

WMO Dobson Ad-Hoc Committee Meeting 30-31 July 2003

MeteoSwiss Arosa, Switzerland.

Participants:

R.D. Evans	(Chairman), NOAA-CMDL/WDCC Boulder, Colorado
U. Koehler	RDCC-E, Hohenpeissenberg
M. Proffitt	WMO/ENV, GAW Geneva
J. Staehelin	ETH Zurich
R. Stubi	MeteoSwiss, Observatory Payerne/Arosa
K. Vaníček	GAW/SAG-Ozone, CHMI Hradec Kralove
P. Viatte	MeteoSwiss, Observatory Payerne/Arosa

Guests:

I. Petropavlovkich	NOAA, Boulder, Colorado
E. Maillard	MeteoSwiss, Observatory Payerne
F. De Nile	Observatory Sestola
M. Stanek	SHMI, Observatory Hradec Kralove

This report follows in general the agenda of the meeting and the comments of the participants.

1. Recent intercomparison campaigns

After the last meeting of DAHC held in Hradec Králové, Czech Republic, May 2001 the following WMO Dobson Intercomparisons (IC) were held and documented:

- Lauder New Zealand (2002 – Draft Report)
- Tsukuba, Japan (2003 – Draft Report),
- Hohenpeissenberg (2001, 2002, 2003)

Note: The intercomparison in Japan, March 2003 had only two instruments (China) participating. The previous intercomparisons in Asia (Region II) were in 1996, and the calibrations in that region are well behind schedule. A discussion was made of the geographical and political problems in the region. A note to the effect that the calibration schedule in that region is well behind schedule will be made given to the WMO via the SAG-ozone.)

2. Upcoming intercomparison campaigns

Buenos Aires, Argentina, November 2003

The Argentine meteorological service will host the IC with support from the WMO. Arrangements of this IC are almost finished.

Instruments: Argentina, Brazil, Peru, Uruguay, and possibly Cuba

Reference: D065 as support from NOAA/CMDL plus personnel.

Hurghada, Egypt, 2004

The Egyptian Met Authority is making plans to host the IC, with support from the WMO. Arrangements have not been completed yet. With respect to the Egyptian IC, the committee had these concerns and requests: (to be given as a recommendation to the WMO via the SAG-Ozone)

- That customs problems noted in past transportation of instruments into Egypt be solved before the IC
- That South Africa has a high profile participation in the IC – more than just an instrument and operator.
- That the European RDCC-E participates in the IC with their expertise and equipment. This is also an opportunity for a cross check of the calibration of the D064 versus the D065 (US) instrument.
- An assistance of experts from the Czech Hydrometeorological Institute (CHMI) to this campaign in the framework of a Czech governmental project and in cooperation within RDCC-E is highly desirable.

Instruments: Algeria, Egypt (3), Kenya, Nigeria, South Africa, Germany and Seychelles plus a possible instrument for the proposed Cape Verde Islands.

Reference: D065 as support from NOAA/CMDL plus personnel.

Hohenpeissenberg, Germany 2004

A regular yearly of IC's are scheduled and organized by RDCC-E and supported by the German Meteorological Service and the Czech Hydrometeorological Institute

Instruments: Three instruments from the United Kingdom, others to be defined

Reference: D064 MOHp/RDCC-E

Current state of a possible WMO (or UNEP?) trust fund, to provide financial support for such activities. Mike Proffitt reported three sources of funding for IC's of varying reliability. Buenos Aires is fully funded for total number of 8 instruments. Other sources of funds will support the Egyptian IC. This latter was verified after the Ad-Hoc Meeting.

