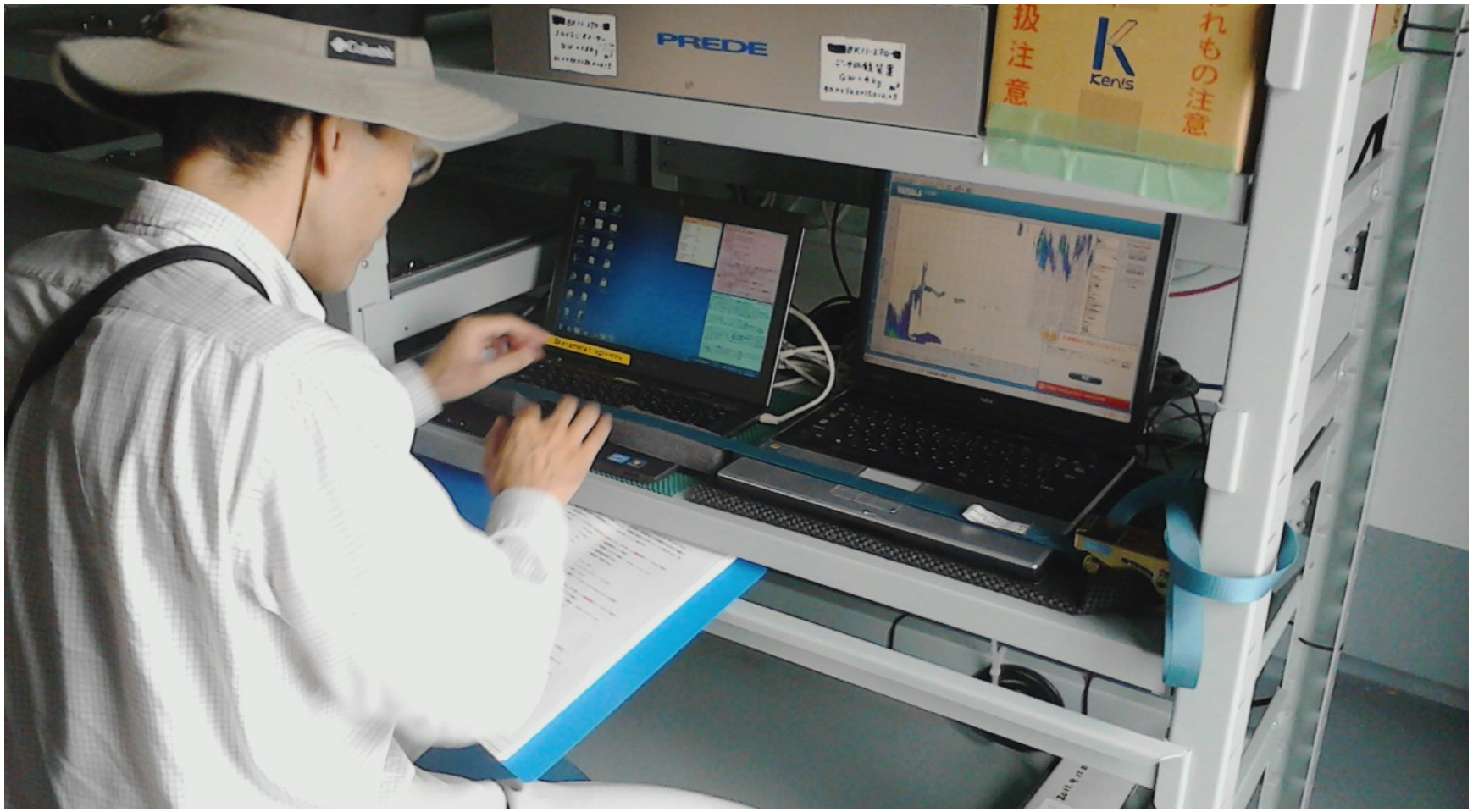
It would be one of the good platforms for the validation of the SGLI cloud products.

