

File Revision Date:

August 17, 2021

Data Set Description:

PI: Jérôme BRIOUDE
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Instrument: ECC Ozonesonde
Site: Reunion Island St Denis (France in SW Indian Ocean)

The St Denis station is located at the University (preparation of the ozonesonde) but the launch area is at Gillot (Roland Garros airport) about 7 km away from the University

Latitude: 20.89°S

Longitude: 55.49°E

Altitude: 8m asl

Measured Quantities: ozone current (ozone partial pressure), altitude, GPS altitude (pressure), temperature, relative humidity, GPS position (latitude, longitude), wind (speed and direction).

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Reference Articles:

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Articles related to La Reunion Ozonesonde measurements:

Thompson, A. M., Balashov, N. V., Witte, J. C., Coetzee, J. G. R., Thouret, V., and Posny, F.: Tropospheric ozone increases over the southern Africa region: bellwether for rapid growth in Southern Hemisphere pollution? *Atmos. Chem. Phys.*, 14, 9855–9869, <https://doi.org/10.5194/acp-14-9855-2014>, 2014

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Instrument Description:

The ECC Ozonesonde (Electrochemical Concentration Cell Ozonesonde) is a lightweight balloon-borne instrument connected to a meteorological radiosonde. Ozone is measured through two Electrochemical Concentration Cells filled with KI solutions at two different concentrations. Ambient air is pumped from outside with a small motor and bubbled in the cathode solution. Ozone reacts with the diluted KI solution to produce a current proportional to ozone concentration in the air. This current (from few hundredths to few tens μA) is measured and transmitted to a ground station by radiowave through a meteorological radiosonde via an interface board. The Ozonesonde and the meteorological radiosonde are lifted together by a balloon inflated with helium at an average speed of 5m/s from the ground level to the burst altitude (30-35km)

Ozone sensor: Environmental Science (EN-SCI) Corporation 2Z

Sensing Solution Type (SST) cathode: 0.5% KI, 0.5x (half buffer) 2.5 cm³

Meteorological radiosonde: Meteomodem M10

Launch frequency: weekly, Local launch time 14:00-15:00 (10:00-11:00 UTC)

The instrument has participated to the Jülich Ozone Sonde Intercomparison Experiment JOSIE 2000 and JOSIE 2017.

Algorithm Description:

Ozone partial pressure (PO_3 in nb) is calculated from the ECC Ozonesonde current reduced from the background current (i in μA), the pump temperature (T in K), the flow rate of the pump: time to pump

100 ml of air through the pump (t in s) and a pump correction factor to account the loss in pump efficiency at lower pressures (pcf). The constant is half the ratio of ideal gas constant to Faraday's constant.

$$PO_3 = 0.004307 * i * T * t * pcf$$

The applied pcf are derived from the table of Komhyr (1986) for a 2.5 ml cathode solution.

The pump temperature T was measured with the thermistor tied to the tube between the pump and the cathode cell till December 2002. After that date T is measured in the pump.

Since April 2018 the software Eoscan from Meteomodem is used. It allows to follow in real time the ascent and descent of the ozonesonde with its GPS position and the display of the profiles of PO₃, T, RH and wind in function of altitude, pressure or time.

Expected Precision/Accuracy of Instrument:

Ozonesonde:

Accuracy	Precision	Resolution
+/- 5%	+/- 4%	100-150m

The main sources of error are the efficiency pump correction factor at high altitudes and the value of the background current in the troposphere.

Instrument History:

The ozonesonde measurements have begun at La Reunion in September 1992 with two launches per month. In 1996 La Reunion entered the NDSC/NDACC network and in 1998 the SHADOZ program. Since January 1999 the launch frequency has been increased to once a week thanks to the SHADOZ/NASA program support.

ECC Ozonesonde and Sensing Solution changes:

Manufacturer	Model	Sensing Solution	Period
EN-SCI	Z	1% full buffer	till 06/1998
EN-SCI	Z	0.5% half buffer	06/1998 - 06/1999
SPC	6A	0.5% half buffer	07/1999 - 07/2000 (except 12/1999 EN-SCI Z)
EN-SCI	Z, 1Z, 2Z	0.5% half buffer	08/2000 - 05/2006
EN-SCI	2Z	0.5% ??? buffer	05/2006 - 08/2007
EN-SCI	Z, 1Z	0.5% full buffer	08/2007 - 12/2016
EN-SCI	Z, 2Z	0.5% half buffer	01/2017 - present

Transfer functions have been used to convert data to SPC 1% full buffer and EN-SCI 0.5% half buffer (see Deshler 2017 and Witte 2017).

Meteorological Radiosonde changes:

Vaisala RS80 till 10/2006 with TMAX interface board

Modem M2K2 08/2007 - 02/2013 with Modem interface board

Modem M10 03/2013 - present with Modem interface board

Retrieval or data processing code:

1998-2002 -> oztr.bas and echan1.bas: home codes

2003-2006 -> STRATO.EXE: Holger VOMEL's code from NOAA/CMDL

2007-April 2018 -> ICAR: Meteomodem code

April 2018-present -> Eoscan: Meteomodem code