3. Stations with instrument problems, or problematic data records.

- **Seychelles and Kenya** Instruments from the Seychelles and Kenya are expected to be repaired at the planned Egyptian IC in 2004. The Seychelles instrument had mechanical problems after the South African IC in 2000, and was repaired by local authorities. The repair was not verified by more experienced people. The University of Kenya operates D018, which failed electrically in 2001. The University personnel have not been cooperative with efforts to fix the instrument. The ozone values from this represent a very important long-term data series of GAW and the instrument is used to support the Mount Kenya GAW facility's ozonesonde program. Great concern was expressed that the University would not continue regular measurement program even after the instrument is repaired and re-calibrated. The decision was made to repair and re-calibrate the instrument, and evaluate the measurement frequency and quality after the intercomparison. If the measurement record were not maintained, another Kenyan organization would

- be given the charge and support to make the observations with another instrument. (This recommendation will be made to the WMO via the SAG-Ozone.)
- **Indian Stations** In the WMO report No. 45, the Indian authorities state that the D112 is used to calibrate their station instruments. D112 was last calibrated in the GAW network in 1996. No report of the intercomparison of the station instruments has been made available to the scientific community for the evaluation of the data from these stations. A report of intercomparisons – the dates, the calibration levels, the evaluations of the past data, etc – should be requested by the WMO. (This recommendation will be made to the WMO via the SAG-Ozone.)
 - **Unused instruments. (D015, D067, D102, Shimadzu)**
 - D015 is being held in South Africa for eventual use in a future GAW station in Botswana, the building of which is about four years behind schedule. It is suggested to WMO via the SAG-Ozone to keep D015 in South Africa and to allow South African Weather Bureau to use D015 in its field operations. GAW will assist the maintenance and the operation of the instrument. (Information received after DAHC meeting indicates the Botswana station may be closer to completion than originally reported.)
 - D067 is being held in Boulder NOAA/CMDL facilities. It is functional and operational. In reference to a suggestion by WMO it is recommended to install D067 at the Cuban ozone monitoring station as an eventual replacement of the existing but less precise and less reliable M-124 filter instruments – after an appropriate time for evaluation of how to minimize the effect of the replacement. The DAHC agrees, and the instrument should go to the Buenos Aires intercomparison 2003 to meet the new operators.
 - The Meteorological Service of Canada has donated D102 to the WMO. The instrument has been electrically renovated with funds provided by NASA. At the moment, it is in Goddard Space Flight Center to have the slit functions measured. Once that project is complete (2004), the instrument will be available to the WMO. This instrument was used at 50 degrees north in western Canada and is a candidate for the proposed high latitude station in Russia.
 - The Shimadzu instrument is also in Boulder NOAA/ CMDL facilities. It is operational, but with unsatisfactory observational results. The instrument will be available after the problem is solved.
 - **Possible new observing stations and unused instruments.** Mike Proffitt announced the application of the Meteorological Service of the Cape Verde Islands for the installation of an ozone monitoring station on their main island. As this organization has the support of the Portuguese Meteorological Service, which has experience with operation of both Dobson and Brewer instruments, DAHC strongly supports this project and will assist in finding an appropriate instrument to be installed in this region without ground-based measurements. At this point it

was noted that several nations in Europe were no longer operating Dobson instruments at various site (Norway, Hungary, Italy, and the UK were mentioned) The committee supports efforts to persuade the organizations with unused the instruments to donate the spectrophotometers to sites selected via the WMO and ozone data users. The DAHC members will assist the WMO to define the requirements of such stations. The WMO should contact the nations with unused Dobson instruments requesting donation of such instruments for the WMO's use. (This recommendation will be made to the WMO via the SAG-Ozone.)

- **Stations requiring training in the operation of an observing program.** In 2002 operators of Dobson spectrophotometers from Brazil and Uruguay completed the training given by the Czech Hydrometeorological Institute (CHMI). In 2003 operators from Peru and Pakistan are to be trained by CHMI. The training programme is supported by CHMI and by WMO. If the Czech Government approves a project for assistance to ozone monitoring stations in developing countries proposed by CHMI in 2003; the Czech support of training activities will continue at least in 2004-2006. The future trainees will be selected operationally by DAHC in cooperation with GAW, as was done in the past.

