

# Ver.3 Cryosphere Products

# Evaluation Summary

Product	Release threshold	Standard accuracy	Target accuracy	Status* <sup>1</sup>	Evaluation Methods
Snow and Ice covered area (incl. cloud detection)	10%	7%	5%	○ ⇒ ◎	Comparison with other satellites data (e.g. MODIS, VIIRS, Sentinel-3...).
Okhotsk sea-ice distribution	10%	5%	3%	○ ⇒ ◎	Comparison with other satellites data (e.g. MODIS, VIIRS, Sensinel-3...).
Snow and ice surface Temperature	5K	2K	1K	◎	Comparison with in-situ observation (Automatic weather station thermal radiometer data) and other satellites data (e.g. MODIS, VIIRS Sentinel-3...).
Snow grain size of shallow layer	100%	50%	30%	◎	Comparison with in-situ data for the standard and target accuracy thresholds.

\*1 Symbols denote as follows; ○: the release threshold achieved, ◎: the standard accuracy achieved, ☆: the target accuracy achieved.

# Validation results of Cryosphere products – SICE/OKID

## - Version 3 Major changes and validation details

### C1AB/SICE - Snow and Ice cover area algorithm

- Revised cloud detection/surface classification training data set using Neural network machine learning method
- All training data were simulated by DISORT radiative transfer model

### C1C/OKID - Okhotsk sea-ice distribution algorithm

- Revised cloud detection/surface classification training data set using Neural network machine learning method – communalize with C1AB
- All training data were simulated by DISORT radiative transfer model

### Validation data for the C1AB/ SICE

- Snow area: MOD10C2 Snow Cover Extent Product
- Sea ice area\*: MOD29E1D Sea Ice Product

### Validation data for the C1C/OKID

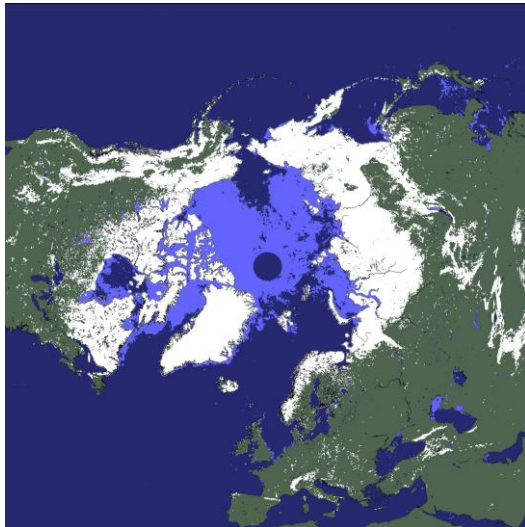
- Sea ice area\* : MOD29E1D Sea Ice Product

\*NSIDC defines sea ice exists in case of the ice fraction/ice concentration more than 15%.

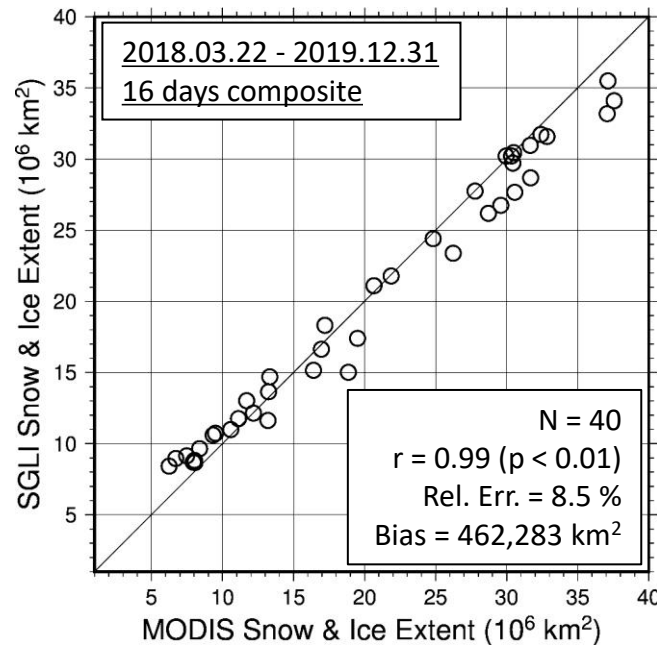
# Validation results of Cryosphere products - SICE

