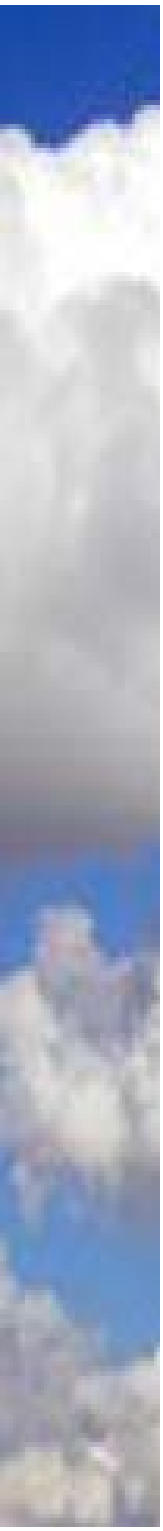
MSc Thesis in Remote Sensing of the Atmosphere

Do two cloud radars provide the same reflectivity values when measuring the same cloud?



Context

Clouds are an essential part of the water cycle. In addition, depending on the particles they contain, they may have a cooling or warming effect on the atmosphere. Therefore, there is a large effort in Europe to measure them with cloud radars. The primary measurement of an atmospheric radar (weather or cloud) is the reflectivity. Cloud radars provide reflectivity values to the European data platform (ACTRIS). Despite the calibration of radar systems, data are generally biased.

Methodology

A measurement campaign is taking place at the meteorological site of Cabauw, which is part of the national Ruisdael Observatory for investigating two techniques to mitigate these biases. One technique uses the measurement of a known reflecting object (trihedral corner reflector) and the other one in-situ measurements of the raindrop size distribution acquired by diverse disdrometers. Two different types of cloud radars are present on the site, one owned by LATMOS (France) and the other one by TU-Delft.

Research questions

This master topic involves the data analysis of the measurement campaign in the context of the following questions:

Can we get the radar constant from the known single object measurement?

Can we obtain the radar constant from in-situ raindrop size distribution measurements?

What are the pros and cons of these methods? What are their errors? Do they provide the same results?

Suppose a reference radar is well calibrated, how can we transfer the calibration of the reference radar to other radars with the same frequency in Europe? What is the appropriate procedure? What can we propose when the radars have different frequencies?

It is not required to solve all these questions. A selection will be made. Experience is available at TU-Delft and LATMOS in this field.

Conclusion

For the interested student, this topic provides a great experience in data analysis and methodology development, which can be applicable to other instruments than radars and disdrometers. The societal impact, monitoring the possible changes of cloud types in the context of a warming climate, is large.

The master thesis work requires Matlab or Python coding. The interested student can start from November 1st.

Contact information

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Team

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