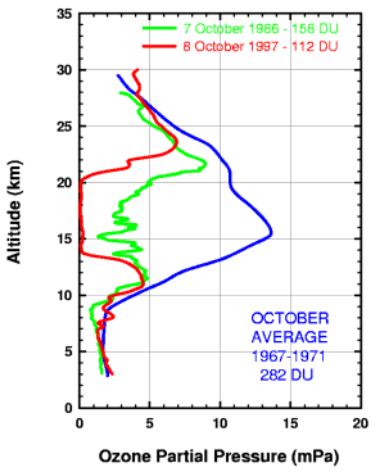
NETWORK FOR THE
DETECTION OF
STRATOSPHERIC CHANGE



The ozonesonde working group

Report to the NDSC Steering Committee

Île de la Réunion, December 1998

Geir O. Braathen, NILU

NILU

Introduction

This report summarises the ozonesonde activities carried out at the various NDSC ozonesonde stations. This document is also available in electroic form from NILU's anonymous ftp server at:

ftp://ftp.nilu.no/pub/NILU/geir/ndsc-sc

Ozonesonde working group

At present the ozonesonde working group consists of Samuel Oltmans (NOAA) and Geir Braathen (NILU).

Sam Oltmans wants to retire from the ozonesonde WG due to duties in the Dobson-Brewer WG. A new candidate for the position as co-chair of the ozonesonde science team will have to be found. For the Lauder station Greg Bodeker has taken over the responsibility as ozonesonde PI from Andrew Matthews.

The network

The following NDSC stations have been included as ozonesonde stations so far and are supposed to deliver sonde data to the NDSC data base: Ny-Ålesund, Thule, Eureka, Observatoire de Haute Provence, Mauna Loa, Lauder, Dumont d'Urville, McMurdo, South Pole.

At last year's meeting in Ny-Ålesund in August 1997 it was agreed that the ozonesonde WG should contact the PIs of Hohenpeißenberg and Payerne and solicit their applications for NDSC affiliation. This has been done and their applications have been reviewed by Sam Oltmans, Peter von der Gathen and Geir Braathen. The unanimous recommendation is that these two stations be accepted as NDSC sites. The final approval will have to be done by the NDSC steering committee during the meeting at Île de la Réunion in December 1998.

One should consider whether more stations should be included as there are more NDSC stations with ozonesonde facilities either at the site or nearby. These stations are: Aberystwyth, Andøya, Kiruna (sondes are launched during campaigns), Lerwick, Scoresbysund, Sodankylä. In addition, Gardermoen is close to Harestua.

Ozonesonde PI meeting in Potsdam, June/July 1998

The increasing number of ozonesonde stations as well as the tighter cooperation between these stations, through exercises such as SESAME, THESEO, satellite validation and Match, and networks such as NDSC, has given rise to a need for agreement on common practices among the stations. The request from ECMWF to receive ozonesonde data in real time has further increased the need for homogeneity. In order to discuss practical matters pertaining to ozonesonde measurements it was decided to organise a workshop for NDSC ozonesonde PIs. AWI volunteered to host the meeting and it was held in Potsdam from 30 June to 2 July, 1998. The meeting was attended by 38 ozonesonde PIs or co-PIs. Among the topics discussed were:

- Pre-flight preparation practices
- Conversion of raw data into geophysical data
- Quality control of sonde data
- Data file format
- Regional WMO centre for Europe
- Provision of sonde data in real time to the GTS
- Intercomparison between ozonesondes and other NDSC instruments
- Ozonesonde intercomparisons and differences between sondes

The draft minutes from the meeting were circulated in July and based on the comments and corrections from the participants the final minutes were distributed in October 1998. This document has been copied and distributed at the NDSC Steering Committee meeting in December 1998. It is also available via anonymous ftp at:

ftp://ftp.nilu.no/pub/NILU/geir/potsdam/minutes_potsdam_final.pdf

It is also available in other formats (ps, rtf etc.).

Station reports

Ny-Ålesund

Submitted by: Hartwig Gernandt

1. Personnel

Scientific personnel: Hartwig Gernandt, Peter von der Gathen, Markus Rex, Astrid Schulz

Station personnel: Bodo Wichura (until March 1998),

Dirk Römermann (since March 1998)

2. Status of the instrument

No change to previous years

3. Technical developments

No change

4. Measurements and data evaluation

The number of launched ECC ozonesondes in 1997 and 1998 is given in Table 1.

Table 1: Number of soundings from Ny-Ålesund

Month	1997	1998
Jan	19	18
Feb	11	14
Mar	13	10
Apr	11	8
May	9	5
Jun	5	4
Jul	5	5
Aug	5	7
Sep	4	5
Oct	5	5
Nov	9	
Dec	9	

In winter 1997/98 AWI coordinated the ozonesonde launches of the stations inside the Arctic polar vortex within the campaign Match 97/98.

5. Data transfer to NDSC data bank

The data of 96 ozonesonde launches have been transferred to the NDSC data

bank (range: July 1997 - June 1998).

6. Participation in meetings and conferences:

4th European Workshop on Stratospheric Ozone, Schliersee, Germany, Sept. 23-26, 1997.

Arctic Ozone Data Workshop, Tokyo, Japan, Dec 3-5, 1997.

NDSC Ozonesonde PI meeting, Potsdam, Germany, June 29 - July 1, 1998. (Organizer)

7. Intercomparison campaigns

Ozone soundings took part in the NAOMI campaign.

8. Scientific highlights

Little chemical ozone destruction at 475 K in the first two months of the year 1998 in the polar vortex. Results from the Match campaigns since 1992 are shown in Figure 1.

The temporal development of the ozone mixing ratio above Ny-Ålesund as a function of potential temperature for the winter 1997-98 is shown in Figure 2.

9. Projects

- EU project OSDOC (Ozone Soundings as a tool for Detecting Ozone Change) included the Match activities 1996/97 and 1997/98.

