File Revision Date:
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August 22, 2025

Data Set Description:
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PI: Patrick Cullis
Instrument: ECC Ozonesondes
Sites: Boulder, CO USA 39.949°N, 105.197°W, 1743 masl
Hilo, HI USA 19.717°N, 155.049°W, 10 masl
South Pole, ANTARCTICA 45.038°S, 169.683°E, 370 masl
Pago Pago, AMERICAN SAMOA 14.331°S, 170.714°W, 5 masl

Measurement Quantities: Ozone partial pressure, Ozone mixing ratio, Pressure, Temperature, Relative humidity, Geopotential height, GPS Altitude, Latitude and Longitude of payload (for most soundings since 2009), Horizontal wind speed and direction (for most soundings since 2009).

Contact Information:
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DOI:

Not at this time.

Data License:
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CC0

Reference Articles:
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Johnson, B. J., Oltmans, S. J., Vömel, H., Smit, H. G. J., Deshler, T., and Kroger, C., Electrochemical concentration cell (ECC) ozonesonde pump efficiency measurements and tests on the sensitivity to ozone of buffered and unbuffered ECC sensor cathode solutions, J. Geophys. Res., 107(D19), 4393, doi:10.1029/2001JD000557, 2002.

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Hofmann, D.J., Oltmans, S.J., Harris, J.M., Komhyr, W.D., Lathrop, L.A., Defoor, T., and Kuniyuki, D., Ozonesonde measurements at Hilo, Hawaii following the eruption of Pinatubo, Geophys. Res. Lett. 20, 1555-1558, 1993.

Instrument Description:
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The ECC Ozonesonde (Electrochemical Concentration Cell Ozonesonde) is a lightweight, balloon-borne instrument mated to a meteorological radiosonde and flown to 30+ km while transmitting data back to a ground station. The heart of the ozonesonde is an electochemical concentration cell (ECC) that senses ozone as it reacts with a dilute solution of potassium iodide to produce an electrical current proportional to the ozone concentration of the air.

ECC's connected to Vaisala RS-80-15 type radiosondes using En-Sci V2C interface board.
ECC's connected to Intermet iMet-1 type radiosondes using En-Sci V7 interface board.
ECC's connected to Intermet iMet-4-RSB type radiosondes using En-Sci V7 interface board.
TMAX interface board used for all 5A, 6A, and 1Z sondes
Analog data system used for most 4A sondes

Vaisala radiosonde receiving station was an ICOM receiver and 300 baud modem (V2C) or a KAM Plus programmable modem (TMAX) into the NOAA/CMDL data acquisition program: Strato version 7.2
Starting in 2009 with Intermet iMet-1 radiosondes, data is received with SkySonde software and ICOM receiver, or software modem built in to SkySonde.

Boulder:
Project start date: March 12, 1979
Pre-project period: April 27, 1967 to July 20, 1971
Start digital data acquisition: June 11, 1991
Switched from 1% KI buffered cathode solution to 2% KI unbuffered: August 21, 1997.
Switched from 2% KI unbuffered cathode solution to 1% 1/10th buffered: August-November, 2005.
Used Science Pump 4A, 5A, 6A and ENSCI 1Z, 2Z models.

Hilo:
Project start date: September 21, 1982
Start digital data acquisition: July 18, 1991
Switched from 1% KI buffered cathode solution to 2% KI unbuffered: April 15, 1998.
Switched from 2% KI unbuffered cathode solution to 1% 1/10th buffered: December 20, 2005.
Used Science Pump 4A, 5A, 6A and ENSCI 1Z, 2Z models.

S.Pole:
Project start date: January 20, 1986
Pre-project period: January 17, 1967 to October 14, 1971
Start digital data acquisition for ozonesondes: November 3, 1990
Switched from 1% KI buffered cathode solution to 2% KI unbuffered: March 4, 1998.
Switched from 2% KI unbuffered cathode solution to 1% 1/10th buffered: November 15, 2004.
Used Science Pump 4A, 5A, 6A and ENSCI 1Z, 2Z models.

Samoa:
Project start date: August 8, 1995
Pre-project period: April 1, 1986 to January 23, 1990
Start digital data acquisition: August 8, 1995
Switched from 1% KI buffered cathode solution to 2% KI unbuffered: April 17, 1998
Switched from 2% KI unbuffered cathode solution to 1% 1/10th buffered: October 22, 2005
Used Science Pump 4A, 6A and ENSCI 1Z, 2Z models.

