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Data Set Description:

PI:	Pavla Skrivankova
Instrument:	ECC 5A and ECC6A (1992 -)
	Brewer-Mast Ozonesonde, type OSM-2 and OSM-2 (1979 - 1991)
Site(s):	Prague Aerological Station (14.45E, 50.01 N)
	The station is located in a suburb of the capital of the Czech Republic
Measurement Quantities:	Ozone partial pressure, Temperature, Pressure, RH, Wind speed and direction, Geopotential Height

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DOI:
Not at this time.

Data License:

Reference Articles on ozone sondes:

Jiang, Y. B., Froidevaux, L., Lambert, A., Livesey, N. J., Read, W. G., Waters, J. W., Validation of Aura Microwave Limb Sounder Ozone by ozonesonde and lidar measurements (2008)

Rex, M., Deckelmann, H., Harris, N. R. P., Allaart, M., Andersen, S. B., Bipolar ozone loss rates measured by ozonesonde Match campaigns during IPY (2008)

Schoeberl, M.R., Ziemke, J.R., Bojkov, B., Livesey, N., Duncan, B., Strahan, S., A trajectory-based estimate of the tropospheric ozone column using the residual method (2007)

Streibel, M., Rex, M., Lehmann, R., Harris, N. R. P., Braathen, G. O., Chemical ozone loss in the Arctic winter 2002/2003 determined with Match (2006)

Rex, M., Salawitch, R. J., Deckelmann, H., Harris, N. R. P., Chipperfield, M. P., Arctic winter 2005: Implications for stratospheric ozone loss and climate change (2006)

M. Streibel, M. Rex, R. Lehmann, G. O. Braathen, Chemical ozone loss in the Arctic winter 2002/2003 determined with Match (2006)

T. Christensen, B. M. Knudsen, M. Streibel, S. B. Andersen, A. Benesova, G. Braathen, H. Claude,J. Davies, H. De Backer, H. Dier, V. Dorokhov, M. Gerding, M. Gil0, B. Henchoz, H. Kelder, R. Kivi,E. Kyrö, Z. Litynska, D. Moore, G. Peters, P. Skrivankova, R. Stübi, T. Turunen, G. Vaughan, P. Viatte, A. F. Vik, P. von der Gathen, I. Zaitcev. Vortex-averaged Arctic ozone depletion in the winter 2002/2003, Atmos.Chem.Phys., 5, 131-138, 2005.

Streibel, M., Gathen, P., Rex, M., Deckelmann, H., Harris, N. R. P., Braathen, G. O., Chipperfield, M., Reimer, E., Alfier, R., Allaart, M., Andersen, S. B., Balis, D., Cambridge, C., Claude, H., Davies, J., Backer, H., Dier, H., Dorokhov, V., Fast, H., Gerding, M., Kyro, E., Litynska, Z., Moore, D., Moran, E., Nagai, T., Nakane, H., Parrondo, C., Ravegnani, P., Skrivankova, C., Varotsos, C., Vialle, C., Viatte, P., Yushkov, V., Zerefos, C. S. Chemical ozone loss in the Arcitc winter 2002/03 determined with Match, EGS-AGU-EUG, Joint Assembly, 06-11, Nice, France, 2003.

Lait, L. R., Schoeberl, M. R., Newman, P. A., McGee, T., Burris, J., Browell, E. V., Richard, E., Braathen, G. O., Bojkov, B. R., Goutail, F., Gathen, P. von der, Kyrö, E., Vaughan, G., Kelder, H., Kirkwood, S., Woods, P., Dorokhov, V., Zaitcev, I., Litynska, Z., Kois, B., Benesova, A., Skrivankova, P., Backer, H. de, Davies, J., J?rgensen, T., Mikkelsen, I. S. Ozone loss from quasi-conservative coordinate mapping during the 1999-2000 SOLVE campaign, Journal of Geophysical Research, 107/D20, 8274, 2002.