- BMBF project “Bestimmung des chemischen Ozonverlustes in der Arktis und in mittleren Breiten” is an Annex to OSDOC.

- EU project THESEO-O_3LOSS is the follow up project to OSDOC and includes the Match activities in 1998/99.

- EU project PVC (Polar Vortex Change) includes climatological analysis of ozonesondes data of the past.

10. Planned activities

- Continuation of long term measurement program, i.e. 1 launch per week at least.

- Match 1998/99 (ozonesondes and ozone lidars) in the polar vortex and in mid-latitude, i.e. increased launch frequency during winter.

- New Balloon house in negotiation phase

11. Publications using Ny-Ålesund ozone sounding data

Rex, M., N. R. P. Harris, P. von der Gathen, R. Lehmann, G. O. Braathen, E. Reimer, A. Beck, M. P. Chipperfield, R. Alfier, M. Allaart, F. O’Connor, H. Dier, V. Dorokhov, H. Fast, M. Gil, E. Kyrö, Z. Lityñska, I. S. Mikkelsen, M. G. Molyneux, H. Nakane, J. Notholt, M. Rummukainen, P. Viatte, J. Wenger, Prolonged stratospheric ozone loss in the 1995/96 Arctic winter, Nature, 389, 835-838, 1997.

Rex, M., P. von der Gathen, N. R. P. Harris, D. Lucic, B. M. Knudsen, G. O. Braathen, S. J. Reid, H. De Backer, H. Claude, R. Fabian, H. Fast, M. Gil, E. Kyrö, I. S. Mikkelsen, M. Rummukainen, H. G. Smit, J. Stähelin, C. Varotsos, I. Zaitcev, In-situ Measurements of Stratospheric Ozone Depletion Rates in the Arctic Winter 1991/92: A Lagrangian Approach, J. Geophys. Res., 103, D5, 5843-5853, 1998.

Reid, S. J., M. Rex, P. von der Gathen, I. Fløisand, F. Stordal, G. D. Carver, A. Beck, E. Reimer, R. Krüger-Carstensen,

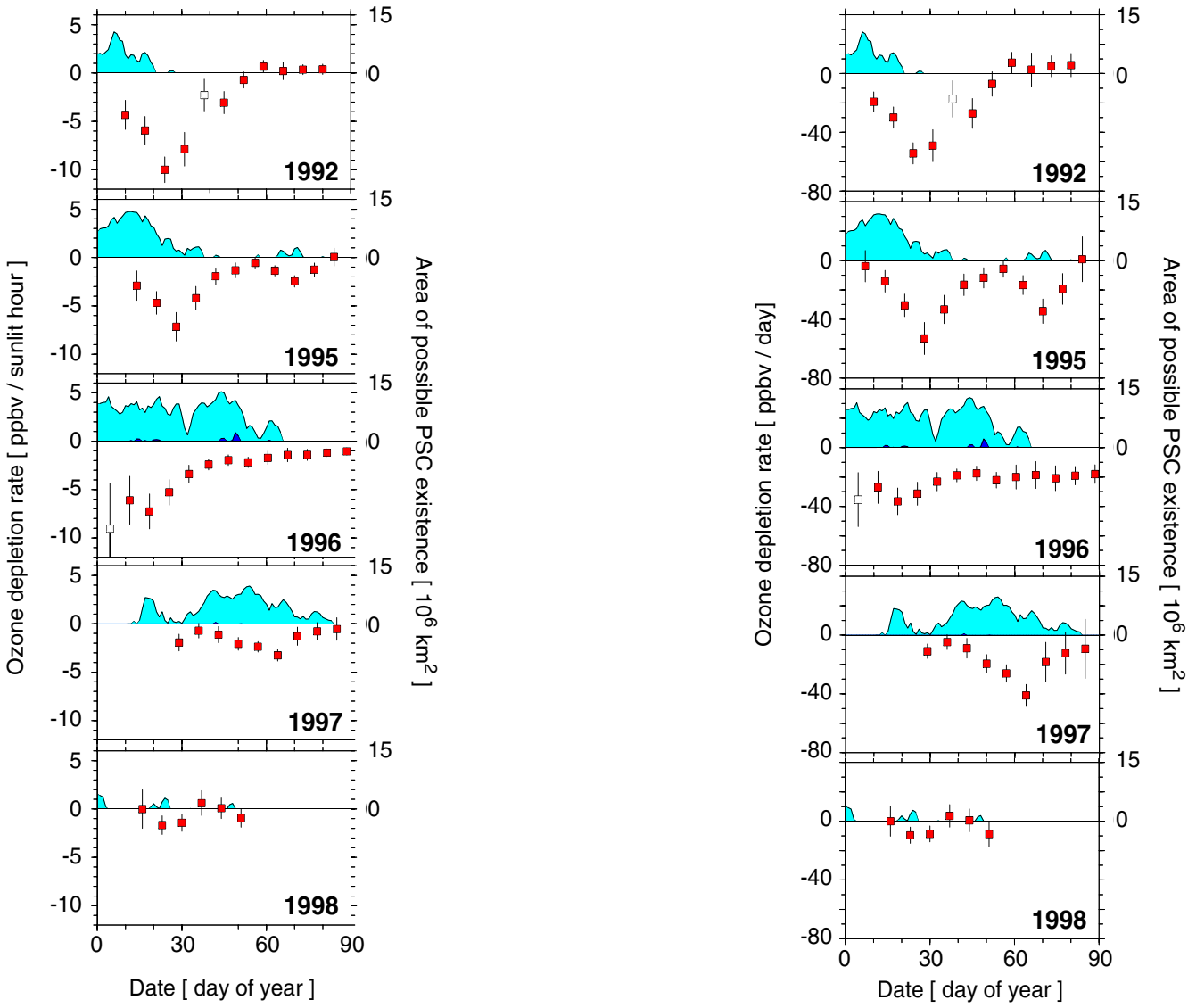


Figure 1. *Ozone loss rates (red squares) at 475 K (approx. 20 km) from the European Match campaigns for the winters 1992, 1995, 1996, 1997 and 1998. The left panel shows the depletion rate in ppbv ozone per sunlit hour. The right panel shows the depletion rate in ppbv ozone per day. The light blue shaded curve shows the geographical area with temperatures below the condensation limit for NAT. These results show clearly the difference between the winters and also the correspondence between low temperatures (or PSC activity) and ozone loss.*

