The version upgrade of the GCOM-C/SGLI Cryosphere products

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Japan Aerospace Exploration Agency (JAXA) polar-orbit satellite, Global Change Observation Mission for Climate (GCOM-C) which carries Second-generation Global Imager (SGLI) has been launched on 23 December 2017. The GCOM-C/SGLI observes various geophysical variables in the Atmosphere, Ocean, Land and Cryosphere. The GCOM-C/SGLI version 1 products released in public on 20 December 2018. On 29 June 2020, the GCOM-C/SGLI version 2 products released in public. In this version upgrade, the accuracies of the most products were improved from version 1. In this study, we show the upgraded cryosphere products and validation results. GCOM-C/SGLI regularly creates cryosphere product including classification product (C1) and snow properties product (C2). C1 product has focused on cloud mask and surface classification for polar and high altitude region. C2 product has focused on snow and ice physical parameters: snow grain size and snow and ice surface temperature. Major change for the C1 product was revising cloud detection/surface classification algorithm from ordinary threshold method to neural network machine learning method. All training data were simulated by the DISORT radiative transfer model. C1 product was validated by comparing Terra/MODIS snow and sea ice extent product (snow area: MOD10C2 Snow Cover Extent Product, sea ice area: MOD29E1D Sea Ice Product). In the comparison of snow and ice extent, its accuracy showed 8.5% as relative error (defined as quotient of root mean square error and average of validation data). This accuracy was improved from version 1 accuracy (9.4%). From previous study, cloud mask of MODIS was not optimal as a benchmark of cloud detection evaluation (Chen *et al.,* 2018). Therefore, we need to validate by comparing with more accurate dataset not only extent but cloud detection accuracy. Major changes for the snow grain size of shallow layer including C2 product were revising snow grain size retrieval algorithm using neural network machine learning method. In order to improve the processing speed, the algorithm was added the hidden layer numbers of neural-net. And it was revised the training data set and BRDF data set using neural-net in order to improve inversion accuracy. C2 product was validated by comparing with in-situ observation results obtained at the E-GRIP site on the North-eastern Greenland Ice Sheet in July 2018 and the Nakasatsunai site on the Northern Japan in February 2020. In the comparison of shallow layer snow grain size, its accuracy showed 34 % as relative error. This accuracy was improved from version 1 accuracy (86%, arctic region only). From these validation results, JAXA decided to release the GCOM-C/SGLI version 2 product including C1 and C2. And we are planning to continue the validation and algorithm improvement.

Table1. GCOM-C/SGLI Cryosphere products Accuracies.

	GCOM-C/SGLI Cryopshere products	Version 1	Version 2	Release Accuacy	Standard Accuracy	Target Accuracy
C1	Snow and Ice covered area	9.4%	8.5%	10%	7%	5%
	Okhotsk sea-ice distribution	9.1%	9.0%	10%	5%	3%
C2	Snow and ice surface Temperature	1.5 K	1.4 K	5 K	2 K	1 K
	Snow grain size of shallow layer	86%	34%	100%	50%	30%

References

Chen, N., W. Li, C. Gatebe, T. Tanikawa, M. Hori, R. Shimada, T. Aoki and K. Stamnes, New neural network cloud mask algorithm based on radiative transfer simulations, *Remote Sens. Environ.*, 219, 62-71, 2018.