File Revision Date:
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Data Set Description:

PI: David Tarasick, Jonathan Davies
Instrument: ECC ozonesonde
Site: Alert (weather station: 82.49N, 62.34 W)
Measurement Quantities: Pressure, Temperature, RH, Wind speed and direction, Geopotential height, Ozone partial pressure, Box temperature

Contact Information:

Name: David Tarasick, Jonathan Davies
Address: Environment and Climate Change Canada
4905 Dufferin Street
Downsview, ON
Canada M3H 5T4
Phone: David Tarasick 416-739-4623, Jonathan Davies 416-739-4210
FAX: 416-739-4281
Email: David.Tarasick@ec.gc.ca, Jonathan.Davies@ec.gc.ca

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Data License:

Reference Articles:

Tarasick**,** D.W., H.G.J. Smit, A.M. Thompson G.A. Morris, J.C. Witte, J. Davies, T. Nakano, R. van Malderen, R.M. Stauffer, T. Deshler, B.J. Johnson, R. Stübi, S.J. Oltmans and H. Vömel (2021), Improving ECC ozonesonde data quality: Assessment of current methods and outstanding issues. *Earth and Space Science*, *8*, e2019EA000914. https://doi.org/10.1029/2019EA000914.

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Tarasick, D.W., J. Davies, K. Anlauf, M. Watt, W. Steinbrecht and H.J. Claude (2002) Laboratory investigations of the response of Brewer-Mast sondes to tropospheric ozone, *J. Geophys. Res.*, *107*(D16), 4308, https://doi.org/10.1029/2001JD001167.

Instrument Description:

At Alert the ECC type ozone sonde has been used exclusively since 1987. A detailed description of the instrument and the preparation methods are given in the references; see in particular *Tarasick et al.* (2016). The program has used Science Pump 5A, 6A and EN-SCI 1Z and 2Z type ECC sondes, prepared the same way irrespective of the manufacturer, using a 1% KI solution (along with KBr and a pH buffer). Thermistor placement has changed (from box to pump). Older data have been revised for these known biases according to *Tarasick et al.* (2016), but this is not necessarily reflected in the NDACC archives (users are cautioned to check). However, data after 2014 are so corrected as part of standard processing. Differences are small (1-5%) but will affect trend calculations if uncorrected data before 2015 are used with newer data.

Prior to 2006, the ECC's were connected to Vaisala RS-80-15 type radio sondes using the Vaisala RSA-11 interface card. Vaisala RS-92 type radio sondes were used until late 2018, when the network switched to Graw DFM-09 sondes.

“Background current” is subtracted according to the original method (assumed to be proportional to pressure). While this is known to be incorrect, it produces better results than the (also incorrect) ASOPOS-recommended constant background subtraction. Future data revisions of the data record will revise this (for all flights) to a time-dependent “background” subtraction (e.g. *Tarasick et al.,* 2021).

Algorithm Description:

Ozone is calculated as a partial pressure. PTU data from the sonde is not used directly in the calculation except in the pump correction.

PPOZ(nb) = 0.004307 * i *Temperature * t

where: i is the current from the sensor - background in uA
t is the time in seconds to pump 0.100 liters of air through the pump multiplied by the pump correction.

No individual calibration of the pump correction is made.
The pump correction is interpolated from a manufacturer-supplied table, included in each file.

Expected Uncertainty of Instrument:
PTU values for RS 92 Radiosonde

Pressure: +/- 0.5 hPa
Temperature: +/- 0.3 K
Humidity: +/- 2% RH (in troposphere)
Geopotential Height: (calculated, pre-GPS; uncertainties propagated from P and T uncertainties)
Pump Temperature: +/- 0.5 K
Ozone Partial Pressure: +/- 3-7% depending on altitude, not including additional uncertainties from bias corrections (see *Tarasick et al.,* 2021 or WMO ASOPOS-2 report, for more detail)

The main sources of uncertainty are the radiosonde pressure bias uncertainty at high altitudes (in non-GPS sondes) and background current in the troposphere.

Instrument History:

Year	Change	Possible Effect
1979	ECC 3A introduced	~15% increase in tropospheric response relative to BM sondes. Sonde temperature measured via rod thermistor.
1984	ECC 4A introduced	redesigned pump; maximum change <1%, at 50-20 hPa. Sonde "box" temperature measured; new rod thermistor.
1993	ECC 5A introduced	New pump correction; maximum change ~1%, at 100 hPa.
1993	Vaisala RS-80, RSA-11 introduced	Older VIZ sonde: warm bias in daytime; pressure errors. May introduce altitude shifts in profile; ozone increases of up to ~2% at 20 hPa.
1996	ECC 6A	No differences below about 20-25 km [*Smit et al*., 2000].
2001	ENSCI 1Z introduced	High bias with 1% KI solution [*Smit et al*., 2007].
2004	3cc solution (southern sites)	Better ozone capture in troposphere
2006	Vaisala RS-92 introduced	RS80s low by ~20m in the troposphere, high by 100m at 10hPa (Steinbrecht et al., 2008)
2007	Thermistor in ECC pump	More accurate measurement of air volume
2015	Change to standard data processing	Corrections made for ENSCI high bias with 1% KI solution
2021	Graw DFM-09 introduced	
2021	ECC 6A	No correction for 1% solution