R/V Shirase

All-sky camera system

mounted at Yokosuka on August 28, 2013

Control system



Ceilometer next to all-sky camera system

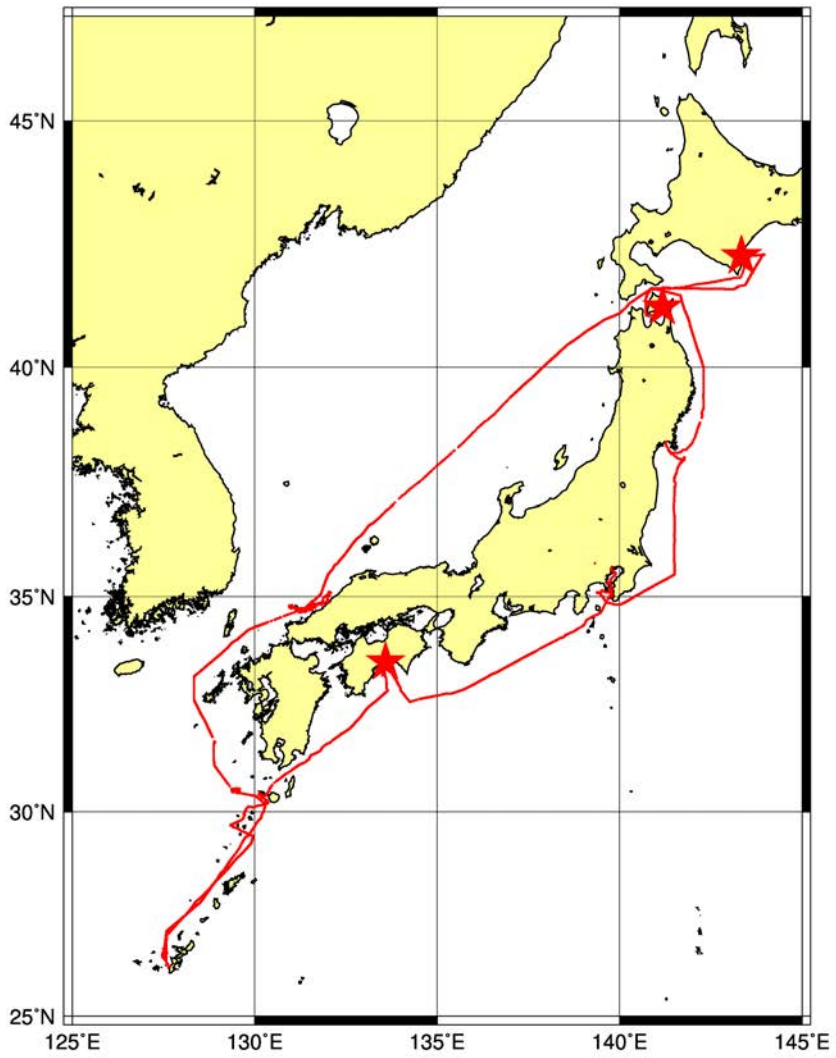
The first image

↑ Top of image corresponds to head of Shirase

Training cruise around Japan in 2013

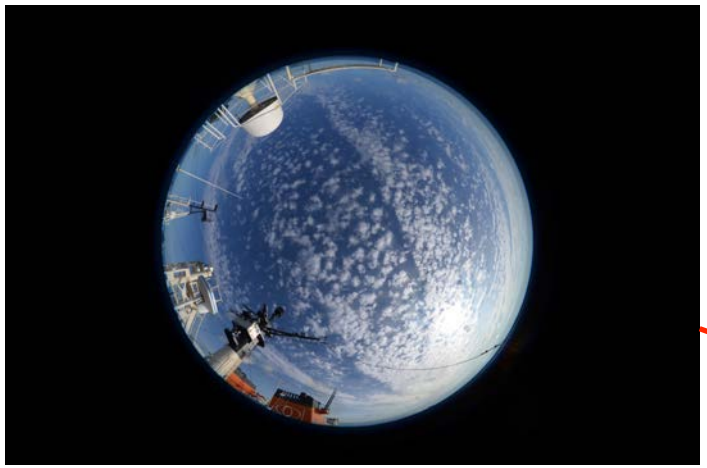
At anchor:
Yokosuka 8/26-8/28
Ishinomaki 8/30-9/2
Mutsu 9/3-9/5
Tokachi 9/6-9/9
Hamada 9/13-9/16
Naha 9/20-9/23
Kochi 9/27-9/30
Yokosuka 10/2-10/20
Shinagawa 10/20-11/1