## - Snow and Ice cover extent product validation results using other satellite products

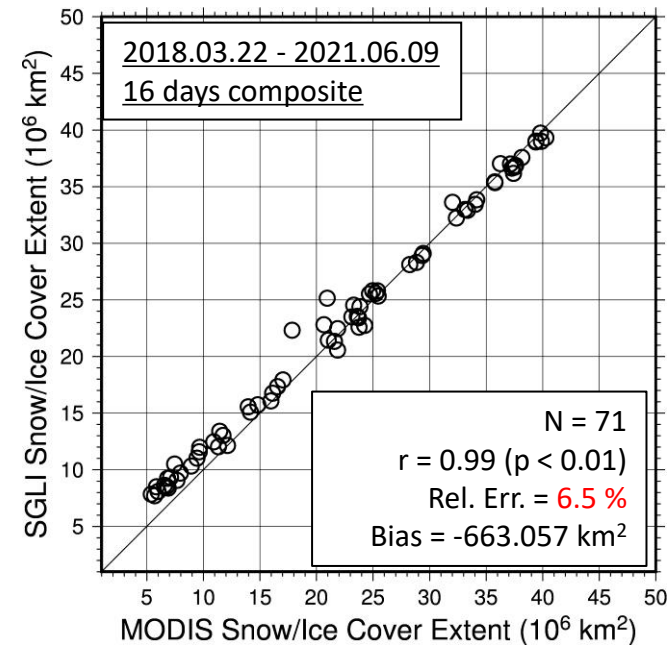
Ver.3 sample image  
2019.05.09 – 2019.05.24



Validation result of Ver. 2



Validation result of Ver. 3



Validation period was expanded: 1.5 year to 3 year.

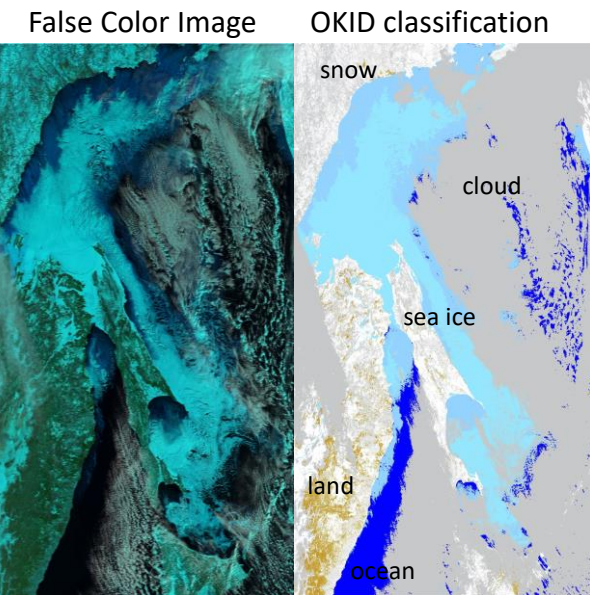
Validation result	Release accuracy	Standard accuracy	Target accuracy
Ver.2: 8.5 % (Mar. 2018 - Dec. 2019)	10 %	7 %	5 %
Ver.3: 6.5 % (Mar. 2018 - Jun. 2021)			

**Accuracy improved and SICE product is achieved the standard accuracy**

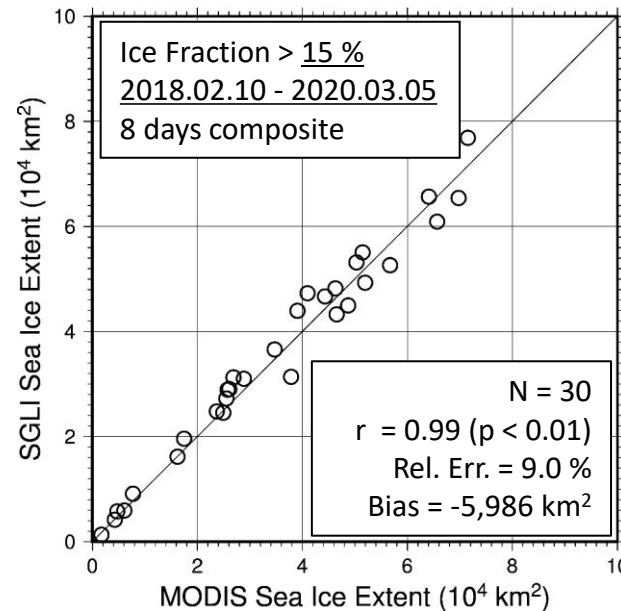
# Validation results of Cryosphere products - OKID

