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Data set Description:

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Instrument: Ozonesonde
Site: Observatoire de Haute Provence
Measurement Quantities: Ozone, Pressure, Altitude, Temperature, Humidity, Wind speed and direction, Internal Sonde temperature, ECC current

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Instrument Description:

Electrochemical ozonesondes have been used since 1991 to measure every week the ozone vertical profile at OHP (44°N,5.7°E) from 0 to 30-33 km. Simultaneous measurement of pressure, temperature and humidity are also available. Wind is measured since 2007 using GPS position of the balloon platform. The measurement method of the ECC is based on the electrolysis of ozone in two Teflon cells using bright-platinum electrodes. The cathode chamber contains 1000 ml of solution with 1% of potassium iodide(KI), 2.5% of potassium bromide (Kbr) and a buffer. The anode chamber is saturated with KI and the chambers are linked with an ion bridge. An internal temperature of the ozonesonde (Tecc) is also recorded to be able to calculate the ozone concentration from the ECC current (iecc). The position of the ECC temperature sensor is internal to the pump after 2007 and taped on the ECC pump before.

Preparation has been made according to NOAA guidelines (Komhyr, 1995). The ECC pump flow rate efficiency is measured for each flight using a bubble flow meter. Correction is now included for the wetting effect due to lab humidity changes when measuring the pump flow rate. Lab humidity and temperature are available on sounding preparation sheet before 2004 and in the Ames file since then. The background current of the ECC (ib0) is measured before and after the ozonesonde exposure to ozone for linearity response check. The zero ozone air is now from the ENSCI Ozonizer unit (MSA Filter cartridge type H + Mersorb indicator 3390) and was from a DASIBI ozone monitor with charcoal filter before 1997.

Balloon are generally launched around noon every week, but some night soundings coincident with lidar measurement sometimes replaced the noon flights (< 2% of the data base). A correction factor (fc) is calculated using a normalization of the total ozone from the sonde to the total ozone measured by a Dobson before 2000 and with a SAOZ spectrophotometer since 2000. Sonde data recorded are never multiplied by this factor which is strongly sensitive to ozone levels in the stratosphere. Soundings with fc > 1.25 are not kept because they may correspond to unreliable ECC sondes.

The following parameters are included in the AMES file reported to NDACC as a function of height:

Pressure (hPa)
Time after launch (s)
Geopotential height (gpm)
Temperature (°C)
Relative humidity (%)
Temperature of the ECC (°C)
Ozone partial pressure (mPa)

Horizontal wind direction (degrees)
Horizontal wind speed (m/s)
ECC current (µA)
Corrected ECC temperature (K)
Relative Error on corrected temperature (%)
Corrected ozone partial pressure (mPa)
Error on ozone partial pressure (mPa)

The following parameters are given in the header:

Measured PumpFlowrate (s)
Corrected PumpFlowrate (s)
Measured BackGround current i0 (µA)
Corrected BackGround current i0 (µA)
Uncorrected Residual Ozone (DU)
Corrected Residual Ozone (DU)
SAOZ(DOBSON) Total Ozone (DU)
ECC Total Ozone (DU)
Ground pressure (hPa) and temperature (°C).
Lab humidity and température
Uncorrected Correction factor (not applied to ozone partial pressure)
Corrected correction factor (not applied to ozone partial pressure)

Data processing:
Ozone partial pressure (po3) is calculated using the following equation:

po3(mPa) = 4.3e-4 x Conversionefficiency x PumpFlowrate (s) x pumpefficiency * Tecc(K) * [iecc(µA)-i0(µA)].

The altitude is calculated with th hydrostatic equation until june 2007 and now directly measured by the Modem meteorological sonde.

The pump efficiency pressure decreasing coefficients are taken from Komhyr 1986 for SPC-ECC
Pressure: 100 50 30 20 10 5 3
Coefficient: 1.007 1.018 1.022 1.032 1.055 1.092 1.124

The pump efficiency pressure decreasing coefficients are taken from Komhyr 1995 for ENSCI-ECC
Pressure: 100 50 30 20 10 5 3
Coefficient: 1.007 1.018 1.029 1.041 1.066 1.124 1.241

The pressure dependency for ib0 was used but has been removed in the new release including sonde data homogenization.

