BALTEX Cloud Liquid Water Network: CLIWA-NET

Eighth quarterly report

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Contract No: EVK2CT-1999-00007
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Overview
All CLIWA-NET measurement campaigns have been successfully finished. During 6 months in total the prototype of a European cloud observation system was operated and visualizations of all measurements can now be accessed by the broad public via the world wide web. Raw data and derived products of ground-based and aircraft data for the project members are available from the BBC data base. The major effort is now on merging the measurements (ground-based and satellite) for evaluation and improvement of atmospheric models.

The co-ordinator of CLIWA-NET (Dr. Andre van Lammeren) changed to a different position within KNMI on February 1, 2002. After discussion with the WP-Managers it was decided that Dr. Arnout Feijt (KNMI) will be his official successor and scientific coordination will be taken over by the University of Bonn (Prof. Clemens Simmer, Dr. Susanne Crewell).

Highlights of the quarter

Progress Report WP2000: Ground-based network
After the end of the BBC campaign previews of nearly all data were generated and can be viewed via the CLIWA-NET homepage, which also contains the structure of the data base and an overview of available data. Beside the continous observations from Cabauw (two infrared radiometer, three lidar ceilometer, microwave radiometer, three radars, radiation etc.) information from the regional network (lidar ceilometer, pyranometer, infrared and microwave radiometer) and the additional aircraft measurements is available. The results of the Microwave Radiometer Intercomparison Campaign (MICAM) from the first two weeks of August are shown at http://r203d.meteo.uni-bonn.de/CLIWANET/MICAM. For the BBC campaign the availability of continous measurements at Cabauw from joint multispectral microwave radiometer and radar data allows the retrieval of the cloud liquid water (LWC) profile as an additional level2 product.

On February 21, 2002 a meeting between the WP2500 “Cloud Processes” participants (GKSS, KNMI, University of Bonn) took place at KNMI. First statistics for the occurence of supercooled water above the Cabauw site were presented. Future work on issues of drizzle, precipitation initiation and multi-parameter radar analysis was defined.

A two day meeting with several participants of MICAM was organised at Bonn on February 18 and March 1, 2002. The campaign identified a miscalibration of the 23.8 GHz channel of the french DRAKKAR radiometer which measurements should not be used until a revised version becomes available. A correction for the swiss TROWARA radiometer is underway. Significant discrepancies between different radiometer were found especially at 22.235 and 90 GHz. A comparison with the results of radiative transfer comparisons based on corresponding radio soundings shows that the difference between the radiometer is about as much as the uncertainty of the gas absorption. The relative agreement of the radiometer is excellent, however systematic deviations of about 1 to 2 K occur. In the moment the reasons for the differences are investigated. These discrepancies and the
uncertainties in the gas absorption model can lead to systematic errors in the derived liquid water path (LWP) of about 30 gm⁻². Combination with IR radiometer and ceilometer might reduce this effect.

Within WP2600 the CLIWA-NET goal to design a low-cost microwave radiometer has nearly achieved. Due to internal funding Radiometer Physics has already started to build a first demonstration model. The design is partly based on experiences from the microwave radiometer intercomparison campaign and the problems comparison between LWP measurements with model results. One example is the design of a new precipitation sensor and shutter to reduce data loss after rain events. Issues regarding the instrument handling and software were discussed during the MICAM meeting in Bonn. The low-cost radiometer will be available as dual channel radiometer (LWP/IWV) and as profiler (LWP; temperature- and humidity profiles).

Progress Report WP 3000: Satellite remote sensing and integration of observations
Availability of satellite data
The AVHRR data is complete now. The satellite measurements of BBC have been geo-located using the Automatic Navigation Adjustment (ANA) software developed at Meteo-France.

Additionally, the SMHI works on a surface reflectivity map for the CLIWANET analysis area. This map is to give information of the spatial variations in surface reflectivity, that is required for the retrieval of quantitative cloud parameters from radiative transfer model calculations.

SMHI Cloud Type Classification
All AVHRR overpasses have been analyzed using the automatic Cloud Type Classification algorithm of the Satellite Application Facility in support of Nowcasting (NWC SAF) that was developed at SMHI. The Cloud Type Classification yields 20 types of scenes like Cloud free land, Thin Cirrus and Stratus.