4. Replacement of Dobson instruments at stations with long-term measurement programs with other instruments.

The reliability of ground-based measurements is well defined by the long history of the primary instruments and calibration procedures documented for Dobson and Brewer spectrophotometers. The committee does not recommend a replacement of either type of instrument by new instrumentation. The more modern instruments with more capabilities should be used to enhance the measurements at an existing station with a long-term record. If the situation requires the replacement of the older instrument, the replacement should only be done after the long-term stability and reliability of the newer instrument is proven. The recommendations in WMO Report No. 149 should be followed if replacement absolutely necessary. (This recommendation will be made to the WMO via the SAG-Ozone.)

5. Future developments in general relating to Dobson operations.

- **PC-based program for Umkehr Processing and reduction.** The time lag between the Umkehr observations taken at a station and the production of the ozone vertical profile is detrimental to the enthusiasm of the operators. An integrated software package that allows the viewing of the resultant profile shortly after the observations are completed would be very useful. Such a package would also be helpful in standardizing the data management of the Umkehr data. The Japanese observing program has such a package. An extension of the Czech DOBSON software package developed and distributed by CHMI, used at many GAW stations was suggested. This would be a subject of the CHMI project mentioned in the training section above if the project is approved in 2004. Once a standardized program is developed, the WMO should organize workshops for Umkehr data management to support Umkehr monitoring programme under GAW. (This recommendation will be made to the WMO via the SAG-Ozone.)

- **New Umkehr REVUE algorithm.** The latest algorithm for the reduction of the Umkehr measurements and calculation of ozone profiles was used in the REVUE project. The Committee recommends to the WMO via the SAG-ozone that the REVUE algorithm should be adopted as the official reduction process for the WOUDC database of profiles from Umkehr measurements.
- **Umkehr intercomparison.** There is now a history of Umkehr intercomparisons between multiple instruments at WMO sponsored intercalibrations but this is not well documented. As an aid to the standardization of the Umkehr measurement process and reduction, the Committee requested several participants (Bob Evans and Irina Petropavlovkich (NOAA); Eliane Maillard and Rene Stubi (MeteoSwiss)) to produce a WMO report documenting the past intercomparisons, to be submitted to the WMO no later than the end of 2004. (This project will be noted to the WMO via the SAG-Ozone.)
- **Expansion of Umkehr observations.** The usefulness of the Umkehr observations is in the analysis of long time scale atmospheric changes, and in the verification of results from other instruments such as satellite, lidar, and other profile measurements. The value of an expanded Umkehr observing network will be immediately evident in the later function.

6. **Cooperation between Dobson and Brewer Ad Hoc Committees.**

- **Investigation of consistency of Dobson and Brewer data series from collocated stations.** Recent analyses have shown (see WMO/GAW Report No. 149) the Dobson and Brewer total ozone observations are not fully consistent. This inconsistency could introduce shifts into long-term trends or effect the validation of satellite measurements if not handled correctly. Therefore, investigation of simultaneous Dobson and Brewer data series, mainly from collocated stations, has the highest priority in cooperation between Dobson and Brewer community. (This recommendation will be made to the WMO via the SAG-Ozone.)
- **Comparison of the references for the Dobson and Brewer instruments.** With consideration of the above concern, some investigation in to the possibility that calibration scheme for both the Brewer and Dobson instrument is attributing to differences found in the stations records. Other possible causes for the differences include certain assumptions in the reduction of either instrument's measurement to total ozone values. Regular comparisons of the secondary standard Dobson and Brewer spectrophotometers under GAW are recommended to cross-check accuracy of transference of the calibration scales from the world standards into the field stations. The optimal validation of calibration constants of the primary references is by the absolute Langley plot technique – this also could be done with two separate Dobson and Brewer instruments used a single station. Each instrument would be checked for correct optical characteristics, and then taken to an appropriate place for the Langley plot series for calibration. The calibration difference then can be evaluated at that site, and compared to the differences found at the home station on the long term.
- **Joint Brewer/Dobson workshops.** To achieve a better co-operation between the Dobson and Brewer community and to improve function of both networks under GAW the DAHC and BAHC should organize joint workshops scheduled like e.g.

the current Brewer workshops. The workshop could be accompanied by training campaigns for new or inexperienced operators of both types of instruments. A schedule for the upcoming actions can be drafted at a joint DAHC and BAHC meeting suggested during the Ozone Symposium 2004. (This recommendation will be made to the WMO via the SAG-Ozone.)