The ozone residual above balloon burst level used for the normalization to total ozone is calculated using a satellite monthly climatology. The climatogology above the burst level is also scaled to the last ozone concentration measured by the ozonesonde.

Data have been filtered with a running median filter to remove outliers in the ecc current due to wrong telemetry. The filter is using 10 data points recorded every seconds.

If the ECC temperature is missing, it is replaced by a monthly ECC temperature climatology (less than 2% of the data base) and it is specified in the AMES file header. ECC temperature is corrected according to the guidelines for sonde homogenization document (position of internal temperature measurement and truest temperature correction)

The weeting effect is corrected with the measured lab temperature and humidity after 2000 and a montly climatology of these two parameters before 2OOO.

In the uncorrected parameter ozone partial pressure parameter no correction is applied for the ozonesonde manufacturer change in 1997. It is included in the corrected ozone partial pressure (smaller partial pressure after 1997, '% change in troposphere and > 10% in upper stratosphere)

Radiosonde data processing is always based on the software provided by the radiosonde company.

Data are reported with a time resolution of 20 s for 01/1991-02/2004 (8s data available in raw data)
10 s for 03/2004-06/2007
1 s since 07/2007.

Error analysis:
The error on ECC measurement is calculated using the values recommended by the guidelines for sonde homogenization document. It includes the error on corrected ECC temperature, conversion efficiency, pump flow rate, background current correction.

Instrument history
After 6 years of Brewer Mast sounding at OHP (1984 to 1990) recorded at WODC data center, ECC sounding started under the initial supervision of Herman Smit after the 1989 OHP TOR intercomparison campaign.

ECC sondes were manufactured by Science Pump Corporation (SPC) for the period 01/1991-03/1997 and by ENSCI (Z type) since march 1997 but we kept using the 1% KI concentation in the cathode chamber of the ENSCI sonde.

The meteorological radiosondes, electronic interface between ozonesonde and radiosonde and the UHF receiver for the data telemetry have been changed several times and the following configuration have been used:

Date	Radiosondes type	Electronic Interface	Receiver UHF
01/1991-12/1996	VAISALA RS80 + A-Humicap	TMAX HMOS91	Fortier Receiver
01/1997-02/2004	VAISALA RS80 + H-Humicap	TMAX HMOS91	Fortier Receiver
03/2004-11/2004	VAISALA RS80 + H-Humicap	TMAX HMOS91	Home made UHF Receiver
02/2005-06/2007	VAISALA RS80 + H-Humicap	TMAX HMOS91	VASAILA UHF Receiver
07/2007-06/2013	MODEM M2K2	Modem OZAMP	Modem UHF Receiver
07/2013-05/2015	MODEM M10	Modem OZAMP	Modem UHF Receiver
06/2015-now	MODEM M10	Modem OZAMP	Modem UHF Receiver SR10

Batteries for the ECC were alcaline before 02/1995, Lithium 02/1995-08/1996, water 08/1996-02/2016, lithium since 06/2016

In March 1996, the cathode sensing volume was changed from 2.5 cm-3 to 3 cm-3.

The iecc initial measurement record was lost for the time period march 2004 to june 2007 when the Holger Voelmel NOAA data analysis software was used at OHP. Iecc reported in the AMES NDACC file for this time period is recalculated from pO3, Tecc, PumpFlowRate and i0.

In 2015 the iecc current field was added to the AMES file using an interpolation of the current recorded in the raw data files on the pressure level reported in the AMES data file. All the necessary imformation for a calculation of the ozone partial pressure is now available in the AMES data file.

In 2020 the data set from 1991 to 2020 was homogenized using the guidelines for sonde homogenization document. Several sounding have been cleaned before this process to remove spurious ECC current measurements.

**********Specific comments**********
1994: Beware several sondes with elevated correction factor values between May 1994 and November 1994 (probably related to a poor set of SPC sondes)

Nov 1994: No measurement between November 1994 and Feb 2005 (change of UHF receiver)

March/April 2020: no measurements during the lockdown period

Comparison with stratospheric lidar show that upper stratospheric values are biased low if the internal temperature is too low (< 10°C).