4.1.5. OZONESONDES

Table 4.5 summarizes the 1998-1999 CMDL ozonesonde projects. Nine sites, supplied by CMDL, launched one ozonesonde per week. The longest continuous ozonesonde records (>12 years data) are from Boulder, Colorado; MLO; and SPO. One United States site at Trinidad Head, California (August 1997), and the newest site at the University of Alabama-Huntsville (April 1999) are part of the NOAA "Health of the Atmosphere" Air Quality Research Program. These two sites and the Boulder site, represent a broad longitudinal transect across the United States that can be helpful in identifying the impact of anthropogenic emissions on tropospheric ozone levels during the general west-to-east flow across the continental United States.

SMO began launching weekly ozonesondes again in August 1995 as part of the Pacific Exploratory Mission in the Tropics (PEM Tropics). The PEM Tropics sites also included Papeete, Tahiti (July 1995) and Suva, Fiji (February 1997). The PEM Tropics A and B missions were designed to collect baseline data from aircraft platforms and ozonesondes in the South Pacific Basin to aid in the determination of the controlling factors related to the oxidizing power of the troposphere. The PEM Tropics missions ended in late 1999. However, Fiji and SMO continued operation under the Southern Hemisphere Additional Ozonesondes (SHADOZ) campaign. This project uses ozonesonde profile data to validate tropospheric ozone derived from satellite measurements in the tropics and subtropics [*Hudson and Thompson*, 1998]. Additional SHADOZ ozonesondes were launched at San Cristóbal, Galapagos, an island in the eastern equatorial Pacific (0.9°N, 110.0°W), for Special Observations of Ozone and Water in the Equatorial Region (SOWER), and on the NOAA ship *Ronald H. Brown*. The ship cruise went from Norfolk, Virgina, to Capetown, South Africa, and finally to Mauritius (east of Madagascar).

The third intensive field campaign for the Southern Oxidants Study (SOS) was conducted in the Nashville, Tennessee, area from June 15 to July 15, 1999. Daily ozonesondes were launched from Old Hickory, Tennessee. The SOS project included several research groups studying the formation of ozone in the troposphere and evaluating strategies to reduce pollution precursors leading to the high ozone levels often observed in the southern United States in the spring and summer months.

Daily ozonesonde measurements were flown at Kaashidhoo Observatory in the Maldives during early 1999 in a joint project with CMDL, National Aeronautics and Space Administration (NASA) Goddard, and the Center for Clouds, Chemistry and Climate, Scripps Institution of Oceanography (SIO) as part of the Indian Ocean Experiment (INDOEX). And finally, daily ozonesondes were flown in Boulder for 5 days in June of 1998 to provide ozone profiles for the International Photolysis Frequency Measurement and Modeling Intercomparison.

SPO is a key CMDL ozonesonde site. The continuous data set, beginning in 1986, characterizes the typical development of the yearly ozone hole over Antarctica. First signs of the ozone hole recovery will be observed by comparing future ozonesonde data to the long-term south pole record [*Hofmann et. al*., 1997]. Figure 4.2 shows the severe depletion that occurred in both 1998 and 1999, especially in the 14 to 21-km layer. Total ozone dropped by 64%, reaching 95 DU in 1998 and 90 DU in 1999. Table 4.6 lists the minimum total ozone values and the date on which they occurred since 1986.

TABLE 4.5. Summary of 1998-1999 Ozonesonde Projects

	1998		1999		
Ozonesonde Sites	Totals	Dates	Totals	Dates	Project
			Station (weekly)		
Boulder, Colorado	60	Full year	51	Full year	NOAA long term
MLO	44	Full year	47	Full year	NOAA long term
SPO	65	Full year	78	Full year	NOAA long term
Tahiti	33	Jan. 15-Nov. 24	54	Full year	PEM Tropics/SHADOZ
Fiji	42	Full year	53	Full year	PEM Tropics/SHADOZ
SMO	43	Full year	53	Full year	PEM Tropics/SHADOZ
Trinidad Head, California	47	Full year	44	Full year	NOAA "Health of the Atmosphere"
Huntsville, Alabama	0		30	April 20-Dec. 31	NOAA "Health of the Atmosphere"
Galapagos	19	March 25-Dec. 31	58	Full year	SOWER/SHADOZ
			Intensives (~daily)		
Old Hickory, Tennessee	0		30	June 14-July 15	Southern Oxidant Study
Kaashidhoo, Maldives	0		57	Jan. 27-March 28	CMDL/NASA/SCRIPPS
			Ship Cruise		
Atlantic Ocean	0		35	Jan. 15-May 10	SHADOZ NOAA ship *Ronald H. Brown*

