MINUTES OF CLOUD-NET SECOND WORKSHOP

20-21 October 2003, Meteo France, Toulouse, France.
Present: Jacques Pelon, Martial Haeffelin, Alan Protat, Dominique Bouniol (IPSL), Anne Mathieu (LMD), Pierre Claeyman (Degreane); David Donovan, Henk Klein-Baltnink, (KNMI); John Goddard, (RCRU); Herman Russchenberg, (TUD); Robin Hogan, Malcolm Brooks, Anthony Illingworth (co-ordinator.), Nicolas Gaussiat (Administrator), Ewan O'Connor, (UR). Damain Wilson (Met Office), Jean-Marcel Piriou, Francois Vinit and others at various times (Meteo-France).

1. GENERAL REMARKS and PROGRESS ON DELIVERABLES.

1.1 Apologies for absence. Adrian Tomkins (ECMWF), Pekka Ravilla (Vaisala), Gerd-Jan Zadelhof (KNMI), G Kadner (Gematronik).

1.1.1 Actions arising from the minutes. All dealt with under under other headings apart from: OLD ACTION 1.1 - AJI to write to Gerhard Adrian to remind him. This was done a few weeks back, but there has been no answer.

1.1.2 The second annual report was described and requirements for the third annual report due next summer were outlined. (AI). The project currently has low visibility. Now we are producing excellent data this needs to be remedied. There was a brief discussion on data policy – see 8.4 for later discussion.
ACTION 1.1 – All to update publication list in report. It is important that these publications specifically acknowledge CloudNET as copies will be required by Brussels.
ACTION 1.2 - All to submit papers to upcoming (Jul 03) ICCP conference in Bologna which specifically mention CloudNET. Dead line for abstract submission 3 November.
ACTION 1.3 - All to consider submitting papers to ERAD3 in Sweden (Sep 03) specifically mentioning CloudNET. Deadline for abstracts is 1 March 04.
ACTION 1.4 - All to compose list of 'breakthroughs' for third annual report. A two page summary of such breakthroughs should follow the format of those in the second report and posted on the web.

1.2 The current state of the web site with all the model data, observations, and meteorological products with their errors and quality status was described by E O'C and RJH.
ACTION 1.5. EOC and RJH to put the RACMO model data which has just arrived on the web, and also the sample of the MO model (global resolution) to be converted to netCDF and put on the web. (Done)
ACTION 1.6. EOC and RJH to arrange for the web display to have the broad band radiometer and rainfall rate as daily and monthly plots on the web. (Done)
ACTION 1.7 A link to the SIRTA real time web site display to be put on the cloudNET site. MH to supply link to EOC.
ACTION 1.8 . Cabauw does not currently have a real time display. HKB to consider implementing this and linking it to the CloudNET site when he has time.

RJH described categorisation and meteorological products on the web site. Categorisation is an important product which has already been found useful, for example, by the BBC2 campaign. All these quick looks on the web for days and months are freely

visible to the whole world. This was considered to be good publicity. (but see item X>X on data policy). The categorisation program has been much modified over the past few weeks. Apart from radar and lidar backscatter profiles it needs rainfall information (to flag radome attenuation difficulties with the cloud radar) and liquid water path from radiometers (to flag and correct 94GHz attenuation which is located where the lidar signal is a max). RJH showed some comparisons of raingauge data with alternative criteria using Z >0dBZ at 250m or Doppler >3m/s. RJH also showed quicklooks of IWC produced from a simple IWC = f(Z,T) algorithms together with an error estimate either derived from the uncertainty of this algorithm of due to the uncertainty in the attenuation derived from LWP.
ACTION 1.9 The SIRTA data has been categorised and is on the web using Z at 250m as a proxy for rain at the ground but the errors are large as there is no radiometer LWP date. Action MH/AP analyses existing radiometer data when calibrated and place on web as soon as possible so that an improved categorisation etc can proceed. Radiometer calibration should take place in December 03.
ACTION 1.10 The current 94GHz correction scheme uses T+6 to T+11 humidity data from the MO mesoscale model at all three sites. Need to see if there are any significant difference in using humidity from other models – ACTION NG/EJO.
ACTION 1.10. The categorisation scheme needs rainfall rate but this is not available at SIRTA., ACTION NG/RJH to further explore inferring rainfall from the radar using Doppler rather than Z due to calibration problems.
ACTION 1.11. The SIRTA site to compute the fluctuations of the mean Doppler ('sigma v bar') and put the data on the sire. ACTION DHB.
ACTION 1.12. Look at the noisy 'fringing' of Doppler width which occurs at low signal to noise. ACTION AP/MH/DHB.
ACTION 1.13 SIRTA to clean up the speckle on the lidar product so that it can be used for categorisation.
ACTION 1.14. RAL to post process their radiometer data including lens correction to provide more continuous LWP data to aid the interpretation of IWC in ice clouds. NG to try out his new algorithm using model humidity and temperature as a first guess rather than climatology. Action CLW via JG, NG.
ACTION 1.15 EOC to arrange to run the categorisation code when the data arrives on the web site.
ACTION 1.16. EOC to arrange to archive model fluxes. (See also action 3.1 for qr).