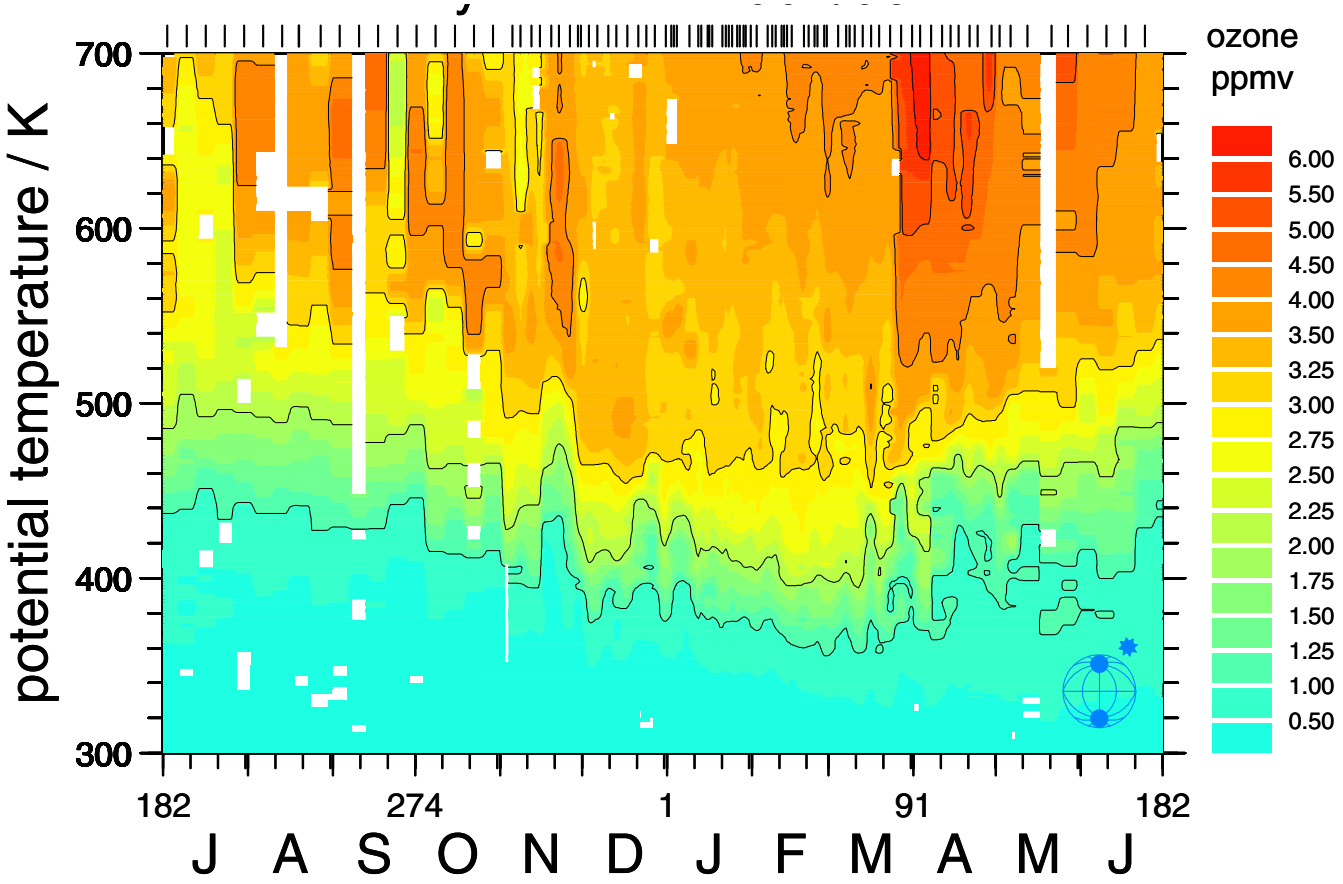


Figure 2. *Ozone mixing ratio (ppmv) over Ny-Ålesund as a function of potential temperature and time during the winter of 1997-98.*

L. L. Haan, G. O. Braathen, V. Dorokhov, H. Fast, E. Kyrö, M. Gil, Z. Lityñska, M. Molyneux, G. Murphy, F. O'Connor, F. Ravegnani, C. Varotsos, J. Wenger, and C. Zerefos, A study of ozone laminae using quasi-isentropic trajectories, contour advection and photochemical trajectory model simulations, J. Atmos. Chem., 30, 187-207, 1998.

Rex, M., P. von der Gathen, G. O. Braathen, S. J. Reid, N. R. P.Harris, M. Chipperfield, E. Reimer, A. Beck, R. Alfier, R. Krüger-Carstensen, H. De Backer, D. Balis, C. Zerefos, F. O'Connor, H. Dier, V. Dorokhov, H. Fast, A. Gamma, M. Gil, E. Kyrö, M. Rummukainen, Z. Lityñska, I. S. Mikkelsen, M. Molyneux, and G. Murphy, Chemical ozone loss in the Arctic winter 1994/95 as determined by the Match technique, J. atmos. Chem., in press.

Becker, G., R. Müller, D. S. McKenna, M. Rex, K. S. Carslaw, Ozone loss rates in the Arctic stratosphere in the winter 1991/92: Model calculations compared with Match results, Geophys. Res. Lett., in press.