PEM Tropics - Pacific Exploratory Mission in the Tropics (a global tropospheric experiment)
SHADOZ - Southern Hemisphere Additional Ozonesondes
SOWER - Soundings of Ozone and Water in the Equatorial Region

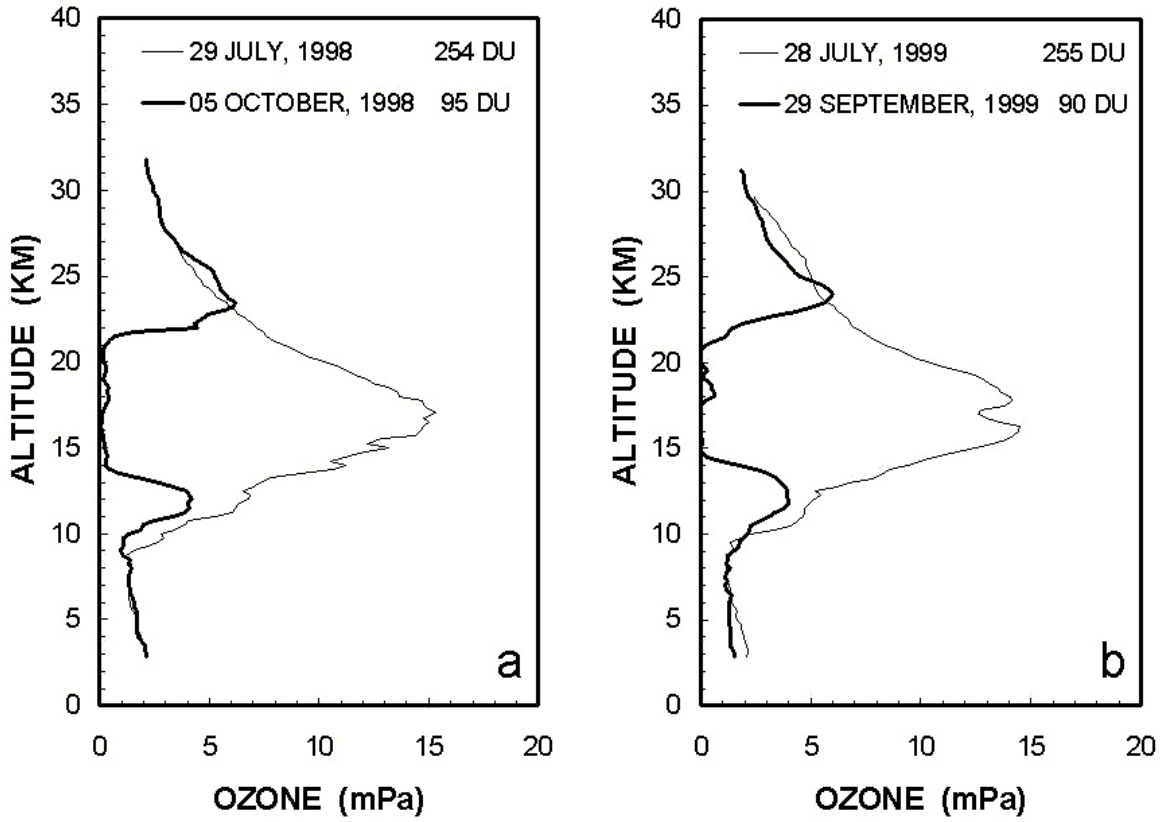

Fig. 4.2. Vertical profiles of ozone partial pressure in millipascals (mPa) at the South Pole Observatory during (a) 1998 and (b) 1999. The thin line represents the pre-depletion profile. The thick line is the profile observed during the minimum in total ozone.

TABLE 4.6. Summary of the Minimum Total Ozone Measured at SPO* and the Date of the Ozonesonde Flight

Year	Date	Total Ozone	Year	Date	Total Ozone
1986	Oct. 7	140	1993	Oct. 6	89
1987	Oct. 9	115	1994	Oct. 5	102
1988	Oct. 10	185	1995	Oct. 5	93
1989	Oct. 9	131	1996	Oct. 6	114
1990	Oct. 7	130	1997	Oct. 8	117
1991	Oct. 7	128	1998	Oct. 5	95
1992	Oct. 11	100	1999	Sept. 29	90

*The uncertainty is ±5 Dobson Units.