2. FIRST RESULTS OF ALGORITHM IMPLEMENTATION AND COMPARISONS WITH MODELS. I.

2.1 MB – Presented results of comparing the cloud fraction at the two sites with the three models as a function of height. The change in the MeteoFrance cloud scheme on 11April03 was clearly visible. The old scheme produced lots of cloud with a cover of 0.2, the new scheme produced most cloud with a fraction cover of 1. The MeteoFrance pdf for a cloud cover of 1 was now much closer to observations. Results for a year ('99-00) at Chilbolton of IWC and cloud fraction were also presented together with a regime classification using up/down drafts at 30 and 700mb and surface (100-900mb) stability.

ACTION 2.1 MB to consider looking at pdfs of iwc and different heights.
ACTION 2.2 MB to consider the effect of removing iwc below radar sensitivity from the model output before doing the comparison.

ACTION 2.3 For ACTION 2.2 MB needs Z sensitivity at 1km. NG, HKB and AP to supply this calibration.

2.2 HR presented some comparisons of radar data in BBC or stratocumulus which had a reasonable LWP from radiometers but very low values of Z. This implies a high value of drop concentration, N, in the clouds. However a penetrating aircraft recorded a lower concentration of larger droplets. He suggested that the values of Z recorded by the Miracle (GKSS) radar and the KNMI 35GHz were 13dB too low, although extensive cross calibration suggests that they are correct.
ACTION 2.4 HR to establish precisely what is the problem. Meetings are planned with GKSS et al within the next six weeks.

3. SCIENTIFIC TALKS – INTERLUDE.

3.1.Jean Louis Brenguier (meteo-france) presented analysis of aircraft observations with the aim of parameterising stratocumulus in climate models. The clouds and their evolution and drizzle production must be parameterised in terms of cloud depth, cloud liquid water content and droplet concentration N (which is available from climate models because they advect aerosols).
ACTION 3.1 The values of qr (rainfall water content) from the models to be archived so that the model drizzle production in stratocumulus can be compared with observations. ACTION EOC to organise.

3.2.Frank Roux (U of Touloue, Lab Aerologie) presented plans to compare the meso-nh high resolution model cloud physics and dynamics with those observed from new radar instruments to be installed at Lannemezan. The meso-nh high resolution model is initiated with data from the Meteo-France arpege model. CloudNET participants suggested that as a first step meso-nh could be run over some of the cloud-net sites and the cloud net data could provide some validation of meso-nh.

3.3.Anne Mathieu described comparison of observed boundary layer cloud base height in BBC1 with those computed from the Meteofrance arpege model were wrong, with the forecast model often much too low. The error can be 1km! It is as if the model has a lower layer which is much too moist.
ACTION 3.2. AM to look at this effect with other models and other sites using the extensive data set already on the web.

4. FIRST RESULTS OF ALGORITHM IMPLEMENTATION AND COMPARISONS WITH MODELS. II.

4.1 DD presented resuls of retrieving iwc and reff from lidar and radar at Cabauw and Chilbolton and how it compared with the work he has published for ARM SGP. He produced graphs of attenuation and iwc versus Z and T. Also work correlating reff with distance from cloud top.
ACTION 4.1. DD to write up the correlation of reff with depth from cloud top as a breakthrough for the next annual report.

4.2 DB presented a summary of recent work at SIRTA. A) Errors in the computation of Doppler width have been identified and will be corrected (see action 5.3) B) Plots of Doppler V agains Z were displayed. It was suggested that their spread around a best fit was an indication of up and down draft rather than changes in ice particle size for a given Z. c) Further work on ice spectra and correlation of Z/No* against alpha for Rayleigh and Mie scattering were shown. On going work exploring i) radar/lidar retrievals ii) Doppler V versus Z for various cloud types and iii) First comparisons of in-cloud vertical air velocity PDFs in ice clouds as produced by the models and by the radar estimates averaged at the grid box size of each model were shown. All models are far from the in-cloud variability of w derived from the radar. iv) 2D cross sections of terminal fall speed and vertical air velocity as well as their standard deviations averaged at the scale of the four models were presented.

The importance of calibrating the 94GHZ RASTA cloud radar was stressed (see sec 5).

