UNIVERSITY OF COLOGNE
INSTITUTE FOR GEOPHYSICS AND METEOROLOGY

Universität zu Köln

The Institute for Geophysics and Meteorology, University of Cologne (IGMK), Germany, invites applications for several

Post-doctoral positions

(1) Fine-scale simulation of low level Arctic clouds
(2) Arctic snowfall characterization using active and passive millimeter wave satellite data
(3) Precipitation and cloud distribution response to aerosols in observations and modeling
(4) Confronting ICON high-resolution modeling with supersite observations
(5) Assumed PDF cloud schemes for the global climate model ICON and their interaction with radiation

Positions (1) and (2) are related to the Collaborative Research Center TR172 ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms $(AC)^3$, which was recently approved by the German Science Foundation for an initial four year period and will start 1 January 2016. Within the TR172, IGMK together with the collaboration partners (Universities of Leipzig and Bremen, TROPOS and Alfred Wegener Institute) aim to better observe, understand and model processes leading to Arctic amplification.

Positions (3), (4) and (5) are related to the High Definition of Clouds and Precipitation for Climate Prediction $HD(CP)^2$ project (http://hdcp2.eu/). The project will start its second phase in spring 2016 for a three year period, subject to the grant agreement to be issued by the Federal Ministry of Education and Research. Here, the tools developed in Phase I, namely a high-resolution version of the ICON model and a comprehensive observational data base will be exploited to address scientific questions such as “How do clouds respond to perturbations in their aerosol environment?” or “What are controlling factors for boundary layer clouds?”

The positions (100% TV-L E13) are awarded for up to 4 years. We offer a productive and interdisciplinary working atmosphere including several possibilities for career development.

Requirements
We expect strong interest in atmospheric science with specialization in cloud modelling and observations, remote sensing, or statistical modelling, depending on the topic. Applicants should have a Master-of-Science-equivalent university degree in meteorology, geophysics, physics or mathematics and preferably hold a PhD degree. Experience in scientific programming, preferably in a UNIX/LINUX environment, and knowledge in computational modelling is highly desirable. Candidates must possess excellent communication skills both in written and spoken English.

Applications
Interested candidates should send a CV; a cover letter describing background, training and research interests; certificates; and the contact information of two referees as a single PDF to meteo-jobs[at]uni-koeln.de. Please clearly indicate which position(s) you apply for. Review of applications will begin immediately and continue until the positions have been filled, January 31 latest.

Selection
The selection for the positions will be based solely on 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 descriptions

(1) Fine-scale simulation of low level Arctic clouds
Arctic low level clouds play an important role in the global climate at high latitudes. These clouds are associated with potentially significant vertical transport of heat and moisture, as well as a substantial impact on the radiative energy budget. Commonly, the representation of these clouds in climate models fully relies on parameterization. While many of such parameterizations have been based on observational datasets obtained at lower latitudes, in the Arctic such data is scarce. This has complicated the evaluation of such parameterizations. New field campaigns are currently planned and in progress to fill this data gap; in addition, fine-scale cloud resolving simulation, constrained by available measurements, is increasingly used to supplement the observational data record. In this project Large-Eddy Simulation (LES) of Arctic low level clouds is conducted to gain more insight into this phenomenon and to support parameterization development. LES will be performed for mixed-phase stratocumulus and convective clouds in cold-air outbreaks. Both Eulerian and Lagrangian experiments will be conducted, at permanent meteorological supersites and along trajectories of cold air outbreaks. The successful candidate is expected to manage the preparation and configuration of the LES, the execution of actual numerical experiments, and the coordination of the use of the LES data archive in the wider TR172 project. Previous expertise in fine-scale cloud modeling is highly recommended. For more information contact Prof. Dr. Roel Neggers: neggers[at]meteo.uni-koeln.de.

