The Cryosphere Discussions

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Comment on tc-2021-397

Anonymous Referee #1

Referee comment on "A sensor-agnostic albedo retrieval method for realistic sea ice surfaces – Model and validation" by Yingzhen Zhou et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-397-RC1, 2022

General comments: I have read the manuscript entitled "A sensor-agnostic albedo retrieval method for realistic sea ice surfaces - Model and validation". In this manuscript, the authors declared that they developed a sensor-agnostic sea ice albedo estimation method using a coupled atmosphere-surface radiative transfer model (RTM) and a multi-layer artificial neural network (MLANN) model. The results were validated with the measurements of ACLOUD and AFLUX campaigns, and compared with the MCD43D, MERIS, and OLCI albedo product. The validation and comparison results indicated that the albedo estimated by the MLANN method are in good agreement with the *in situ* measurements, and can provide better estimation of sea ice albedo than the other albedo products. The framework for estimating sea ice albedo using RTM/MLANN is interesting for the remote sensing society and polar studies. However, there are still several issues need to be addressed before publication. The main issues of this manuscript are listed as follows.

Specific comments:

- Although detailed information of the coupled radiative transfer model AccRT can be found in the literatures, I suggest to add a concise description about it in the manuscript.
- The method of how to construct the synthetic dataset (SD) with the coupled RTM is not clear. The detailed information about the inherit optical properties (IOPs) listed in Table 2 are needed, such as the data ranges, probability distribution, and constraints.
- The framework of the RTM/MLANN is not clear. I suggest to add a flowchart for it.
- In the manuscript, the MLANN method to used estimate the sea ice albedo. What are the performances of training, validating, and predicting accuracies of this artificial neural network model?
- The authors declared that the sensor-agnostic albedo retrieval method has the ability to apply to any optical sensor, however few explanations about this are shown in the

manuscript. I suggest the authors to further explain the major theories of this method. In fact, other methods such as the MPD and direct-estimation algorithm, can also be adopted to other sensors easily. Please add a discussion about it.

- The comparisons with MCD43D, MERIS, and OLCI datasets were not easily for reader to interpret. I suggested to add scatter plots to compare the differences of these datasets.
- Figure 13, the authors declared that the MERIS albedo product are higher than the albedo estimated by the MLANN method in the areas with large melt pond fraction (greater than 50%). However, this difference is not obvious, and the major differences appeared in the upper right corner. Please provide an explanation for it.
- Figure 13, the measurements of campaigns were not shown in this figure. Why? Please add the validation data for comparison.
- In the abstract, the mean absolute error (MAE) of 0.047 was used for indicating the accuracy of this method. I suggest to use root mean standard error (RMSE) to represent the estimation accuracies for the visible, near infrared, and shortwave albedo.

Technical corrections:

- Figure 7. The color ramp of this figure is not easily to interpret. Please change it.
- Line 493, the sentences of "Istomina et al. (2015); Istomina (2020)" can be rewritten as "Istomina et al. (2015; 2020)".
- Caption of Figure 13. "(Qu et al. (2015), this study, and Istomina et al. (2015))". The reference Qu et al. 2015 is not related with this figure.