## - Okhotsk sea-ice distribution product validation results using other satellite products

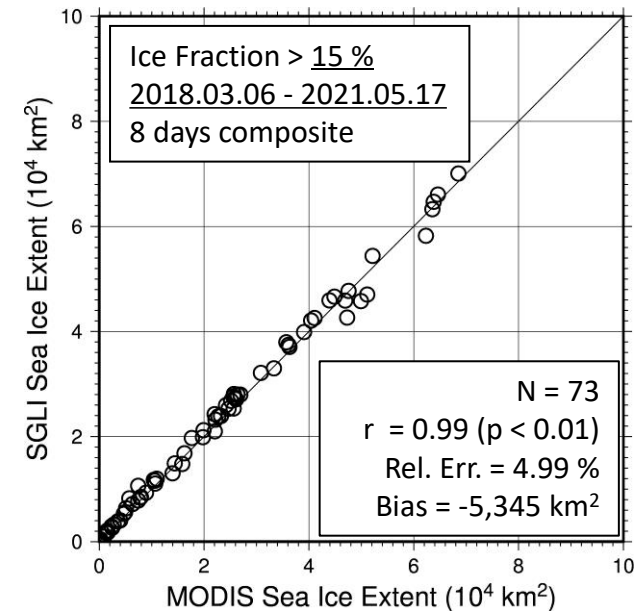
Ver.3 sample image  
2021.02.27



Validation result of Ver. 2



Validation result of Ver. 3



1. Validation period was expanded: 2 season to 4 season.
2. Surface classification was improved from visual evaluation compared with False color image.

Validation result	Release accuracy	Standard accuracy	Target accuracy
Ver.2: 9.0 % (Feb. 2018 - Mar. 2018)	10 %	5 %	3 %
Ver.3: <b>5.0 %</b> (Feb. 2018 - May. 2021)			

**Accuracy improved and OKID product is achieved the standard accuracy**

# Validation results of Cryosphere products - SIPR

## - Version 3 Major changes and validation details

### SGSL - Snow grain size of shallow layer

- Revised snow grain size estimation algorithm using Neural network machine learning method
  - Revised the training data set (BRDF data set) using Neural-net: improved inversion accuracy

### SIST - Snow and Ice surface temperature

- Revised the emissivity table

### SALB - Broadband blue sky Snow ALbedo

- **Add the direct retrieval of broadband blue sky snow albedo product as a research product**
- **Snow albedo estimation using Neural network machine learning algorithm same as snow grain size**

### Validation data for the SGSL

- Field campaign carried out on the Greenland Ice Sheet East-GRIP site (Jul. 2018), Japan/Hokkaido Nakasatsunai site (Feb. 2020), and JARE observation data (2019) on the Antarctic Ice Sheet Dome Fuji Site
- Surface Specific Area (SSA) measured by IceCube and HISSGraS and converted to optical equivalent snow grain size
- All data match-up conditions are in 10 minutes and 250 meters from nearest point of satellites

### Validation data for the SIST

- Ground surface temperature was converted from Longwave radiation Flux observation by Automatic weather station (PROMICE)
- All data match-up conditions are in 10 minutes and 250 meters from nearest point of satellites