Eureka

Submitted by: Hans Fast

This has essentially not changed from the last report. Throughout the year ozonesondes are launched every Wednesday. From December to March, two additional launches per week will be added, on Monday and Friday. The data up to March 1998 is archived on the NDSC facility and more will be added in the near future.

OHP and Dumont d'Urville

Submitted by: Claude Vialle

During the year 1997, OHP, La Réunion and Dumont D'Urville changed the type of ozonesonde to ENSCI type:

- OHP uses 1Z ECC from 1997, March 19th
- Dumont D'Urville uses 1Z ECC from 1997, July 25th

The OHP measurements show clearly better results after this change: the correction factor is close to 1 with a

lower standard deviation.

At Dumont d'Urville, different types of balloons are under test. The preliminary results show that both types Kaysam 2000g or Totex TX1200 rise above 30000m.

Measurement programme Dumont d'Urville 1997:

1 launch a month from January to June

2 launches during July

3 launches during August

4 launches during September

5 launches during October

2 launches during November

1 launch during December

(similar rate in 1998)

Table 2 gives an overview of the number of soundings since 1990.

Table 2: Number of sondes at Dumont d'Urville

Year	ECC/year	Reaching 25 Km
1990	20	9
1991	28	18
1992	40	27
1993	32	22
1994	34	24
1995	25	13
1996	23	12
1997	22	16
1998	> 21	> 15

In Figure 3 are shown two sample soundings from Dumont d'Urville during the austral spring of 1998.

OHP 1997

Standard launches once a week on wednesday at 9-10h UT, some extra launches (PTU only, MATCH and July intercomparison campaign), total 68 launches for 52 O_3 profiles.

OHP 1998

45 launches from January 1st to September 30.

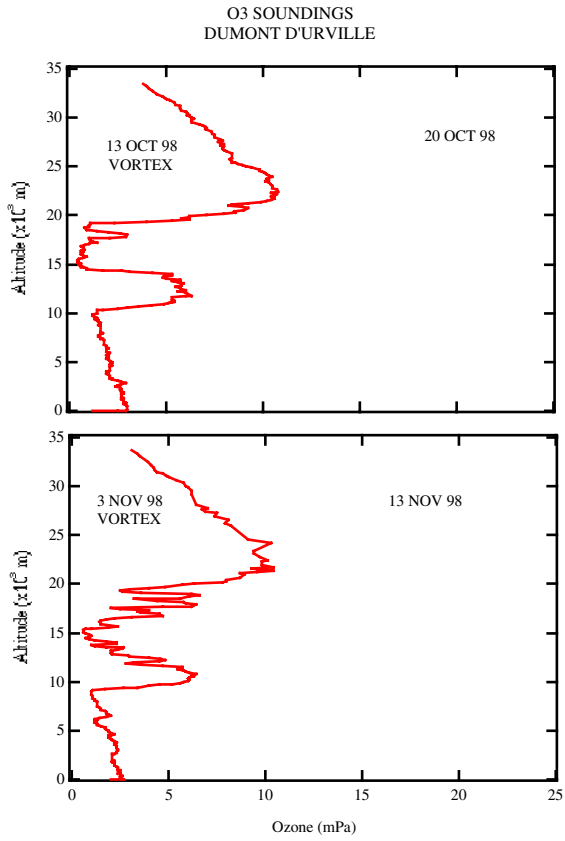


Figure 3. *Two sample ozonesonde profiles from Dumont d'Urville during the austral spring of 1998, taken when the station was inside the polar vortex. Upper panel from 13 October. Lower panel from 3 November.*

Hilo and South Pole

Submitted by: Samuel Oltmans

NOAA/CMDL makes ozone vertical profile measurements using ozonesondes at two locations that are part of NDSC primary stations. The site at Hilo, Hawaii is part of the Mauna Loa/Mauna Kea station and the one at South Pole is part of the Antarctic station. Weekly soundings are made at each of these sites except during the Antarctic spring ozone hole when soundings are done every 3 days at South Pole. These two stations are part of the larger CMDL ozonesonde network which currently consists of the two NDSC sites as well as longer-term programs at Boulder; Trinidad Head, California; and American Samoa. Shorter-term programs currently operate in Tahiti, Fiji, and the Galapagos.

A significant change in procedure was implemented at all of the CMDL sites during 1998 including the NDSC sites. The cathode sensing solution, which is the active ingredient in the ECC sensor was changed from a 1 per-

cent buffered potassium iodide solution to an unbuffered 2 percent solution. At South Pole this change was made in March 1998 and at Hilo in April 1998. Dual soundings using both the old and new solution recipe have been conducted at these sites as well as at Boulder and other sites. This change was necessary in order to get a consistent profile when using larger pump efficiency corrections that we have determined from our laboratory measurements of the pumping efficiency. Data from the period prior to the change were being corrected for the overmeasurement of ozone especially in the portion of the profile above 25 km based on previous laboratory measurements using various sensing solution recipes. Work is nearing completion to determine whether this correction is the optimal one to use for data obtained prior to this change. Since this is not merely a change in the processing algorithm several more comparisons are planned before the data are finalized. Since we are planning to complete this revision in the near future, recent data have not been submitted to the archive. When this is completed a revised data set will be submitted.

Lauder

Submitted by: Greg Bodeker

Ozonesondes were flown weekly from Lauder (45.04˚S, 169.68˚E) during 1998. 1Z series sondes with 0.5% KI cathode solutions were used rather than the usual 1% KI solution following suggestions by the sonde manufacturer and recent tests at Lauder (see Boyd et al., "An assessment of ECC ozonesondes operated using 1% and 0.5% KI cathode solutions at Lauder, New Zealand", GRL, 1998, 2409-2412) which confirmed more accurate measurements using the 0.5% solution. During September 1998, a new GPS based Vaisala Marwin MW12 Ground Receiving system was installed. This allows logging of wind speed and direction and latitude and longitude of the balloon package in addition to the standard vertical profiles of ozone, temperature, pressure and humidity.