Rex, M., Salawitch, R.J., Harris, N.R.P., Gathen, P. von der, Braathen, G.O., Schulz, A., Deckelmann, H., Chipperfield, M., Sinnhuber, B.M., Reimer, E., Alfier, R., Bevilacqua, R., Hoppel, K., Fromm, M., Lumpe, J., Küllmann, H., Kleinböhl, A., Bremer, H., König, M. von, Künzi, K., Toohey, D., Vömel, H., Richard, E., Aikin, K., Jost, H., Greenblatt, J.B., Loewenstein, M., Podolske, J.R., Webster, C.R., Flesch, G.J., Scott, D.C., Herman, R.L., Elkins, J.W., Ray, E.A., Moore, F.L., Hurst, D.F., Romashkin, P., Toon, G.C., Sen, B., Margitan, J.J., Wennberg, P., Neuber, R., Allart, M., Bojkov, R.B., Claude, H., Davies, J., Davies, W., Backer, H. de, Dier, H., Dorokhov, V., Fast, H., Kondo, Y., Kyrö, E., Litynska, Z., Mikkelsen, I.S., Molyneux, M.J., Moran, E., Murphy, G., Nagai, T., Nakane, H., Parrondo, C., Ravegnani, F., Skrivankova, P., Viatte, P., Yushkov, V. Chemical loss of Arctic ozone in winter 1999/2000, Journal of Geophysical Research, 107/D20, 8276, 2002.

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., Cisneros, J., Claude, H., Cuevas, E., Davies, J., Backer, H. de, Dier, H., Dorokhov, V., Fast, H., Godin, S., Johnson, B., Kois, B., Kondo, Y., Kosmidis, E., Kyrö, 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., Gathen, P. von der. Arctic ozone loss in threshold conditions: Match observations in 1997/1998 and 1998/1999, Journal of Geophysical Research, 106/D7, 7495-7503, 2001.

<u>Instrument Description:</u>
ECC5A ozone sondes were flown from January 1992 to January 1997. Since February 1997 ECC6A sondes have been flown.

The ECC's are connected to Vaisala RS80, Vaisala RS92-KL, Vaisala RS92-SGP (2008 to 2019) and Vaisala RS41 (from 2020) radiosondes using the Vaisala OIF11, OIF92 and OIF411 interface card.
The ground equipment is VAISALA DigiCORA I (1992 to 2005), VAISALA DigiCORA III (2006 to 2019) and VAISALA DigiCORA MW41 (from 2020).
A 1% KI cathode solution (3 cm3) is used (along with KBr and a pH buffer).
The preparation is according to the VAISALA handbook.

BM sonde was used from 1979 until end of March 1991.

The manufacturer was Academy of Sciences of former German Democratic Republic. The ozonesonde was coupled to a Czech German meteorological frequency radiosonde type DFR/MARS4K manufactured by Laboratory equipment, Metra Praha.
The ground receiving station was radar METEORIT (Soviet Union).
A 0.1% KI solution (2 cm3) was used.
The preparation was according to the Academy of Sciences of GDR.

The Brewer - Mast (BM) type ozone sonde consists of one electrochemical cell (two different electrodes, a platinum cathode and a silver anode) filled with potassium-iodide solution and a small gas-sampling pump. During sounding ambient air is continuously pumped into the cell where ozone molecules react with the solution to form free iodine:

2KI + O3 + H20 ---> 2KOH + I2 + O2

<u>Algorithm Description:</u>
ECC ozonesonde:
Ozone (POZ) is calculated as a partial pressure with the standard form:

POZ(nb) = 0.00430851 * (i – ib) * Tp * t * E(p)

where: i is the current from the sensor in uA
ib is background current in uA :
1992 – 2002: ib was measured just before launch, proportional to pressure
Since 2003 according to the SOP´s ib is constant measured before cell is exposed to ozon

Tp is the Box temperature - before February 1997 measured on the inlet tube and nowadays in the pump hole of the ECC6A sondes

t is the time to pump 0.100 liters of air through the pump in seconds

E(p) is the pump correction interpolated from the tables (for 3.0 cm3 of cathode solution):

1992 – 1997: ORIGINAL (Komhyr 1986)
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

1998 – 2004: OLD STOIC89

Pressure	Correction
2.0	1.160
3.0	1.241
5.0	1.125
10.0	1.066
20.0	1.041
30.0	1.029
50.0	1.018
100.0	1.010
200.0	1.007
300.0	1.005
500.0	1.002
1000.0	1.000

Since 2005: ORIGINAL (Komhyr 1986) - according to the SOP´s.
Note: No individual calibration of the pump correction is made.
The residual column above the balloon burst (17 hPa) is evaluated using the constant mixing ration rule.
The profiles are not normalized.

