

Improving, assessing and applying cloud fractions from satellite observations over the polar regions based on artificial intelligence methods

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Description:

Identifying and screening of clouds over the polar regions is a challenging task due to unique features of the atmosphere and surface in the Arctic. Clouds in the Arctic tend to be optically thin and at low level. Commonly used visible, thermal, or microwave measurements do not show significant contrast with the underlying surface, which is often covered by reflective snow and ice. Furthermore, snow and ice are often as cold as clouds: the lack of strong thermal contrast together with ubiquitous temperature inversions makes the detection in the infrared challenging [1].

Poulsen et al. (2020) [2] established a flexible yet efficient way to identify clouds and classify surfaces in the polar regions using a neural network (NN) belonging to the group of Artificial Intelligence (AI) approaches. The authors collocated SLSTR and CALIOP satellite measurements. The input data to the NN were taken from SLSTR and the collocated CALIOP data were used for the output classification of the NN. In a recent successful M.Sc. work it could be shown that this approach is feasible for typical Arctic measurements.

In the framework of this M.Sc. work, the implemented approach needs now to be improved where necessary, assessed in terms of quality and applied to a longer period of Arctic SLSTR data.

Skills/Interest: Interest in cloud science and AI/NN methods. Good mathematical background and **very good programming skills (python, git/gitlab, conversational development, object oriented programing)** are required.

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Related links/Web: <https://www.iup.uni-bremen.de/aerosol>

References:

[1] S. Jafariserajehlou, Linlu Mei, Marco Vountas, Vladimir Rozanov, John P. Burrows, and Rainer Hollmann, Atmos. Meas. Tech., 12, 1059–1076, <https://doi.org/10.5194/amt-12-1059-2019>, 2019

[2] C. Poulsen, U. Egede, D. Robbins, B. Sandeford, K. Tazi, T. Zhu, Evaluation and comparison of a machine learning cloud identification algorithm for the SLSTR in polar regions, *Remote Sensing of Environment*, Volume 248, 2020, 111999, ISSN 0034-4257, <https://doi.org/10.1016/j.rse.2020.111999>

[3] Kumar, Sushant (2024) *Satellite Cloud Fraction Over the Polar Regions Based on Artificial Intelligence Methods*. Masters thesis, University of Bremen.

Preliminary work plan:

- 1) Literature survey. Study specifically the approach of Poulsen et al. (2020)/Kumar (2024).
- 2) Become familiar with the implemented method (implemented in the framework of TensorFlow).
- 3) Use correlation matrix (see Fig) to potentially improve the current method.
- 4) Validate with independent (ground-based) data
- 5) Apply the method to at least one month of SLSTR.