### Validation data for the SALB

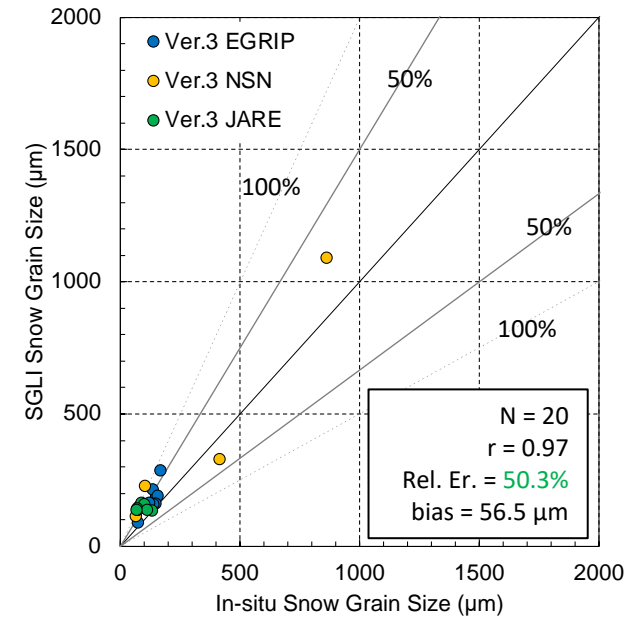
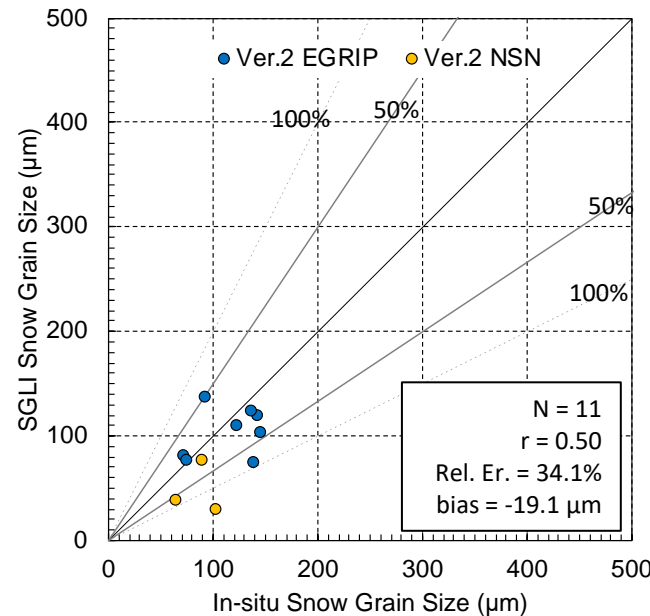
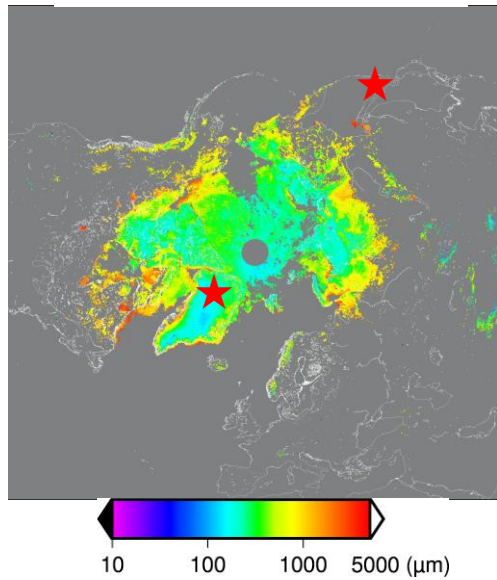
- Surface albedo was calculated from Downward and Upward shortwave radiation flux observation by Automatic weather station (PROMICE)
- All data match-up conditions are in 10 minutes and 250 meters from nearest point of satellites



# Validation results of Cryosphere products - SIPR

- Snow grain size of shallow layer product validation results using in-situ observation data

Ver.3 sample image  
2019.05.09 - 2019.05.24



Validation sites were added: around Dome Fuji site by JARE.