During the year detailed comparisons were made between ozonesonde, lidar, microwave, HALOE and SAGE II vertical ozone profiles following work initiated by the SPARC/IOC assessment of trends in ozone profiles. When possible, ozonesonde launch times are adjusted to ensure simultaneity with satellite overpasses. A paper has been accepted for publication in Journal of Geophysical Research which reports on trends in vertical ozone and temperature profiles measured by the Lauder ozonesondes from 1986 to 1996.

McMurdo

Submitted by: Bruno Nardi

Ozone and temperature profiles were measured from McMurdo Station, Antarctica on 26 occasions between late August and late October 1998. Aerosol profiles were measured on 7 occasions between June and October of 1998. Measurements near the minimum in total column ozone, 151 DU in early October are compared to the initial measurement of 255 DU in late August in Figure 4. The minimum total column is comparable to minima observed in the past several years; however the vertical extent of the region of nearly complete ozone destruction, 14-21 km, is more than one kilometre greater than any previous measurements from McMurdo. Here ozone was reduced uniformly to 95%-99% of its initial value. Ozone levels between 16-20 km are striking in that they define new lows for much of the season when compared with values observed since 1986. In contrast, ozone below 12 km was near the maxima in our record. Sulphuric acid aerosol at these altitudes is currently at or below pre-Pinatubo background levels. The temperature between 12-24 km was

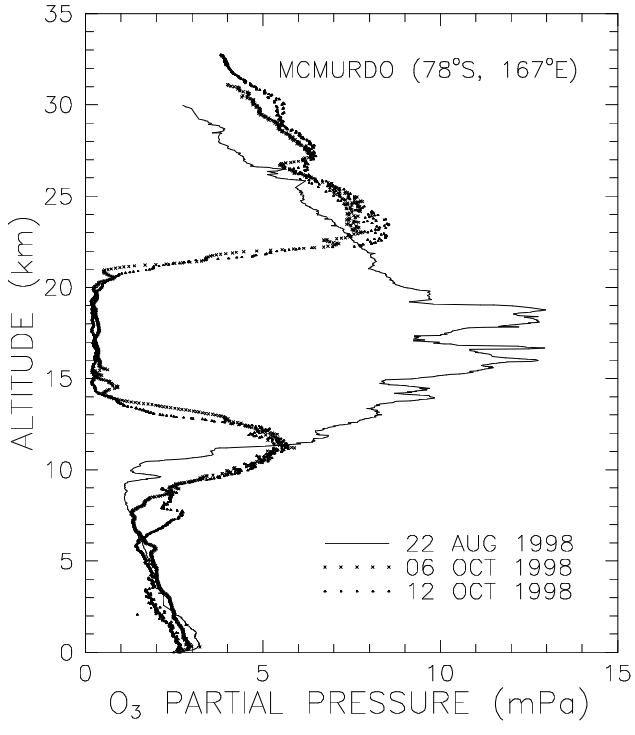


Figure 4. *Ozonesonde observations from the McMurdo station made during the austral winter/spring of 1998. The solid curve represents a sounding made on 22 August before the onset of ozone depletion, and the two dashed curves represent soundings made when the ozone loss was near its maximum on 6 and 12 October, respectively.*

generally cooler than in previous years. Temperatures below -80˚C persisted uninterrupted well into late September, coinciding with an unusually stable polar vortex. Throughout the season minimum temperatures were near, and often below, the record minima since 1986. Both ozonesonde and aerosol measurements are presently designated as NDSC measurements.

Île de la Réunion

Submitted by: Françoise Posny

The soundings are performed currently at La Réunion twice a month with Z ENSCI ozone sondes (0.5% KI cathode solution), TMAX-H interfaces, Vaisala RS80-15 PTU sondes and Kaysam 1200 balloons. The frequency will increase to once a week the 1st of January 1999 in the frame of the SHADOZ campaign.

La Réunion has changed from SPC 5A ozonesondes to Z ENSCI on the 29th of May 1997. The cathode solution was changed from 1.0% KI to 0.5% on the 28th of May 1998. On the figure "sondes.eps" there are two vertical lines which indicate the date of these changes.

Data acquisitions:

- for 1997: 25 launches for 21 profiles 2 in January, 3 in February, 2 in March, 2 in April, 1 in May, 2 in June, 2 in July, 3 in August, 1 in September, 3 in October, 2 in November, 2 in December (one was made the 2nd of December for the NASA SOLSE/LORE experiment),
- for 1998: 33 launches for 33 profiles from January to end of November 3 in January, 1 in February, 0 in March, 3 in April, 2 in May, 2 in June, 13 in July (TRACAS campaign), 1 in August, 2 in September, 3 in October, 3 in November.

Figure 5 shows, since september 1992, all the "measurements" (red triangles) compared with the total O_3 from TOMS or SAOZ (blue middle curve). The two thinner blue curves are TOMS/SAOZ values +or- 20%. "Measurements" means that we have added the O_3 quantity measured by the sondes from 0 to 27 km and the SAGE II data for the part above 27 km.

The code used at La Réunion to retrieve the O_3, PTU profiles is similar to the one used at the OHP station. A comparison between the two codes has been made in May 1998 with two sets of OHP raw data. A good agreement has been found. Figure 6 shows the result for one set of data.