BM ozonesonde:
Ozone (POZ) is calculated as a partial pressure with the form:

POZ(nb) = 0.004309 * i * Tp * t * E(p)

where: i is the current from the sensor in uA
t is the time to pump 0.100 liters of air through the pump in seconds
E(p) is the pump efficiency correction
Tp is the pump temperature assumed to be constant (300 K)

Background current is assumed to be zero.
The pump efficiency correction E(p) is interpolated from the table (Dutsch, 1966, WMO):

Pressure (hPa)	Correction
6.0	1.260
10.0	1.170
15.0	1.120
20.0	1.095
30.0	1.065
50.0	1.035
100.0	1.010
150.0	1.000
1000.0	1.000

The residual column above the balloon burst (17 hPa) is evaluated using the constant mixing ration rule. Between 17 and 60 hPa, the climatology table was used.
The profiles are normalized to the independently measured total ozone amount using the Dobson No.74 at Hradec Kralove (15.83 E, 50.18 N)

<u>Expected Precision/Accuracy of Instrument:</u>
PTU values for RS41 radiosonde

Pressure:
Radiosonde without pressure sensor. Pressure is GPS derived.
Resolution 0.01 hPa
Accuracy> 100 hPa +/- 1.0 hPa
100 – 10 hPa +/- 0.3 hPa
<10 hPa +/- 0.04 hPa

Temperature:
Resolution 0.01 C
Accuracy 0–16 km +/- 0.3 °C
above 16 km +/- 0.4 °C

Humidity:
Resolution 0.1% RH
Accuracy +/- 4 % RH

Geopotential Height:
Resolution 0.1 gpm
Accuracy +/- 10.0 gpm

<u>PTU values for RS-92 radiosonde</u>
Pressure:
Resolution 0.1 hPa
Accuracy 1080 - 100 hPa +/- 1.0 hPa

100 - 3 hPa +/- 0.6 hPa

Temperature:
Resolution 0.1 C
Accuracy +/- 0.5

Humidity:
Resolution 1% RH
Accuracy +/- 5 % RH

Geopotential Height:
Uses Pressure and Temperature profile.
Errors due to uncertainty in these values.

<u>PTU values for RS-80</u>
Pressure:
Resolution 0.1 hPa
Accuracy +/- 0.5 hPa

Temperature:
Resolution 0.1 C
Accuracy +/- 0.2

Humidity:
Resolution 1% RH
Accuracy +/- 2 % RH

Geopotential Height:
Uses Pressure and Temperature profile.
Errors due to uncertainty in these values.

<u>Ozone values for ECC ozonesonde</u>
Box Temperature:
Resolution 0.1 C
Accuracy +/-0.5 C

Ozone Partial Pressure ECC:
Resolution 0.01 mPa
Accuracy +/- 10% or less depending on altitude
(according to the JOSIE report for this type of ECC sonde. However, we didn't took part in the comparison. Smit H., et al., JOSIE: The 1996 WMO International Intercomparison of Ozonesondes under Quasi-flight Conditions in the Environmental Simulation Chamber at Julich, Proc. Quad. Ozone Symp., l'Aquila, Italy, 1996)

The main sources of error are:

- the pump correction at high altitudes
- background current in the troposphere.

<u>PTU values for DFR/MARS4K and ozone values for BM ozonesonde</u>

Pressure:

Resolution 0.1 hPa

Accuracy < 6.6; 2.0> pressure dependent; since 1987 2 hPa up to 100 hPa and 1hPa above

Temperature:

Resolution 0.1 C

Accuracy +/- 0.5

Humidity:

Resolution 1% RH

Accuracy +/- 10% RH

Geopotential Height:

Uses Pressure and Temperature profile.
Errors due to uncertainty in these values.

Ozone Partial Pressure BM

Resolution 0.1 mPa

The main sources of error are:

- the preparation procedure
- the pump efficiency correction at high altitudes
- the background current in the troposphere
- the constant pump temperature

<u>Instrument History:</u>

The significant change in instruments and algorithms has been made by the installation of the new aerological system VAISALA in January 1992 at Prague Station.

The wind has been calculated using Loran C and GPS navigation systems since September 1997 (instead of Omega - 1992-1996).

The thermistor for the box temperature had been situated on the inlet tube before February 3, 1997. Since then the thermistor is inserted in the pump hole of the 6A sondes.