File Revision Date:
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Data Set Description:

PI:	Claude Vialle
Instrument:	ECC ozonesonde
Site:	Haute-Provence Observatory
Lat:	43.93 N
Long:	5.71 E

Measurement Quantities: Pressure, Geopotential height, Temperature, Ozone partial pressure, Humidity and Internal sonde temperature.

Contact Information:

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Reference Articles:

Articles describing the current Haute-Provence ozonesonde program:Smit, H.G., Strater, W., Helten, M., Kley, D., Ciupa, D., Claude, H.J., Kohler, U., Hoegger, B., Levrat, G., Johnson, B., Oltmans, S.J., Kerr, J. B., Tarassick, D. W., Davies, J., Shitamichi, M., Srivastav, S. K., Vialle, C., Velghe, G., : JOSIE : The 1996 WMO International intercomparison of ozonesondes under quasi flight conditions in the environmental simulation chamber at Jülich, in : Proccedings of the XVIII Quadrienal Symposium, L'Aquila, September 1996.

Beekmann, M., Ancellet, G., Martin, D., Abonnel, C., Duverneuil, G., Eideliman, F., Bessemoulin, P., Fritz, N., Gizard, E.: Intercomparison of tropospheric ozone profiles obtained by electrochemical sondes, a ground based lidar and an airborne UV-photometer, in Atmospheric Environment, 29, 9, 1027-1042, 1995.

Beekmann, M., Ancellet, G., Mégie, G., Smit, H.G., Kley, D.: Intercomparaison campaign of vertical ozone profiles including electrochemical sondes of ECC and Brewer-Mast type and a ground based UV-differential absorption lidar, in Journal of atmospherical chemistry, 19, 259-288, 1994

Recent publications concerned with the Haute-Provence ozonesondes:
Schulz,A., Rex,M., Harris,N.R.P., Braathen,G.O., Reimer,E., Alfier,R., Kilbane-Dawe,I., Eckermann,S., Allaart,M., Alpers,M., Bojkov,B.R., Cisneros,J., Claude,H., Cuevas,E., Davies,J., De Backer,H., Dier,H., Dorokhov,V., Fast,H., Godin,S., Johnson,B., Kois,B., Kondo,Y., Kosmidis,E., Kyro,E., Litynska,Z., Mikkelsen,I.S., Molyneux,M.J., Murphy,G., Nagai,T., Nakane,H., O'connor,F., Parrondo,C., Schmidlin,F.J., Skrivankova,P., Varotsos,C., Vialle,C., Viatte,P., Yushkov,V., Zerefos,C. And Von Der Gathen,P., 2001,

Arctic ozone loss in threshold conditions: Match observations in 1997/98 and 1998/99, J. Geophys. Res., 106, 7495-7503.

Schulz, A., Steger, J., Rex, M., Harris, N., Braathen, G.O., Reimer, E., Alfier, R., Beck, A., Alpers, M., Cisneros, J., Claude, H., De Backer, H., Dier, H., Dorokhov, V., Fast, H., Godin, S., Hansen, G., Kondo, Y., Kosmidis, E., Kyrö, E., Molyneux, M.J., Murphy, G., Nakane, H., Parrondo, C., Ravagnani, F., Varostos, C., Vialle, C., Yushkov, V., Zerefos, C., Von Der Gathen, P., : Match observation in the Arctic winter 1996/97 : High stratospheric ozone loss rates correlate with low temperatures deep inside the polar vortex, in Geophysical Research Letters, 27, 2, 205-208, 2000

Guirlet, M., Keckhut, P., Godin, S. and Mégie, G.: Description of the long-term ozone data series obtained from different instrumental techniques at a single location: the observatoire de haute-provence (43.9 °N, 5.7°E), Ann. Geophys., 18, 1325 1339, 2000.

Rex, M., Von der Gathen, P., Schulz, A., Steger, J., Germandt, H., Harris, N.R.P., Reimer, E., Beck, A., Alfier, R., Chipperfield, M., Kilbane-Dawe, I., Allaart, M., Alpers, M., De Backer, H., Balis, D., Bojkov, B.R., Braathen, G.O., Cisneros, J., Claude, H., O'Connor, F.M., Davies, J., Dier, H., Dorokhov, V., Fast, H., Gamma, A., Godin, S., Hansen, G., Kyro, E., Litynska, Z., Mikkelsen, I.S., Molyneux, M.G., Murphy, G., Nakane, H., Parronodo, C., Ravegnani, F., Reid, S.J., Rummukainen, M., Skrivankova, P., Varotsos, C., Vialle, C., Viatte, P., Wenger, J., Yushkov, V. and Zerefos, C., : Ozone loss in the arctic stratosphere as observed by MATCH, in : International Union of Geodesy and Geophysics (IUGG) Birmingham, U.K. July 18-24, 1999, A.22, 1999. (abstract).

Schulz, A., Rex, M., Harris, N., Braathen, G.O., Kyro, E., Reimer, E., Alfier, R., Eckermann, S., Kilbane-Dawe, I., Allaart, M., Alpers, M., Bojkov, B.R., Cisneros, J., Claude, H., Cuevas, E., Davies, J., De Backer, H., Dier, H., Dorokhov, V., Fast, H., Johnson, B., Litynska, Z., Mikkelsen, I.S., Molyneux, M., Murphy, G., Nakane, H., O'Connor, F., Parrondo, C., Skrivankova, P., Varotsos, C., Vialle, C., Viatte, P., Zerefos, C. and Von der Gathen, P., : Contribution about the match results 1997/98 and 1998/99, in : Fifth European Workshop on Stratospheric Ozone, Saint Jean de Luz, 27 Septembre-1 Octobre 1999.