JOSIE-98

Submitted by: Herman Smit

1. Introduction

The state of knowledge regarding long term trends of tropospheric as well as stratospheric ozone is limited due to insufficient global coverage of ozone sounding stations, poor assurance of continuity of data and questionable homogeneity of data (WMO Scientific Assessment of Ozone Depletion, 1995). Particularly, there is an urgent need for improved data quality which must be achieved by intercalibration and intercomparison of existing ozone sonde types as well as agreement on procedures for data processing and analysis (WMO-Report No. 104, 1995). During the fourth WMO meeting of experts on the QA/SACs (Quality Assurance and Science Activity Centres) of the GAW (Global Atmosphere Watch) at Garmisch-Partenkirchen (Germany) in March 1995 (WMO-report No. 104, 1995) it was decided to establish and to designate the environmental simulation chamber at Forschungszentrum Jülich as World Calibration Facility for Ozone Sondes (WCFOS): a facility for quality assurance of ozonesondes used in GAW and GLONET (Global Ozone Network) focusing on ozonesonde precision, accuracy and long term stability. The environmental simulation chamber at the Forschungszentrum Jülich in Germany enables control of pressure, temperature and ozone concentration and can simulate flight conditions of ozone soundings up to an altitude of 35 km. The controlled environment plus the fact that the ozonesonde measurements can be compared to an accurate UV-Photometer as reference (Proffitt et al., 1983, Smit et al. 1994) allows to conduct experiments that are designed to address questions which arose from field intercomparisons.

Tasks Facility

The Jülich Ozone Sonde Intercomparison Experiment (JOSIE, Smit et al., 1998) performed in 1996 was the first GAW-GLONET activity towards implementing a global quality assurance plan for ozone sondes in routine use today around the world. Long term objective is the establishment of a permanent facility for Quality Assurance (QA) of ozonesondes operated in the WMO/GAW-Program. The facility should be assigned with following three major tasks:

I. Quality check of the instrumental performance of different sonde types

II. Test of individual sonde profiling capabilities of different sounding laboratories

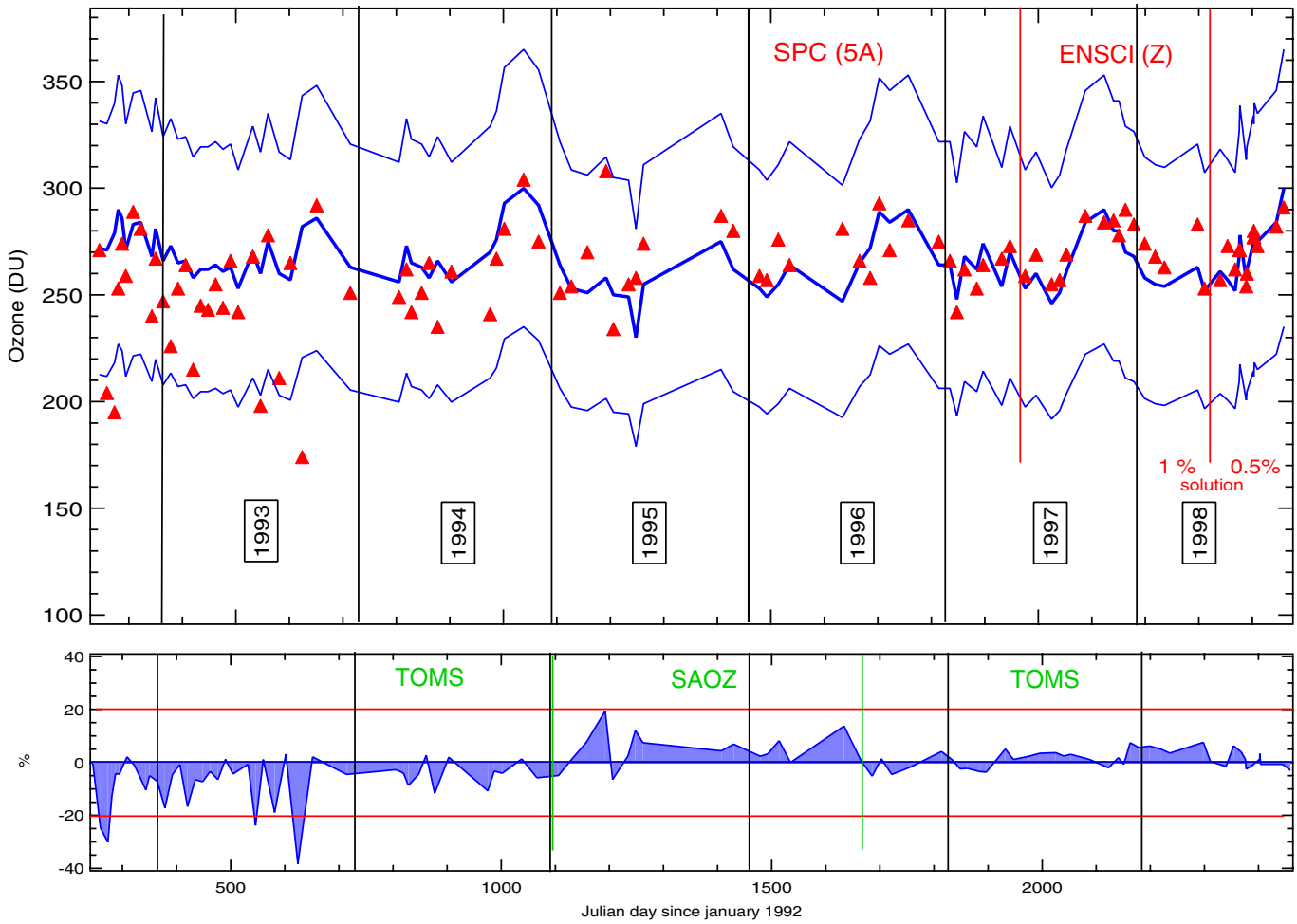


Figure 5. *(Upper panel) Total ozone from ozonesondes (red triangles) and TOMS or SAOZ measurements (middle blue curve) since 1992. The upper and lower blue curves represent the TOMS/SAOZ values ± 20%. Total ozone from sondes have been calculated by integrating the sonde profile from 0-27km and adding data from SAGE II above 27km. The vertical red lines show the change from SPC ECC-5A sondes to ENSCI Z sondes (left line) and the change from 1.0 to 0.5% KI solution (right line) (Lower panel) Difference between total ozone from sondes and from TOMS/SAOZ. The horizontal red lines indicate a difference of ± 20%. The green vertical lines indicate periods where TOMS and SAOZ measurements have been used.*

III. Establishment and up-date of Standard Operating Procedures (SOPs) of different sonde types

During the fourth WMO meeting of experts on the QA/SAC of GAW at Garmisch-Partenkirchen in March 1995 (WMO-report No. 104, 1995) a preliminary working plan was defined which was based on the assumption of a budget of approximately 300,000 US$ per year if all tasks of the facility were accomplished. However, an important constraint is the fact that the budgets for 1998 and 1999 to operate the facility are limited to about 40,000 US$ per year. This means that the activities of the facility in 1998 and 1999, addressed as JOSIE-98/99, has to be revised drastically with regard to the initial working plan of the WOSCF as defined in March 1995 (see above).