Cruise LEG
LEG1: Yokosuka（8/28）– Ishinomaki（8/30）
LEG2: Ishinomaki（9/2）– Mutsu（9/3）
LEG3: Mutsu（9/5）– Tokachi（9/6）
LEG4: Tokachi（9/9）– Hamada（9/13）
LEG5: Hamada（9/16）– Naha（9/20）
LEG6: Naha（9/23）– Kochi（9/27）
LEG7: Kochi（9/30）– Yokosuka（10/2）
LEG8: Yokosuka（10/20）– Shinagawa（10/20）



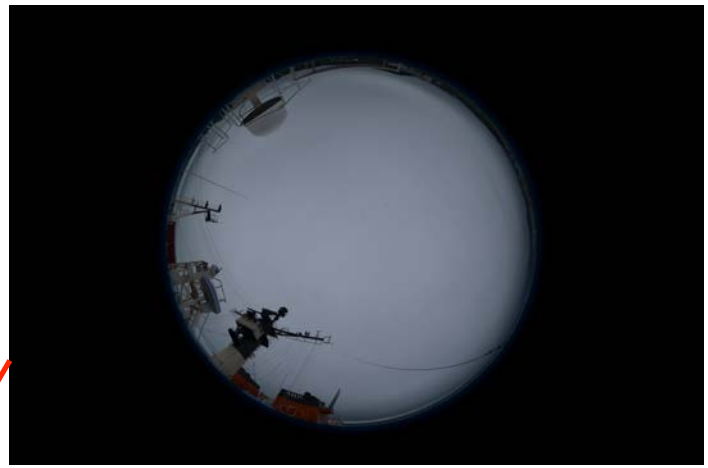
All-sky camera images (Sep. 2013 UTC)