Ancellet, G. and M. Beekmann: Evidence for changes in the ozone concentrations in the free troposphere over Southern France from 1976 to 1995, in Atmos. Environ., 31, 2835-2851, 1997.

Other general reference papers:

Komhyr W.D., Electrochemical concentration cells for gas analysis, Ann. Geophys, 25, 203-210, 1969.

Komhyr W.D., Barnes R.A., Brothers G.B., Lathrop J.A., Opperman D.P., Electrochemical concentration cell ozonesonde performance evaluation during STOIC 1989, in Journal of Geophysical Research, 100, D5, 9231-9244, 1995.

Instrument Description:

The ozonesondes flown at Haute-Provence Observatory have included the 5A ECC sondes manufactured by the Science Pump Corporation and the 1Z series ECC sondes manufactured by the EN-SCI. The 5A

sondes were flown from January 1991 to March 1997 and the 1Z sondes are systematically flown from March 1997.
For ascent into the stratosphere, the instrument is encased in a molded polystyrene weatherproof box. During flight the instrument is coupled to a meteorological radiosonde manufactured by Vaisala Incorporated. Two models have been used : 403 MHz RS80-15 or RS80-18. From January 1997 the humidity sensor is an H-humicap one (RS80-18H model). The balloon is 1200 g meteorological balloon (made in natural rubber latex and provided by Totex or Delasson, more recently by Kaysam). The equipment is tied to the balloon by a 9 m minimum cord. The sensor current is converted in a numerical value by a TMAX (H-MOS type) interface board which also manage the meteorological parameters (PTU) and the other signals such as analog frequencies from radiosonde or temperature box. These parameters are formatted into an hex-ascii serial data stream which is converted to an audio frequencies shift keyed (AFSK) signal. This signal modulates the Vaisala transmitter in place of the standard frequencies.
The telemetry signal is received and demodulated by a 403-Mhz Fortier receiver. The AFSK signal is then converted to an RS232 signal with a modem and fed into a serial port of a PC computer.

Algorithm Description:
Ozone partial pressure is calculated from the ECC current, the total flow rate of the pump and the cell temperature. Data processing is performed in two steps, the first one uses a PC computer and the second one, an Unix machine.
The first concept of the software was designed by the KFA team. During the first step the data from telemetry are converted in geophysical data i.e. pression, air temperature, relative humidity, boxes temperatures and ozone sensor current. The measured signals of the radiosonde are processed exactly according to the standard procedure prescribed by the manufacturer (Vaïsala) and all the calibration parameters from the RS-80 are used, so the values calculated for pression, air temperature, relative humidity, boxes temperatures are final values.
The second step begins by filtering and elimination of wrong lines. The ozone partial pressure is calculated from the measured ECC current during this step. Corrections due to the background current and pump efficiency at lower pressures are calculated according to the standard guidelines of Ozone sondes users' manual. The corrected value of background current is calculated directly using the equation given in the VSS Technical Manual:

IBG=((A0+A1*P+A2*P2)/(A0+A1*P+A2*P2))*I0
The corrections due to reduced ambient pressure at pump are made using the empirical table given by Komhyr (1986) and a linear interpolation.
For 3.0 cc of cathode solution the table is:

Pressure	Correction
2.0	1.171
3.0	1.131
5.0	1.092
10.0	1.055
20.0	1.032

30.0	1.022
50.0	1.015
100.0	1.011
200.0	1.008
300.0	1.006
500.0	1.004
1000.0	1.000

(Note: No individual calibration for the pump correction is made)

The height is calculated using hydrostatic equation. No correction for radiation or ventilation is made. Notice that the first point of the record is representative of starting the running of the ECC and not the time of launch. So, the first step is longer that a standard one and not representative of the ascent rate.

The pre-flight procedure includes air flow rate and zero current measurements. These measurements are made individually for each sonde before flight and the linearity of the ozonesondes is checked against an UV-photometer (Dasibi). The pre-flight procedure is conducted according to the Vaisala technical manual, OES11 Ozonesonde user's guide, 1988, excepted minor points. The ECC sensor solution is exactly prepared as required in the VSS Technical Manual, i.e. filling the sensor cathode with 3 cc of a 1% KI solution pH buffered and filling the sensor anode with 1.5 cc of a saturated KI solution.

<u>Analysis version number:</u>

01:	previous
02:	before October 1993
03:	from November 1993 to January 1997
04:	from February 1997 to November 2001
05:	from December 2001

<u>Expected Precision/Accuracy of Instrument</u>

PTU values for RS 80 Radiosonde

Pressure:	+/- 0.5 mb
Temperature:	+/- 0.2 C
Humidity:	+/- 2% RH

Geopotential Height:

Errors due to uncertainty in Pressure and Temperature values.

Box Temperature:

Thermistor tied to the tube between the pump and the cell, accuracy +/- 0.5 C

Ozone Partial Pressure:

Resolution:	0.01 mPa
Accuracy:	+/- 10% or less depending on altitude (see the JOSIE report for more details)

The main sources of error are the pump correction at high altitudes and background current in the troposphere (see JOSIE results).

Instrument History:
The main significant changes are:

March 1996:	the volume of cathode solution is increased from 2.5 cc to 3.0 cc
January 1997:	The Vaisala RS80 radiosonde is used with a special H-humicap sensor.
March 1997:	the ECC sondes flown at OHP are only ENS-CI Z type
December 2001:	the coupling between ECC sonde and RS-80 radiosonde is made by TMAX C-MOS type instead of H-MOS type