Revised concept for 1998/1999

JOSIE-98/99 Concerning the limited budgets over 1998 and 1999, JOSIE-98 will exclusively focus on task I while JOSIE-99 should be dedicated to task II. For a budget of about 40,000 US$ it is estimated that the WOSCF can perform:

- 1 month of simulation runs (incl. preparation, simulation flight, post-flight data processing: a total of about 25 sondes can be tested),
- 1 month to analyse/interpret the results and
- 1 month to prepare the documentation and report of

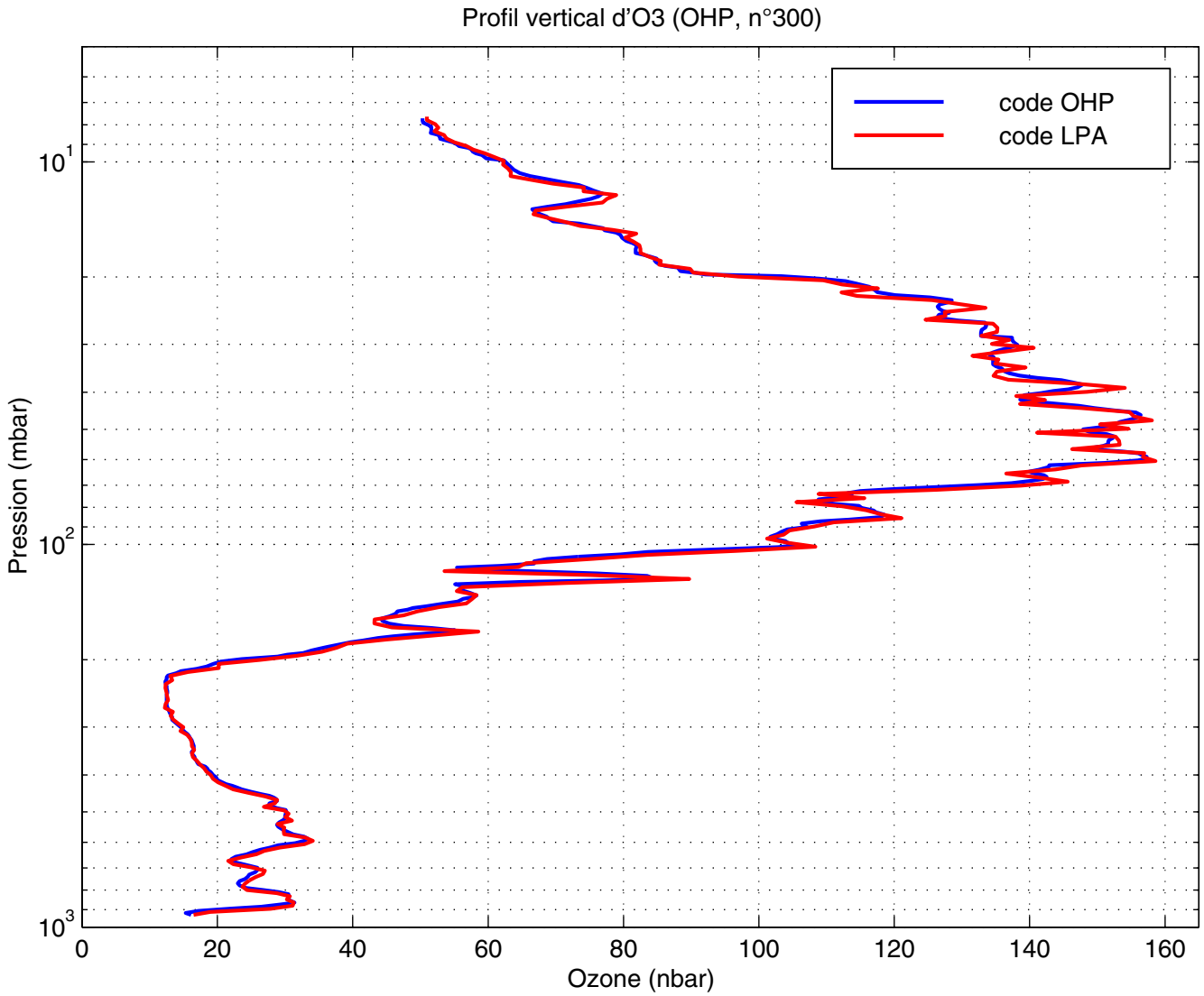


Figure 6. *Resulting ozone profiles with the same raw data input but with the conversion codes from OHP (blue curve) and from La Réunion (red curve). The differences are small, but visible.*

the results of the running year. Further, within the activities of task III of the facility during 1998/1999 the SOPs (presently in preparations) for the different ozonesondes should be finalized.