7. **Updating of the Dobson Standard Operation Procedures – SOPs.** This topic is a task described in the Strategy for Implementation GAW 2001-2007 (WMO report No. 142). The Committee decided to take on this task update the original Dobson SOPs developed by W. Komhyr and published as the WMO Report No. 6 in 1980. Members of DAHC and other related Dobson experts will review the electronic version of the Report No. 6 and submit their recommendations for changes and updates via email. Then a draft of new SOPs will be prepared using a special web page installed by NOAA/CMDL. The document will be ready for publication by the end of 2004. (This project will be noted to the WMO via the SAG-Ozone.)

Recommendations for the SAG-Ozone

- 1) **Regarding Intercomparisons and calibrations**, the DAHC recommends and notes that:
 - a) The calibration schedule for the instruments in the WMO Region II is not being maintained.
 - b) The IC in Hurghada, Egypt, early 2004, has for the committee these concerns:
 - i) The past history of Customs clearance problems needs to be considered.
 - ii) The South African Weather Bureau has a “high profile” in the IC.
 - iii) Considering the number of instruments participating, the RDCC-E – German and Czech experts – should also assist in the IC. The RDCC-E standard should also attend as a check on that instrument’s calibration.
- 2) **Regarding stations with known or suspected instrument problems**, the DAHC recommends and notes:
 - a) If the total ozone record of the instrument at the University of Kenya cannot be maintained and thus the ozonesonde flights at the Mount Kenya GAW station are not supported, another organization in Kenya should be identified and charged with the responsibility. The WMO would then supply that organization with an instrument and training.
 - b) The calibration history of the instruments in the Indian network has not been published. The WMO is asked to request a comprehensive (dates, calibration levels, reprocessing of back data, etc) report of the transference of the calibrations of the national standard to the station instruments as an assistance of the data users.
- 3) **Regarding the replacement of Dobson (or Brewer) instruments at stations with long-term measurement records with other, newer instruments**; the DAHC recommends no replacement – at least not without a thorough study of the effects to the data record. The recommendations described in the WMO/GAW Report No.149 should be followed if replacement is absolutely necessary.
- 4) **Regarding possible new stations and unused instruments**, the DAHC recommends and notes:
 - a) The WMO suggestion to supply D067 to the Cuba ozone monitoring station to eventual replaced of the less reliable and less precise M124 filter instrument current used by that station is supported.
 - b) The proposed station in the Cape Verde Islands is supported, and the DAHC will assist in finding an instrument for that station.
 - c) The WMO should actively pursue unused Dobson instruments to be placed in stations in regions with under-represented ground based total ozone measurements.
- 5) **Regarding Umkehr observations made with the Dobson instrument**, the DAHC recommends and notes:
 - a) That WMO support the development of a PC-based data management program for Umkehr observations.

- b) That the WMO organize data management training workshops for this program.
 - c) The REVUE algorithm should be adopted as the official reduction process for the WOUDC database of profiles from Umkehr measurements
 - d) That several participants in the DAHC will produce and submit to the WMO a report of the history of intercomparison Umkehr measurements, by the end of 2004.
- 6) **Regarding the cooperation between Dobson and Brewer Ad Hoc Committees**, the DAHC recommends
- a) That the WMO encourage the organizations that operate Dobson and Brewer instruments at the same stations publish a comprehensive comparative history of the measurements to evaluate possible calibration level differences.
 - b) That the WMO organize joint workshops on Dobson and Brewer issues.
- 7) **The committee notes that its members have started the task to update the WMO Report No. 6**, which serves as the Standard Operating Procedures for the Dobson instruments and observing programs.

Copies:

Participants

DAHC members

GAW SAG-Ozone (members)

GAW - BAHC (Chairman)