9th 23:04:00

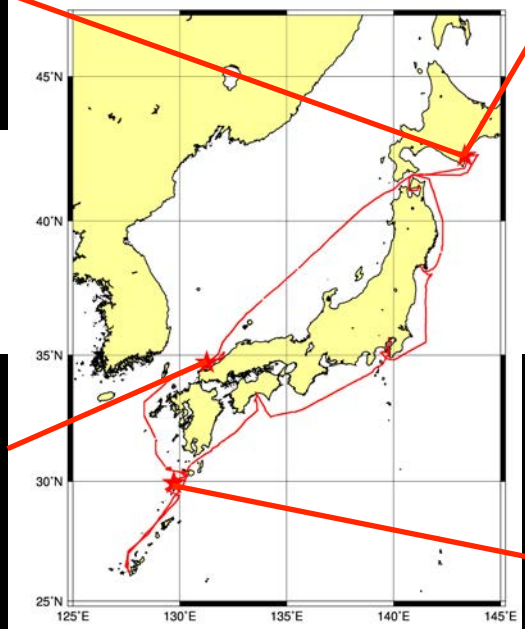


altocumulus

7th 00:50:10



Cloud amount 10/10



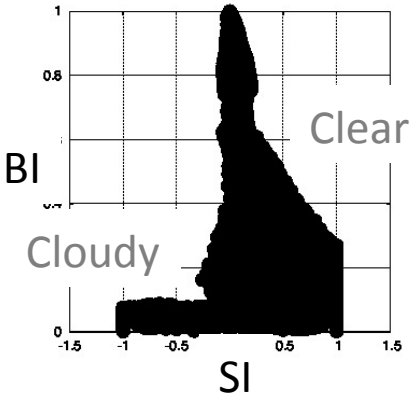
16th 05:55:00

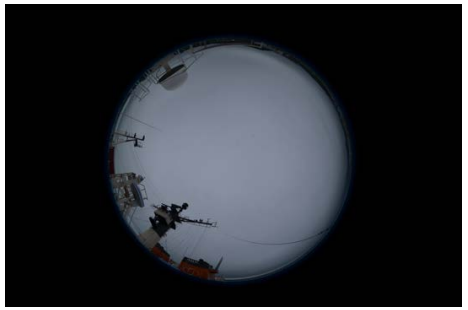
fine

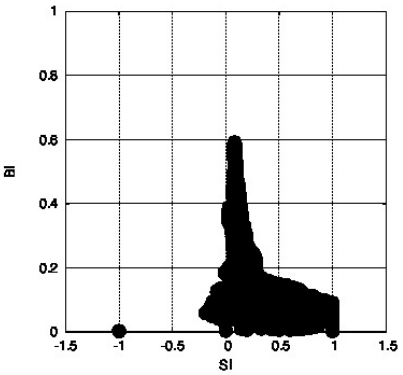
24th 04:05:10

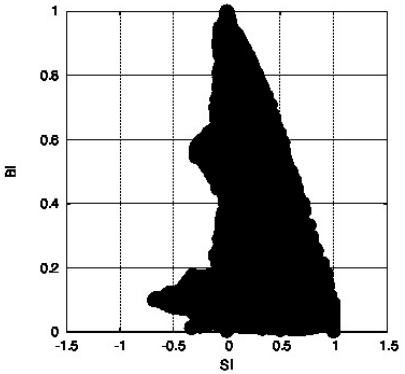
cumulus

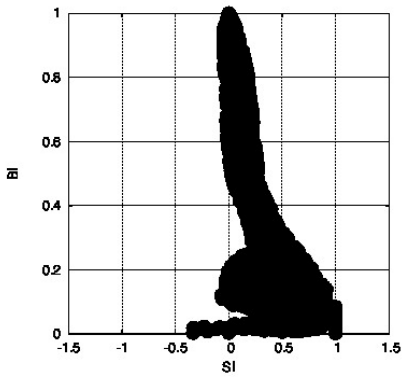
SI-BI plot for cloud screening (under discussion)











BI = (Blue + Green + Red) / (3×255) versus SI = (Blue – Red) / (Blue + Red)

Current status

The training cruise

- Observation period: 21 Aug. 2013 to 28 Oct. 2013
- Temporal resolution：5 min.
- 18182 JPEG files
- Careful quality check seems necessary
- Cloud detection is ongoing with BI-SI, etc.

The Antarctic cruise

- Almost good operation from Japan to Antarctica
- Some trouble at Antarctica now

The shipborne observation is going to be a precious counterpart to SGLI cloud products over ocean in particular.

Research summary JFY2013

Retrieval and validation of cloud top and bottom heights (60%)

- core of algorithm was fixed and ATBD is being prepared
- global analysis of GLI data is ongoing
- ground-based cloud radar system (Chiba Univ.)
- objective analysis data with a relative humidity threshold

Surface radiation budget (40%)

- downward longwave radiation with BSRN
- cloud bottom heights with micro pulse lidar (MPLnet)

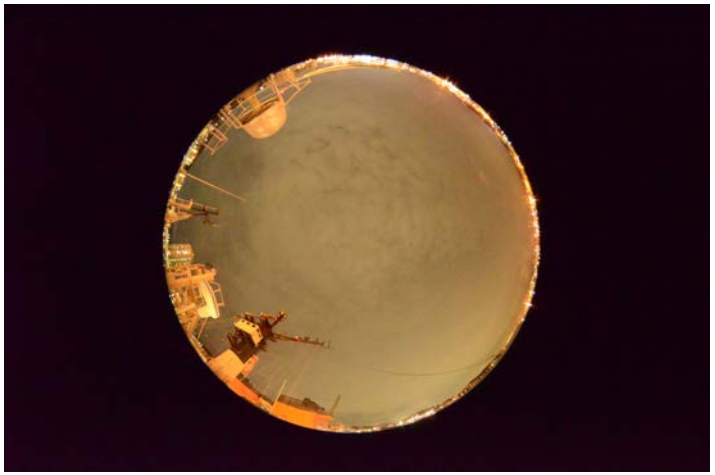
Validation with shipborne observation (30%)