Algorithm Description:
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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 *pcf

where:
i is the current from the sensor - background in uA.
t is the time in seconds to pump 100 CCs of air through the pump.
Temperature is the pump temperature (K).
Pcf is the pump correction factor to account for loss in pump efficiency at lower pressures.

Background current is assumed to be constant.

The average pump correction factor (pcf) is calculated from an average of ozonesonde flow rates measured at NOAA/CMDL using an oil bubble flow meter inside an environmental chamber.

Pressure	(pcf)
5.0	1.255
7.0	1.191
10.0	1.137
20.0	1.074
30.0	1.056
50.0	1.041
100.0	1.025
300.0	1.007
1000	1.000

Expected Precision/Accuracy of Instrument:

Ozonesonde:

hPa	Accuracy	Precision	Resolution
1000	+/- 5%	+/- 4%	0.3km
100	+/- 5%	+/- 3%	0.3km
10	+/- 5%	+/- 3%	0.4km
4	+/- 10%	+/- 10%	0.4km

Vaisala RS80 Radiosonde Measurements of Pressure, Temperature and Relative Humidity

Pressure:
Resolution 0.1 hPa
Accuracy +/- 0.5 hPa

Temperature:
Resolution 0.1 K
Accuracy +/- 0.2 K

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

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InterMet iMet-1-RSB Measurements of Pressure, Temperature and Relative Humidity (PTU)

Pressure:
Resolution 0.01 hPa
Accuracy +/- 0.5 hPa

Temperature:
Resolution 0.01 K
Accuracy +/- 0.2 K

Relative Humidity:
Resolution 0.1% RH
Accuracy +/- 5 % RH

Geopotential Height:
Calculated using radiosonde PTU measurements.
Errors due to uncertainty in the PTU values.

Instrument History:

ECC Ozonesondes:

Manufacturer:	Model #	Time Period Used	Ozonesonde Design and Changes
Science Pump	1A	1967-1981	Rectangular pump/square Teflon sensor cell
			Thermistor at base of ozonesonde body
			Analog data acquisition
Science Pump	3A	1979-1982	Commutator moved to electronics board
Science Pump	4A	1982-1991	Cylindrical piston pump
Science Pump	5A	1990-1996	Digital data acquisition
			Pump Temperature thermistor epoxied to corner of pump block
Science Pump	6A	1996-present	Pump temperature thermistor inside of pump block
EN-SCI	1Z	1994-2000	Different manufacturer but the same design as Science Pump 6A
EN-SCI	2Z	1997-present	Circular molded plastic sensor cell

Boulder:
1A: April 1967 - June 1981
3A: September 1981 - June 1982
4A: June 1982 - December 1989
5A: June 1991 - October 1994
1Z: March 1994 - January 1999
6A: January 1997 - Present (Most before November 2005)
2Z: January 1998 - Present

Hilo
4A: September 1982 - July 1991
5A: July 1991 - December 1994
1Z: April 1994 - March 1998
6A: January 1997 - November 1998
2Z: July 1998 - Present

S.Pole

Samoa
4A: April 1, 1986 - January 23, 1990
1Z: August 8, 1995 - January 23, 1997
6A: January 30, 1997 - May 4, 2007
2Z: January 27, 2006 - Present

Solution Recipe Changes:
1967-1998 - 1% KI, 1.0x buffer
1998-2005 - 2% KI, no buffer
2005-present 1% KI, 0.1x buffer

Radiosonde changes:
1967-1991 - VIZ "A" radiosondes and analog data recording.
Feb 1991-2009 - Vaisala RS-80 radiosondes
May 2009-2020/2022 Intermet iMet-1 radiosondes
2020/2022-present Intermet iMet-4 radiosondes

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Switched from 1% KI buffered cathode solution to 2% KI unbuffered: March 4, 1998.
Switched from 2% KI unbuffered cathode solution to 1% KI 1/10th buffered: November 15, 2004.

Samoa:
Switched from 1% KI buffered cathode solution to 2% KI unbuffered: April 17, 1998.
Switched from 2% KI unbuffered cathode solution to 1% KI 1/10th buffered: October 22, 2005.