From this spatial distribution of cloud type classification, SMHI sampled the distribution around each ground station for the BBC campaign. This sampled set is used for comparison of ground-based measurements, satellite derived cloud type classification and model results at the location of the ground station.

For the BBC a two monthly statistics will be made, similar to the CNN1 and CNN2 statistics. The statistics include total cloud cover, low level cloud and cirrus clouds.

KLAGOS
During this 8th quarter of the project the AVHRR data over CNN1 and CNN2 and BBC were analyzed with respect to: cloud presents, cloud optical thickness (assuming ice particles), optical thickness (assuming water cloud particles), cloud top temperature, cloud liquid water content, cloud ice water content. The resulting Cloud Liquid Water Path was compared to vertical integrated liquid water as measured from ground based microwave radiometer measurements for a number of cases.

Research is on-going to obtain higher order cloud products from AVHRR analysis. Promising results have been obtained with respect to the retrieval of cloud particle phase, water particle size and ice crystal type from the combination of measured reflectivity in the 0.6 and 1.6micron spectral bands.

KLAGOS was upgraded with more accurate algorithms for the viewing geometry calculations, sun-position calculations and calibration of the visible channels.

KLAGOS was extended to include some new visualization features that enable easy selection of specific areas and specific parameter value ranges. These new features are handy to identify spurious values or to select specific clouds/surfaces.
AMSU
The work on a neural network statistical scheme that was implemented during the 7th quarter was extended to a larger set of radiosonde profiles in order to get a more stable neural network.

Progress Report WP4000: Model evaluation/Improvement
Model Evaluation (WP4100):
The model evaluation based on validated data (level 1b and 2 for LWP-product) is continuing. ECMWF, the Rossby Center, and KNMI have produced model forecasts for all three measuring campaigns (CNN-I, CNN-II, and BBC). So far, DWD only covered CNN-I and CNN-II. A more comprehensive evaluation of the model representation of the characteristics of boundary-layer clouds has been carried out. Focus was put on the distinct difference in evolution of the cloud-topped boundary layers observed at Lindenberg/Potsdam and at Kiruna, the former being convectively driven from the surface, the latter being primarily the result of advection over a thin stably stratified boundary layer.

Horizontal resolution (WP4200):
Work on aspects of horizontal model resolution as formulated in Workpackage 4200 is continuing in a mutual MIUB/KNMI effort with case studies for CNN-I and BBC campaign.

Parametric issues (WP4300):
At the Rossby Center work continued in various areas of cloud-linked parametric issues in relation to observations inferred within CLIWA-Net:
   i) the diurnal cycles of clouds and cloud radiative forcing,
   ii) cloud amount and cloud content in shallow convection
   b) the sensitivity of cloud liquid water to microphysical parameterisation assumptions
   iii) the vertical structure of clouds in numerical models
   b) cloud overlap assumptions
   c) the effect of increased resolution on the representation of clouds

Conferences and Workshops:
MICAM meeting, University of Bonn, 28 February – 1 March, 2002

Highlights of the quarter:
Two papers submitted to Special BALTEX Issue for BER (Boreal Environmental Research)
Cloud Observations and Modeling within the European BALTEX Cloud Liquid Water Network,
   Susanne Crewell, Matthias Drusch, Erik van Meijgaard and André van Lammeren
Retrieval of the spatial distribution of Liquid Water Path from combined ground based and satellite
   observations for atmospheric model evaluation, Arnout Feijt, Dominique Jolivet and Erik van
   Meijgaard

Problems encountered:
WP2000: Breakdown of the CLIWA-NET ftp server at University of Bonn due to severe power
   failure, data could be restored within 2 weeks.

Significant departures from Description of Work:
DWD is still lagging in the delivery of LM-model data

Upcoming Meetings:
European Geophysical Society, XXVII General Assembly, Nice, France, 21-26 April 2002; including
   Meeting on interfacing between WP2000 und WP3000 in preparation of BBC meeting
   BBC-workshop, Leipzig, 13-14 May 2002
   CLIWA-Net workshop, Leipzig, 15-16 May 2001