The Leipzig Institute for Meteorology (LIM), Germany, invites applications for a

PhD Position

1. Variability of Arctic cloud top cooling as a function of cloud microphysical properties derived from airborne thermal infrared imagery

We offer a PhD position to study Arctic clouds using state of the art airborne remote sensing instruments. The aim of this project is to use downward viewing airborne thermal infrared imagery to investigate the cloud top temperature with high spatial (< 10 m pixel size) and temporal (100 Hz) resolution. The measurements will be used to quantify the influence of spatial cloud inhomogeneities on the cloud top cooling, a key process leading to the long life time of Arctic clouds and potentially contributing to the amplified Arctic warming (Arctic Amplification). Details of the project motivation are given below.

The position is funded within the Transregional Collaborative Research Center TR172 on "ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms $(AC)^3$" (www.ac3-tr.de) by the University Leipzig. Within the TR172, LIM together with the collaboration partners (Universities of Cologne and Bremen, TROPOS and Alfred Wegener Institute) aim to better observe, understand, and simulate processes leading to the current drastic climate changes in the Arctic. The PhD candidate will work in close collaboration with these $(AC)^3$ partners and link own results to their modelling and satellite remote sensing activities.

Terms of employment

The PhD position (65% TV-L E13) is awarded for 3 years and open starting as soon as possible. We offer a productive and interdisciplinary working group including comprehensive supervision and integration into the Leipzig Graduate School on Clouds, Aerosol and Radiation (http://www.lgs-car.tropos.de/) which is part of the ITRG of $(AC)^3$ (https://www.ac3-tr.de/phd/).

Qualification requirements

For the PhD position we expect strong interest in atmospheric science, in particular in cloud physics, remote sensing, radiative transfer, and climate. Applicants should have a Master in Meteorology or a related field. Experience in high-level scientific programming for data analysis is desirable. Candidates must possess excellent communication skills in written and spoken English.

Applications

Interested candidates should send a cover letter describing background; a CV, training and research interests; certificates; and the contact information of two referees as a single PDF to

michael.schaefer[at]uni-leipzig.de.

Review of applications will begin immediately and continue until the position has been filled.

Selection

The selection for the position will be based solely on scientific merit without regard to gender, religion, national origin, political affiliation, marital or family status or other differences. Among equally qualified candidates, handicapped candidates will be given preference.

Detailed project description

Information on the Collaborative Research Center TR172 Arctic Amplification are presented on the web page:

www.ac3-tr.de

1. **Variability of Arctic cloud top cooling as a function of cloud microphysical properties derived from airborne thermal infrared imagery**

The understanding of Arctic cloud processes crucially depends on the availability of appropriate observations. However, comprehensive field measurements (long-term ground based or short-term campaigns) require costly research infrastructure that need to be operated in the harsh Arctic environment. Therefore, observations of cloud processes within the Arctic Circle are sparse. Satellite remote sensing techniques can partly help to fill the gap of missing field observations in Arctic regions. However, although they may cover large spatial and temporal scales, they are unable to provide the required spatial and temporal resolution to investigate small-scale or short-term processes in clouds. In comparison, airborne observations, such as spectral imaging of reflected solar or emitted thermal radiation, provide areal measurements with a high spatial resolution down to several meters.

Arctic clouds are known to possess a significant cloud top cooling, which induces turbulence and entrainment processes and is crucial for the long life time of Arctic boundary layer clouds. However, the cloud top typically shows significant horizontally inhomogeneous structures. These small-scale inhomogeneities may feedback to the cloud top cooling depending on the position within, above or below the cloud top temperature inversion. Therefore, the differential cloud top cooling may buffer or enhance the cloud top inhomogeneities. However, those horizontal small-scale inhomogeneities are far below the spatial resolution of most of the satellite sensors. Therefore, airborne observations will be analysed to quantify the influence of spatial cloud inhomogeneities on the cloud top cooling.

The aim of this project is to use downward viewing airborne thermal infrared imagery to investigate the cloud top temperature with high spatial (< 10 m pixel size) and temporal (100 Hz) resolution, measured within different spectral channels. The infrared imager is installed on board of the High Altitude and Long Range Research Aircraft (HALO). Using this imager, first airborne measurements in Arctic regions will be performed out of Kiruna, Sweden during the HALO-$(AC)^3$ campaign in March/April 2022. The observed cloud top temperature shall be evaluated as a function of the optical and microphysical cloud properties for different states of cloud top inhomogeneity. For this, cloud optical and microphysical retrievals based on thermal infrared wavelengths are required. Besides the measurements, necessary input for the retrievals will be obtained from radiative transfer simulations. Additional cloud information will be available from lidar, radar, imaging spectrometers in the solar spectral range and broadband radiometer.

For more information contact: michael.schaefer[at]uni-leipzig.de