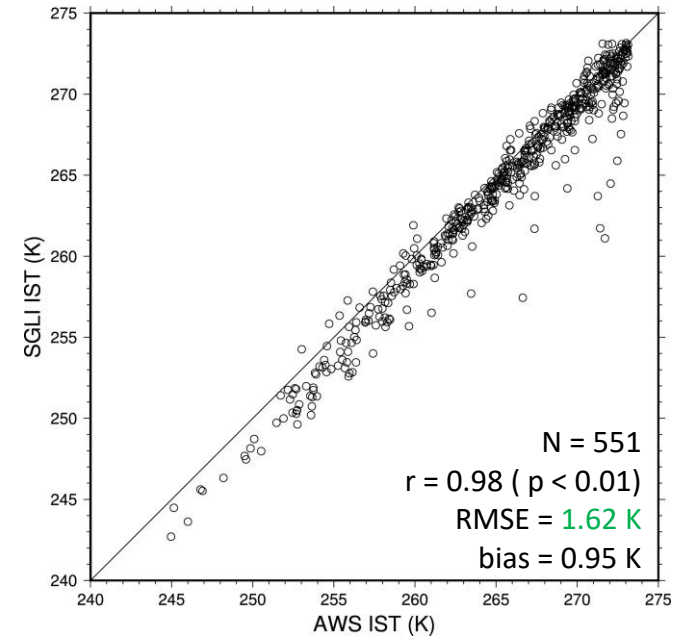
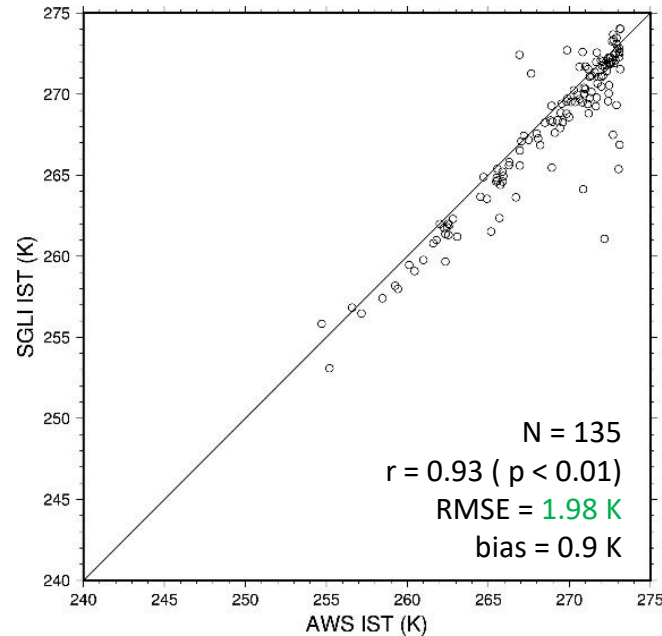
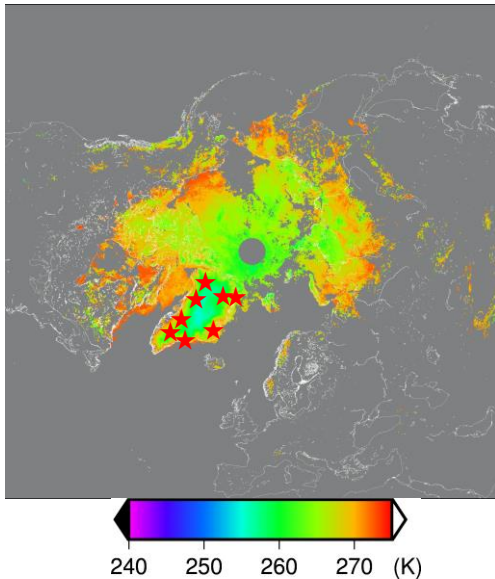
Validation result	Release accuracy	Standard accuracy	Target accuracy
Ver.2: 34 % (Greenland and Japan)	100 %	50 %	30 %
Ver.3: <b>50 %</b> (Added the Antarctica)			

**Retrieval became stable on wide region and SGSL product achieved the standard accuracy**

# Validation results of Cryosphere products - SIPR

- Snow and Ice surface temperature product validation results using AWS observation data

Ver.3 sample image  
2019.05.09 - 2019.05.24



Validation period was expanded: 2 years to 3 years.

