NOAA Dual-Beam UV Absorption Ozone Photometer

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Principle of Operation:

Ozone is measured *in situ* using a photometer consisting of a mercury lamp, two sample that can be periodically scrubbed of ozone, and two detectors that measure the 254-nm radiation transmitted through the chamber (*Proffitt et al.* [1983]). The ozone number density is calculated using the ozone absorption cross-section at 254 nm and the Beer-Lambert Law. Since the two absorption chambers are identical, virtually continuous measurements of ozone are made by alternating the ambient air sample and ozone-scrubbed sample between the two chambers. A flow of ambient air through the chambers is maintained with dynamic pressure at the inlet opening outside the fuselage. At a one-second data collection rate, the minimum detectable concentration of ozone (one standard deviation) is 1.5 x 10^{10} molecules/ cm^3 (0.6ppbv at STP). This instrument has a long and successful history of operation on the NASA ER-2 and WB-57 high-altitude research aircraft. Over 300 flights have been logged (~1800 flight hours) during stratospheric missions dating back to 1985. The instrument has most recently flown on the Tropical Composition, Cloud and Climate Coupling (TC^4) mission.

Instrument Specifications

Accuracy	3% + precision
Precision	1.5 x1010 molecules/cm^3
Weight	24 kg
Data rate	1 second
Power	250 W max. (28 VDC)

Partial Mission History

Missions and latitude coverage for NOAA-AL Ozone Photometer

Mission	Base Location	Lat range	Time Span	Platform	Hours
STEP	California	40N - 35N	1986	U-2	40
STEP	Darwin, Australia	37N - 30S	1987	ER-2	121
AAOE	Punta Arenas, Chile	37N - 72S	1987	ER-2	120
AASE	Stavanger, Norway	82N - 37N	1988 - 1989	ER-2	123
SAGE Validation	California	37N - 34N	1991	ER-2	11
AASEII	Bangor/Fairbanks	90N - 22N	1991 - 1992	ER-2	202
SPADE	California	60N - 14N	1992 - 1993	ER-2	114
ASHOE/MAESA	California/New Zealand	61N - 70S	1994	ER-2	283
STRAT	California/Hawaii	62N - 2S	1995 - 1996	ER-2	260
POLARIS	Fairbanks/Hawaii	90N - 3S	1997	ER-2	168
WAM	Houston	45N - 10N	1998	WB-57	51
RISO	Houston	34N - 28N	1999	WB-57	24
ACCENT	Houston	45N - 9N	1999	WB-57	45
SOLVE	Kiruna, Sweden	89N - 21S	1999 - 2000	ER-2	128
ACCENT2	Houston	30N - 4S	2000	WB-57	27
CAMEX-4	Jacksonville	16N-39N	2001	ER-2	83

Publications Describing the Instrument:

Proffitt, M. H., and R. J. McLaughlin, Fast-response dual-beam UV absorption ozone photometer suitable for use on stratospheric balloons, *Rev. Sci. Instrum. 54*, 1719-1728, 1983.

Proffitt, M. H. et al., Ozone loss in the Arctic polar vortex inferred from high-altitude aircraft measurements, *Nature, 347*, 31-36, 1990.

Proffitt, M. H., et al., Ozone loss inside the northern polar vortex during the 1991-1992 Winter, *Science, 261*, 1150-1154, 1993.

Richard, E. C., et al., Severe chemical ozone loss inside the Arctic polar vortex during Winter 1999-2000 inferred from *in situ* airborne measurements, *Geophys. Res. Lett*., 28, 2197-2200, 2001.