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MEASUREMENTS OF H_2O IN THE TERRESTRIAL MESOSPHERE AND IMPLICATIONS FOR EXTRA-TERRESTRIAL SOURCES; J.J. Olivero, Department of Meteorology, The Pennsylvania State University, University Park, PA 16802

Water vapor is an important minor constituent in the terrestrial mesosphere (approx. 50 km to 85 km or 10^{0} mbar to 10^{-2} mbar) and nearly coincident D-region ionosphere (~60 km to 90 km). Its photolysis products control ozone above the ozone mixing ratio peak; they are radiatively active, especially in the infrared; water sublimes to cause polar mesospheric clouds and possibly other suggested aerosol phenomena; the molecules cluster to form massive ions which dominate the chemistry of the lower ionosphere; and, finally, as the principal hydrogen compound below the mesosphere, it controls the global hydrogen budget and H escape rate.

During the last decade several measurement techniques have been employed to observe H_2O at these atmospheric levels; these are presented in Figure 1 with symbols given in Table 1.

Five of these data sets were produced by ground-based microwave radiometry (B1, SC, B2, OL, TS). These results were all contributed by a collaboration between The Pennsylvania State University and the Naval Research Laboratory, joined recently by the Jet Propulsion Laboratory. The observations cover all seasons but are limited to a small range of latitudes - 34N to 24N - over North America.

The second group (AK, GR, OE, RD, SN, WA) involve various aircraft and rocket techniques and were observed over a much wider range of latitudes.

Ground-based microwave measurements at mid-latitudes strongly support a very dry mesopause-lower thermosphere. Other measurements, [6] and [7], can be interpreted as being consistent with a high altitude or external source of H_2O. The latter process was not seriously considered until very recently--[12], [13] and [14]--however, these new hypotheses have profound implications for the upper atmospheres of all the planets [15].

The remainder of the talk will discuss the apparent qualitative limits that H_2O measurements to date place upon a downward H_2O flux above the mesosphere.

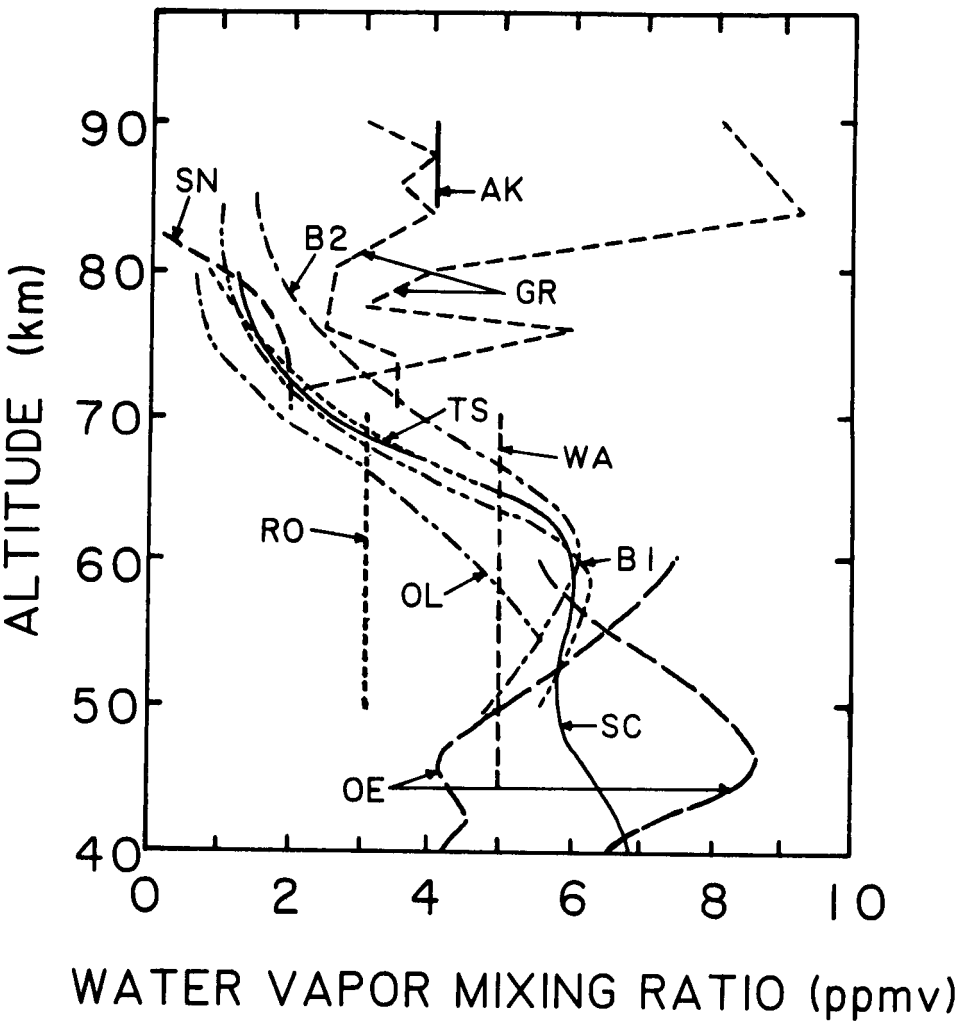

Figure 1. A collection of measurements of mesospheric water vapor from the past decade; symbols referenced in Table 1.

Table 1.

KEY TO SYMBOLS IN FIGURE 1

SYMBOL	REFERENCE		COMMENT
B1	Bevilacqua, et al. (1983).....	[1]	GROUND-BASED
SC	Schwartz, et al. (1983).....	[2]	MICROWAVE
B2	Bevilacqua, et al. (1985).....	[3]	RADIOMETRY
OL	Olivero, et al. (1986).....	[4]	MID-LATITUDES
TS	Tsou (1986).....	[5]	
AK	Arnold and Krankowsky (1979)..	[6]	MISCELLANEOUS
GR	Grossmann, et al. (1982).....	[7]	TECHNIQUES
OE	O'Brien and Evans (1981).....	[8]	-
RO	Rogers, et al. (1977).....	[9]	RANGE OF
SN	Swider and Narcisi (1975).....	[10]	NON-POLAR
WA	Waters, et al. (1980.....	[11]	LATITUDES

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