4.3 NG presented computations of the affect of radar noise levels on deriving lwc profiles from 94/35GHZ differential attenuation . LWC should be a product at Chilbolton once the present 35GHZ is connected to its larger antenaa scheduled for Nov 2003.

5.OVERVIEW OF INSTRUMENTATION, DATA GATHERING AND CALIBRATION ISSUES.

5.1Radar and Lidar calibration at the three sites.

5.1.1 Chilbolton. JWFG reported that 94GHZ with the new tube has operated continuously since April 03. NG had carried out an approximate calibration from rain with an assumed radome attenuation. The cradle for tipping the radar and the canopy should be ready during November. Then the rain calibration technique can be tried. In addition comparisons with the 3GHz values of Z in ice clouds could give an independent 'absolute' calibration. SIRTA. The CT75 ceilometer is calibrated by EOC using the integrated backscatter in stratocumulus clouds.

5.1.2 SIRTA. The LNA operates 5 days a week and 10/12 hours a day if there is no precipitation.

ACTION 5.1a MH to calibrate the backscatter using molecular backscatter for useful periods when the ice cloud is visible. This data to be converted to netCDF with an indication of which time periods have been calibrated. MH to supply data for web site to EOC.

Monitoring of the RASTA power shows it has changed by less than 1dB in the past few months. A comparative calibration using the 94GHz Galileo at Chilbolton was deemed to be desirable.

ACTION 5.1b. AJI/AP/DB. The RASTA radar to be transported to Chilbolton and run along side the calibrated Galileo radar for a couple of days. On the return trip RASTA to be fun for a day or so next to the 35GHz cloud radar at Cabauw for cross-calibration. Before this occurs the calibration of the Galileo radar at Chilbolton to be confirmed. A date in December seems most probable.

5.2 Chilbolton Issues.

JWFG showed more observations on the performance of various rain sensors with respect to sensing when the 94GHz radome might be wet. The tipping bucket was no use because it needs 0.2mm to tip, the drop counter had a lag of 2-5 mins, The Vaisala DRD11A (cost 740Euro) and the Sontay WD-RS (cost 170 Euro, but build your own interface) capacitative rain sensor performance was compared. The Vaisala was the most sensitive.
ACTION 5.2 JWFG to look at 94GHz radar for 1 October (examined above) to see how if it agrees with the capacitative output and can be used as a simple proxy – using either the value of Z of the Doppler.
ACTION 5.3 HKB to compare TARA and 35GHz sensitivity after rain to see if there is evidence that on a damp winter's day the radome can remain wet for some time after rain has ceased.

5.3 SIRTA Issues
Action 5.4 DBH to change the Doppler width algorithms so that it works OK with low signal to noise data and remove noisy data from existing data set on the web. Inform EOC when completed.
Action 5.5 MH/AP to restore the September 03 data on the web site, using nearest neighbour algorithms to remove speckle from the LIDAR signal. Inform EOC when completed.
ACTION 5.6 AP/MH to calibrated the DRAKKAR 23 and 32 GHz radiometer in December, then the data gathered since Jul 02 can be converted to LWP. Inform EOC when completed, so that categorisation code can be run.

5.4 Cabauw issues.
The GPS integrated water vapour has not yet been analysed.
The two channel radiometer is expected soon from ESA
There have been some difficulties with the MICCY radiometer data flow.
A report on the BBC-2 campaign was given. Disagreement of the vertical velocities between TARA and the 35GHz radar may be because on e of the radars is not quite vertical.
HR reported that since May 03 the TARA 3GHz data has had a Blackman-Harris window applied, this minimises range sidelobes but reduces the range resolution from 60 to 30m.
ACTION 5.7. HR to reprocess this data clean up the noise background at low altitude and convert to netCDF and place on web site.
ACTION 5.8. HR to look at dual wavelength TARA and 35GHZ algorithms for deriving lwc from the attenuation and deriving the size of large ice particles.

6. OTHER INSTRUMENTATAL ISSUES – RECOMMENDED OBSERVING SYSTEM.

6.1 DD and JP reported on deriving water droplet size from the variable field of view lidar. JP showed several hours data and reported that the smaller field of view had lower return higher in the cloud as expected from the multiple scattering theory, but had a higher return from near cloud base. One suggestion was that this is specular reflection, but this seems unlikely as the lidars were operated off zenith. There may be also a problem that the lidars are not precisely aligned and also not operating within their linear range.

ACTION 6.1 DD and JP look at exiting data and check linearity and alighnment. Gather more data to see if this backscatter ratio is more consistent.

6.2 and 6.3 still awaiting student at SIRTA to look at zenith v off zenith lidar returns.

6.4 DD reported on comparisons of returns from the LD40 at zenith and 1 and 3 deg off zenith. Because of the low sensitivity of the LD40 the results were inconclusive.