- all-sky camera (JAXA) onboard R/V Shirase (NIPR)
- ceilometer (NIPR) onboard R/V Shirase in future

Night mode

At anchor

8/26 10:30:08



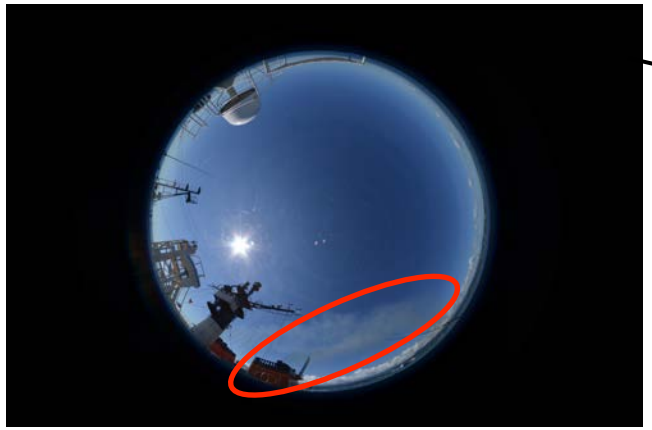
Crusing

8/28 10:30:08

9/18 10:30:09

Other events

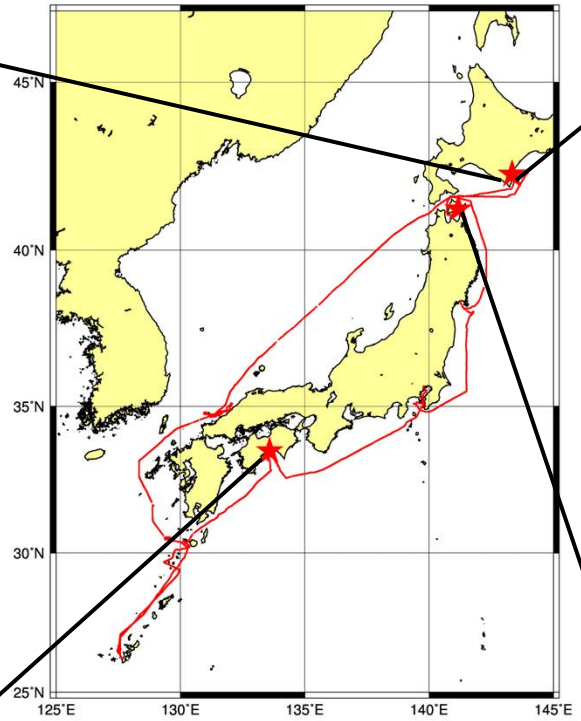
9/9 01:15:09 (UTC)



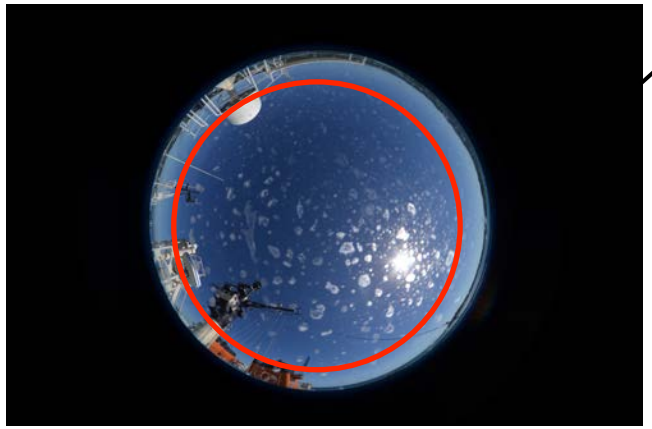
Exhaust gas

9/8 21:20:10 (UTC)

Condensation



9/27 05:00:09 (UTC)