(2) Arctic snowfall characterization using active and passive millimeter wave satellite data
Snowfall is an integral part of the water cycle in the Arctic. However, snowfall is extremely difficult to capture both in models and observations at the relevant regional spatial scales. In close cooperation with regional climate modelers from AWI the postdoc will exploit the longterm record of active and passive millimeter wave satellite data sets via a) the observation-to-model approach using snowfall retrievals and b) a model-to-observation approach that creates synthetic observables, i.e. radar reflectivities and brightness temperatures, from regional climate model (RCM) simulations. For the latter RCM consistent treatment of active and passive radiative transfer including scattering by frozen hydrometeors and interaction with different surface types will be important. Observations, reanalysis and a set of RCM simulations will be used to investigate the links between sea-ice reduction and cloud changes, the impact on snowfall and snowfall-to-precipitation ratio. Consequently we seek a candidate with experience in microwave remote sensing of clouds and precipitation and/or model evaluation. For more information contact Prof. Dr. Susanne Crewell: crewell[at]meteo.uni-koeln.de.

(3) Precipitation and cloud distribution response to aerosols in observations and modeling
How do clouds respond to perturbations in their aerosol environment? This is the overall question posed by a consortium of partners from eight different german institutions. We will use ICON-LES simulations with different aerosol loads to define observables and observing strategies sensitive to cloud-aerosol effects. A wide variety of cloud and precipitation properties available from ground-based supersites and satellite will be used to explore whether the aerosol load leads to changes in individual cloud parameters and whether compensating effects might lead to no significant effects in surface precipitation. Observing system simulation experiments
(OSSEs) will be performed for sensors deployed at supersites (Doppler cloud radars and microwave radiometers) to investigate the sensitivity of different observables to IN and CCN loads and to define the strategy how the aerosol effect can be identified from observations alone. Similar efforts will be done for satellite observations employing forward operators. For these tasks we look for a person with broad background in cloud observation and modeling with interest in team work. For more information contact Prof. Dr. Susanne Crewell: crewell[at]meteo.uni-koeln.de.

(4) Confronting ICON high-resolution modeling with supersite observations

What are controlling factors for boundary layer clouds? For a process-oriented model evaluation of the large domain high-resolution (~100 m) $HD(CP)^2$ model ICON it is particularly instructive to evaluate the vertical structure of grid-columns at high frequency and at various locations in the domains of interest. The main questions to focus on in this project are: 1.) Is the model capable of reproducing the main low cloud features in the first place? 2.) Do any major biases exist? 3.) If so, which model physics or cloud-/precipitation processes can they be attributed to?

To answer these questions, the post-doc will categorize long-term supersite observations (radar, lidar, passive microwave and infrared observations) and model output from the available high-resolution ICON-LES simulations with respect to location, time-of year, boundary layer type, large-scale forcing, etc. in order to better identify model shortcomings. In addition, the project will focus on long-term local LES simulations over supersites in order to assess these as virtual labs for 4D cloud observations and to specify their potential for evaluating the ICON large-domain simulations. For more information contact PD Dr. Ulrich Löhnert: loehnert[at]meteo.uni-koeln.de.

(5) Assumed PDF cloud schemes for the global climate model ICON and their interaction with radiation

Low-level boundary layer clouds and their connected processes remain unresolved in most present-day global climate models, and are a major source of future climate uncertainty. In particular cloud inhomogeneity, within single clouds and whole cloud fields, is often poorly represented. New cloud schemes based on probability density functions (PDF) provide opportunities to achieve a better description of the associated subgrid-scale variability. Another advantage of PDF-based cloud schemes is that they could facilitate parameterization integration – e.g. between cloud physics, dynamics and radiation. The successful candidate will work on PDF-based cloud schemes in the framework of the newly developed ICON model. A model hierarchy, consisting of single-column models and large-eddy simulations, will be used for the evaluation of existing schemes and the development of new ideas. Building on these results a new or extended scheme will be developed and implemented in the global ICON model. During the whole process the focus will be on the interaction between the cloud scheme and the radiation parameterization, working towards a better representation of cloud inhomogeneity in general. For more information contact Dr. Vera Schemann: schemann[at]meteo.uni-koeln.de