Validation result	Release accuracy	Standard accuracy	Target accuracy
Ver.2: 2 K (GrIS: 2018 - 2019) Ver.3: 1.6 K (GrIS: 2018 - 2020)	5 K	2 K	1 K

**Accuracy improved and SIST product achieved the standard accuracy**

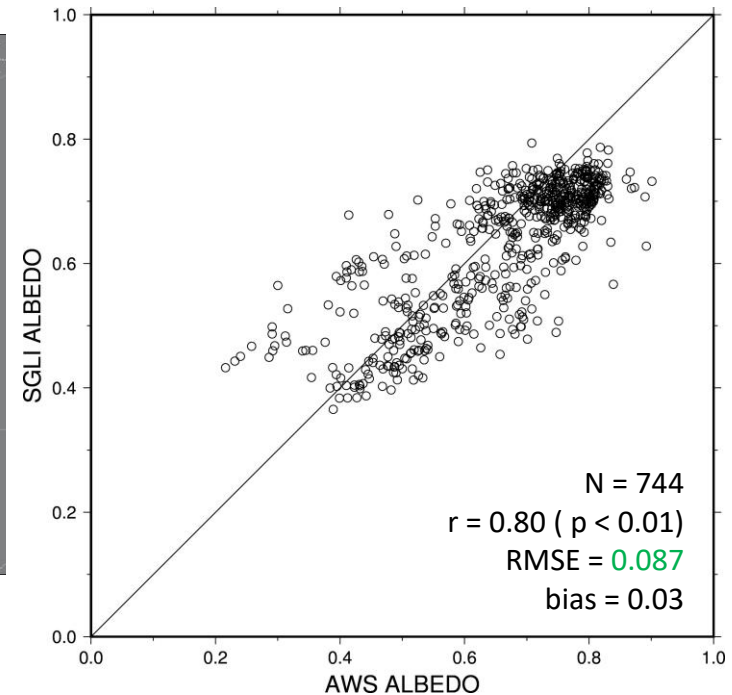
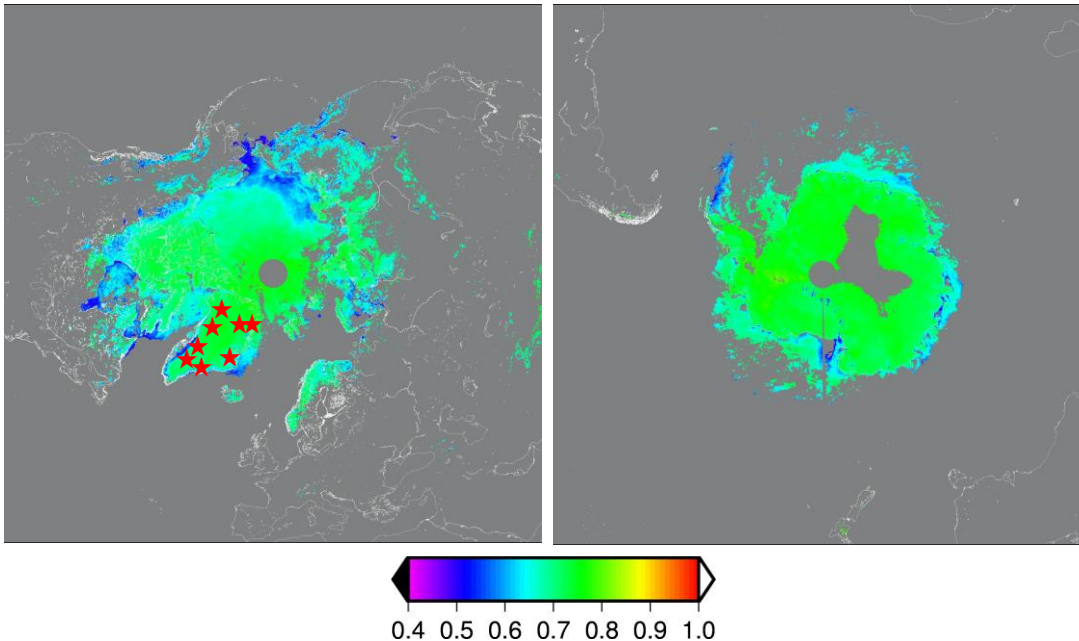


# Validation results of Cryosphere products - SIPR

- Snow and Ice surface albedo product validation results using AWS observation data

Sample image  
2020.05.09 - 2020.05.24

Sample image  
2020.11.17 - 2020.12.02



Validation result	Release accuracy	Standard accuracy	Target accuracy
0.087 (13 %)	-	-	7 %

**SALB product needs more in-situ data & quality control**