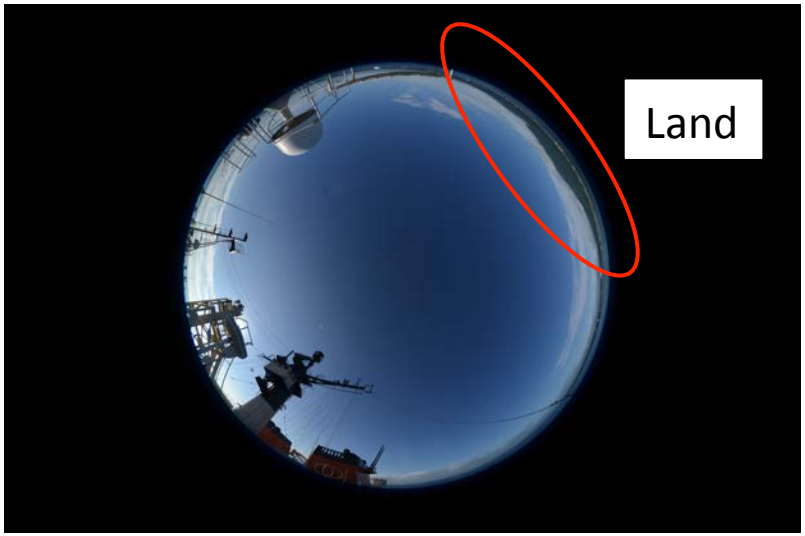
Sea Salt

9/5 01:45:10 (UTC)

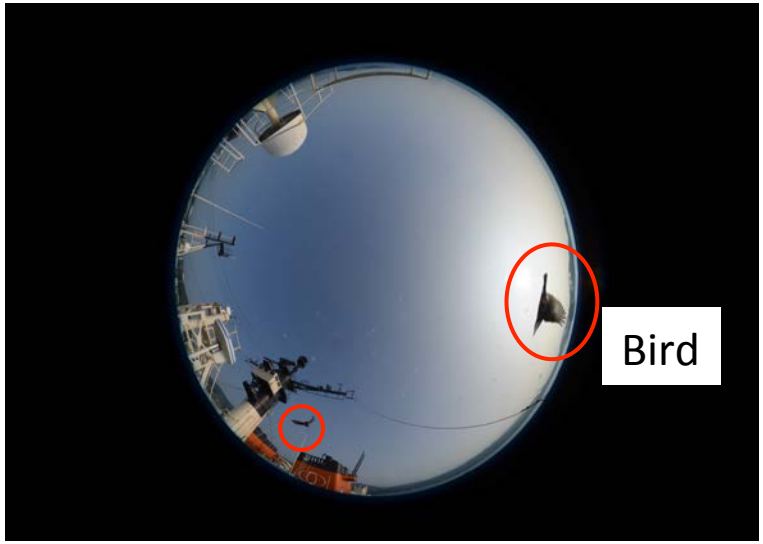
Halo

Other events 2

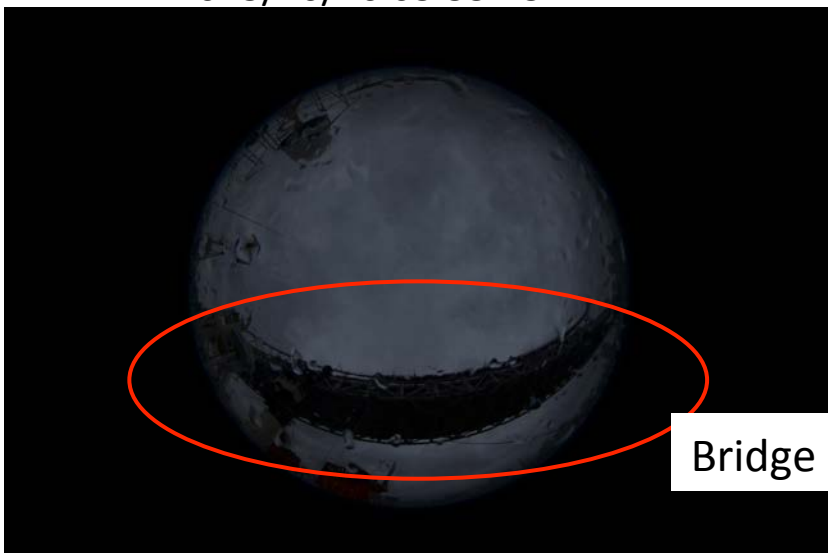
2013/09/03 22:10:09 (UTC)