Experimental Design of JOSIE-98

Concerning the limited sample of about 25 sondes which can be tested in the simulation chamber, the primary goal of JOSIE-98 will be dedicated exclusively to the quality check of the instrumental performance of ECC (=Electrochemical Concentration Cell)-sondes. More than 80 percent of the GAW/GLONET-ozone sounding network are using ECC-sondes which are manufactured by either Science Pump Corporation (model type SPC-6A[1]) or Environmental Science Corporation (model type: ENSCI-1Z). Small differences of instrumental lay out of the different sonde types exist which may influence the instrumental response of the different model types. The primary goal of JOSIE-98 is to do a quality check of the instrumental performance over a sample of 25 randomly selected ECC-sondes, representing the different model types and which would be provided by the different ECC-sonde users in the GAW-sounding network. The experimental design of the simulation experiments is to evaluate the sensi-

1. Since early 1996 the previous SPC-5A type is not produced any more, such that this sonde type will not be participating in JOSIE-98

tivity, precision and accuracy of the tested ECC-sondes at different pressure altitudes and ozone levels. Included are questions addressed by the experiments with regard to the sonde performance such as:

(i) influence of pre-launch procedures

(ii) time response

(iii) background signal correction

(iv) total ozone normalization

(v) pump flow efficiency correction.

The experiments will be related to mid-latitude type of simulation profiles used during JOSIE-96 and based on the results obtained during the JOSIE-96 intercomparison. The evaluation of JOSIE-98 will primarily focus on the statistical analysis of the instrumental performance of the sample of 25 tested ECC-sondes. However, attention will also be paid to differences of sonde performance between the different ECC-model types type (SPC-5A, SPC-6A and ENSCI-1Z).

Strategy of JOSIE-98

Important objectives of JOSIE-98 are:

1. The ECC-sondes to be tested should be randomly picked from the stocks of new ECC-sondes at different, randomly selected, sounding sites of the GAW/ GLONET-community. However, the final sample should contain at least 8 ECC-sondes of each model type (SPC-5A, SPC-6A and ENSCI-1Z). All selected ECC-sondes have to brand new, in the original packing of the manufacturer, while the manufacturing date has to be after January 1., 1997

2. The selection of the sounding sites has to be anonymous (included the people at the calibration facility to guarantee their independency) and only allowed to be known by the referee of JOSIE-98, Prof. Volker Mohnen

3. Due to the strictly blind character it is requested that Prof. Mohnen does the necessary arrangements with regard of composing a set of 25 ECC-sondes to be provided to the calibration facility.

4. The set of 25 ECC-sondes has to be available at the calibration facility before August 1., 1998.

5. All ECC-sondes will be operated according the procedures described by Komhyr, 1986.

6. All ECC-sondes will be prepared in the laboratory prior to their simulation runs using the same equipment

7. All ECC-sondes will have the same interfacing electronics to the data acquisition system of the facility.

8. Preparation of the sondes, simulation runs, data processing, data analysis and data evaluation will be carried out by the crew of the facility site

References

Komhyr, W.D., Operations handbook - Ozone measurements to 40 km altitude with model 4A-ECC-ozone sondes, NOAA Techn. Memorandum ERL-ARL-149, 1986.

Proffitt, M.H., and R.J. McLaughlin, Fast response dual-beam UV-absorption photometer suitable for use on stratospheric balloons, Rev. Sci. Instrum., 54, 1719-1728, 1983.

Smit, H.G.J., W. Sträter, D. Kley, and M.H. Proffitt, The evaluation of ECC-ozonesondes under quasi flight conditions in the environmental simulation chamber at Jülich, in P.M. Borell et al. (eds.), Proceedings of Eurotrac symposium 1994, 349-353, SPB Academic Publishing bv, The Hague, The Netherlands, 1994.

Smit H.G.J., W. Sträter, M. Helten, D. Kley, D. Ciupa, H.J. Claude, U. Köhler, B. Hoegger, G. Levrat, B. Johnson, S.J. Oltmans, J.B. Kerr, D.W. Tarasick, J. Davies, M. Shitamichi, S.K. Srivastav, C. Vialle, and G. Velghe, JOSIE: The 1996 WMO International intercomparison of ozonesondes under quasi flight conditions in the environmental simulation chamber at Jülich, Proceedings of the XVIII Quadrennial Ozone Symposium, Eds. R. Bojkov, and G. Visconti, L'Aquila, Italy, September 1996, 971-974, 1998.

WMO (=World Meteorological Organization), Scientific Assessment of Ozone Depletion: 1994, Global Ozone Research and Monitoring Project - Report No. 37, World Meteorological Organization, Geneva, 1995.

WMO report No. 104, Report of the fourth WMO meeting of experts on the quality assurance/science activity centres (QA/SACs) of the global atmosphere watch. Jointly held with the first meeting of the coordinating committees of IGAC-GLONET and IGAC-ACE at Garmisch-Partenkirchen, Germany, 13-17 March 1995, WMO TD.No. 689

Status on data delivery

Below follows a table showing the number of ozonesonde files submitted to the NDSC data base as of 26 November 1998.

Table 3: Number of submitted sondes

Station	Number of sondes in database		
	Nov. 1996	Aug. 1997	Nov. 1998
Ny-Ålesund	532	637	733
Thule	18	18	18
Eureka	0	105	181
OHP	0	0	0
Mauna Loa (Hilo)	0	0	0
Lauder	111	209	277
Dumont d'Urville	0	0	0
McMurdo	0	76	416
South Pole	0	0	0

Sonde activities at NDSC stations that do not report to the NDSC data base

There are several NDSC stations that launch ozonesondes and aerosol sondes without these measurements being reported to the NDSC data base. The table below lists the stations that the working group is aware of as of November 1998.

Table 4: NDSC stations that launch ozonesondes and/or aerosol sondes and that have not been asked to report to NDSC

Station name	reported data
aberyst	uvvis
andoya	lidar
dumong	uvvis, lidar
harestua	ftir (Gardermoen is close)
kiruna	uvvis
lerwick	uvvis
moshiri	uvvis
reunion	uvvis, lidar
scoresby	uvvis
sodanky	uvvis
syowa?	uvvis

These stations should be solicited to submit ozonesonde data to the NDSC database.

The ozonesonde stations in Payerne will give good support for the stations in the Alpine area (Bern, Garmisch, Jungfrau, Zugspitze).