PROJECT TITLE

Remote sensing of clouds

PROJECT DESCRIPTION

Clouds and aerosols contribute the largest uncertainty to estimates and interpretations of the Earth's changing energy budget. The resulting climate model biases in surface radiation and temperatures are largest over the Southern Ocean, a region which is also considered pivotal for the global climate system. Evidence suggests that these biases are primarily due to the poor representation of mixed phase clouds (MPCs) in these models. The Southern Ocean Cloud (SOC) project is aims to improve understanding of aerosol and cloud microphysics - particularly of MPCs – through a combined measurement and modelling effort. Within the scope of SOC, several in-situ and remote sensing instruments will be deployed on Rothera and on ships in the coming years. Among the remote sensing instruments is the new Mini Micro Pulse LiDAR (MiniMPL) which has been running at BAS in Cambridge alongside a ceilometer since November 2020. Both instruments make laser light backscattering measurements from which vertical profiles of the aerosol backscatter coefficient, the altitude of the Planetary Boundary Layer (PBL) and height of the cloud base can be retrieved. The LiDAR is sufficiently powerful to measure through several cloud layers up to high cirrus clouds – providing additional information on cloud types. The LiDAR is also equipped with dual-polarisation capabilities, meaning that it can distinguish between pure water clouds and mixed phase clouds. In view of the importance of the LiDAR measurements for the SOC project, we would like to get a better understanding of its performance in measuring these different variables in varying atmospheric conditions. Additional data that could be used within the scope of this project is radio sounding data to retrieve and compare PBL height, local meteorological observations (temperature, pressure, humidity and precipitation) and meteorological model or back trajectory data to identify different meteorological and airmass conditions in which the instrument's performance will be evaluated.

SUGGESTED LENGTH – 10 weeks.

JOB DESCRIPTION

The remote sensing of clouds intern will be working with LiDAR and ceilometer data to perform an intercomparison and evaluate the performance of the instruments. Ideally, the incumbent would use additional available datasets to stratify the analysis according to different operating, airmass and meteorological conditions. Ideally, the output of this part of the work would consist of a report containing an evaluation of the LiDAR's performance. The incumbent will work with a variety of meteorological datasets and statistical analysis tools within a programming environment (preferably Python, Matlab or R). Depending on the incumbent's experience and interests, the importance of additional datasets (in-situ or model) can be adjusted and different analysis tools (statistics or machine learning) can be considered. If there's enough time and depending on the incumbent's interests, additional work may be related to working directly with the instruments on-site to experiment with features and settings, or to applying more advanced analysis (clustering or classification) techniques to the LiDAR vertical profiles. The outputs of this part of the work would ideally include a set of recommendations for the operation of the instrument and/or a set of exploratory data analysis tools to be applied on SOC data.

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WHAT ARE WE LOOKING FOR?

Basic knowledge of, or willingness to learn, a programming language (preferably Python, Matlab or R). Some experience in data analysis and statistics. An interest in atmospheric sciences, and an interest in remote sensing.