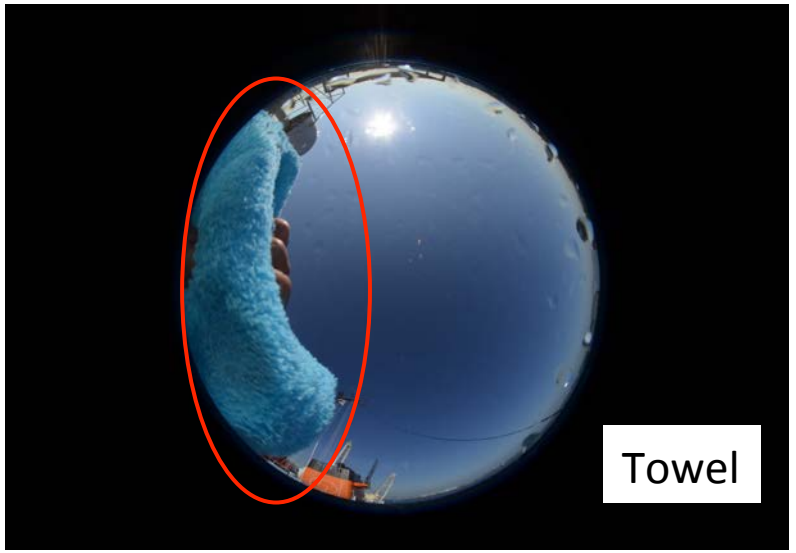
2013/09/13 07:05:09



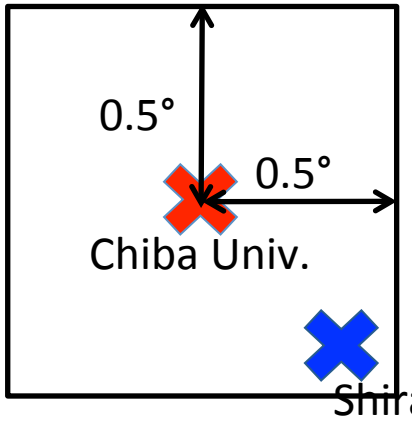
2013/10/20 03:55:15



2013/10/28 05:05:10

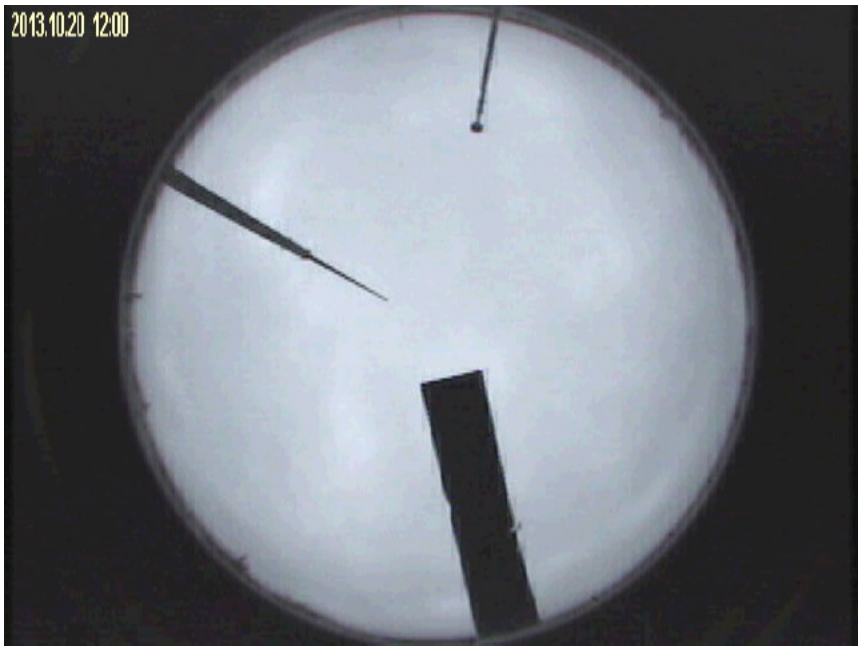


Comparison of images: Shirase vs. Chiba



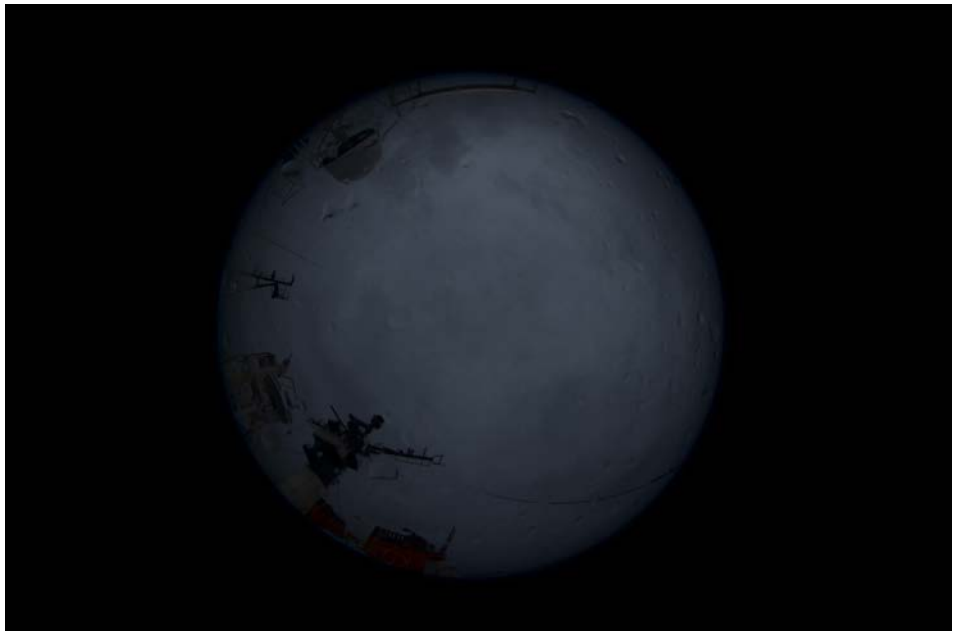
Comparison of images within ±0.5° lat. and lon.