6.5 ACTION 6.1 EOC will report on the use of the background light level of the CT75 at the next meeting.

6.6 NG radome attenuation dealt with in item 4.1.2.
6.7 Data quality for radiometers. DD reported that CLIWAnet was reporting errors in derived LWP of 20g/m^2. The limit was now due to unknown physics /ill defined coefficients for the absorption lines.

6.8 CLW reported from Chilbolton that errors from the dual frequency system were now about +/- 25g/m^2 and LWP was truly zero in clear sky conditions. A weekly calibration was needed.

6.9 MH described a water vapour retrieval field programme planned for may-june 04 at SIRTA involving GPS, radiometers and Raman lidar to be compared with satellite such as polder and SSMI.

6.10 NG reported some encouraging results using the model values of water vapour and temperature rather than climatological values when retrieving lwp from radiometers. ACTION 6.3 NG to implement (same as action 1.14 for NG).

6.11 There was a brief discussion on the likely recommendation for a simple cloud observing system which raised the following issues:
a) Is 35GHz best from the ground because of lower attenuation and more mature technology?
b)What is the most reliable lidar system which can operate unattended? Currently we only have ceilometers that meet this specification. We need to find a lidar system which can be left to operate unattended.
c) At 35GHz is it really necessary to have lwp from radiometers to correct for attenuation?

7. MODEL DEVELOPMENTS.

DW reported some small changes to the data assimilation scheme in the MO code: 4 Dec 02 and March 03 small changes in treatment of moisture which may affect low level cloud.

JMP confirmed that in April a new cloud scheme had been introduced in to the Meteo-France model based on Xu and Randall 96 to increase the low level cloud the aim being to produce better cyclogenesis. Remember the scheme does not have a prognostic cloud variable. See analysis of MB in 2.1.

There were no significant developments to report for the other models.

8. WRAP UP SESSION.

8.1 Errors and formats were discussed. It was agreed to use the error and bias format currently on the web developed by RJH for IWC as a template.
ACTION 8.1 All to report to RJH their experience with this.

8.2 Version number of products. It was agreed that in principle if an algorithm is changes then a new data set should be produced and placed on the web with a new versions number. However, currently algorithms are changing rapidly so there is little to be gained with producing new duplicate data sets when the original is known to be worthless.
ACTION 8.2 RJH/EOC to email members with thoughts on how to implement this.

8.3 New data sets needed to be incorporated in the site were discussed. It was agreed that it would be useful to incorporate the local sonde ascents in the data set.
ACTION 8.3 JMP to look into acquiring Trappe ascents and placing on the web. HKB to do the same for de Bilt and EOC for Larkhill.. In view of MO sensitivities the Larkhill data should not be made public but be password protected.

8.4 Data policy.
It was decided that all data (as opposed to quickooks) should be private to the members of CloudNET until the project finishes when it would be opened to the public. Any specific requests for access to data from known and close collaborators will be considered individually on their merits.
ACTION 8.4 AJI/NG to circulate statement to be put on the web site for approval.

8.5 Future work.
A detailed discussion took place on how to derive iwc and lwc from the data sets A two stage process was decided. So for IWC;
a) ACTION 8.5 DD/DBH (to be completed by Jan 04) to use classification scheme to identify regions where there was both radar and lidar for ice clouds and to produce accurate iwc, particle size with errors for these regions. A cursory look at the classification data suggested that such regions were not common as most ice cloud coincided with low level cloud which the lidar could not penetrate. It was decided that alpha (attenuation) should be a product from these algorithms.
b) ACTION 8.6. KNMI to try out the Matrosov (used operationally in ARM) method using Z and V for better IWC for various case studies and compare with a) above.
c) ACTION 8.7 NG would do the same with the dual wavelength radar available which should soon be available from Chilbolton.
d) These retrievals would then be compared with those from the IWC = f(Z,T) product to evaluate its accuracy and see if it was possible to develop a Z algorithm which was a function of the height with respect to cloud top/base.

And for LWC we have the differential attenuation and the Frisch/TUD method:
e) ACTION 8.8. When the dual wavelength data is available NG to produce lwc profiles and see if they are consistent with the lwp from the radiometers.

f) ACTION 8.9 DD to produce lwc profiles/lwp from the TUD method and compare with the dual wavelength values.

The table for the division of responsibilities was modified and posted on the web along with this report. Note that bias and error estimates are to be included in all products. In addition the radiation computations and comparisons with surface fluxes by IPSL and KNMI identified in the previous minutes (9.5b) ar
ACTION 8.10 IPSL/KNMI to try this out on case studies for the next meeting.

9. ANY OTHER BUSINESS. There was none.

10. Date of next meeting.
Monday 19 - Tuesday 20 April 2003 starting at 9am at the Met Office, Exeter.