Satellite Cloud Fraction over the polar regions based on artificial intelligence methods

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Identifying and screening of clouds over the Arctic 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 with 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 IR potentially problematic [1].

A recent publication by Poulsen et al. (2020) [2] might give the opportunity to establish flexible yet efficient measures to identify clouds and classify surfaces in the polar regions. The authors colocated SLSTR and CALIOP measurements. The input data to the Neural Network were taken from SLSTR and 9 spectral channels, geolocation, and observation angles, have been considered as input data to the NN. The colocated CALIOP data were used for the output classification of the NN.

This approach needs to be implemented and to be transferred to satellite spectrometer data. The reason for this is, that unfortunately, these instruments often do not have useful approaches for cloud masking in polar regions. The above mentioned approach could offer promising results especially for GOME2 and/or TROPOMI.

Skills/Interest: Interest in cloud science and AI/NN methods. Good mathematical background and **very good programming skills** are important prerequisites.

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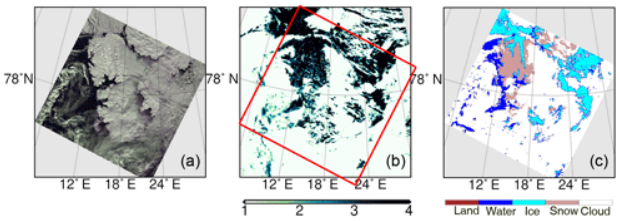
Related links/Web: http://www.iup.uni-bremen.de/aerosol



Example of a physical based method to classify clouds and surfaces in the Arctic [1]

[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

Preliminary workplan:

1) Literature survey. What is already there? Which quality?
2) Study specifically the approach of Poulsen et al. (2020).
3) Become familiar with TensorFlow.
4) Organize test data. Set up training testbed.
5) Judge (preliminary) the potential.