Chiba Univ. 2013/10/20 03:00 UTC



http://atmos.cr.chiba-u.ac.jp/html/skyview/index_chiba.html

Shirase 2013/10/20 02:50:14 UTC



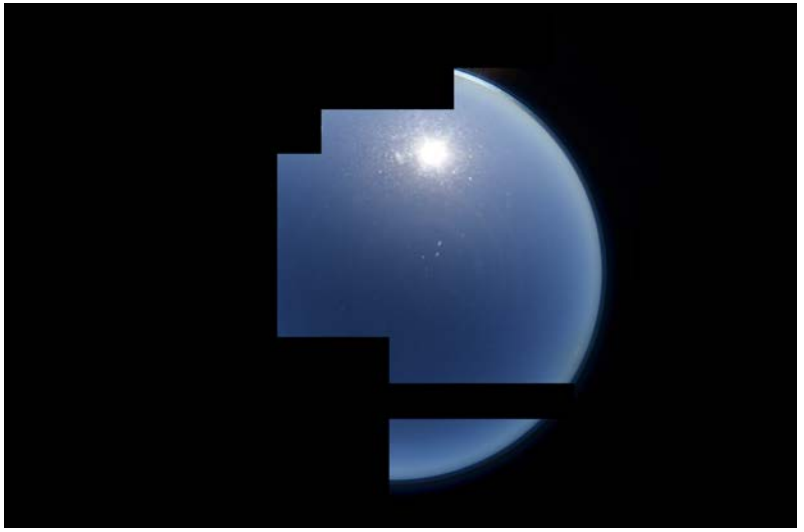
Cloud amount 10/10, but different brightness…

Mask of obstacles onboard

As preliminary analyses, some obstacles were masked roughly.

Original

Masked



05:55:00 UTC September 16, 2013