WATER VAPOUR ON MARS FROM MARS-EXPRESS PFS AND OMEGA MEASUREMENTS

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Introduction:

The water cycle is a key element of the martian climate, involving interactions between atmospheric reservoirs (water vapor, clouds), surface reservoirs (polar caps and perhaps permafrost), and atmospheric dust. Extensive monitoring of the water cycle has been performed in the past, primarily from Viking/MAWD (Jakosky and Farmer 1982), MGS/TES (Smith 2002, 2004), and with contributions from ground-based observations in the visible and millimeter wavelengths. While the main features of the water cycle are now understood for the most part (e.g. Montmessin et al. 2004), some aspects need to be observationally better characterized, e.g. the inter-annual variability, the geographical distribution of water, the details of the onset of the sublimation in the polar caps, and the vertical distribution of water as a function of season.

Observations and goals:

Mars Express carries three instruments capable to map and monitor the water vapor content of the Martian atmosphere: SPICAM – at 1.38 µm, OMEGA – at 2.56 µm and PFS – at 2.56 µm and 30-50 µm. We will present results based on PFS and OMEGA data. We will focus on

1. The inter-comparison between results obtained from the two instruments, and from the different wavelength range.
2. The longitudinal distribution of water vapor at mid-latitudes and its relation to atmospheric dynamics and potential subsurface sources
3. The spatial distribution in polar regions during periods of water maximum
4. The vertical distribution of water
5. The HDO abundance and the search for possible variations in the HDO/H_2O ratio

Preliminary results are illustrated in the figures below.

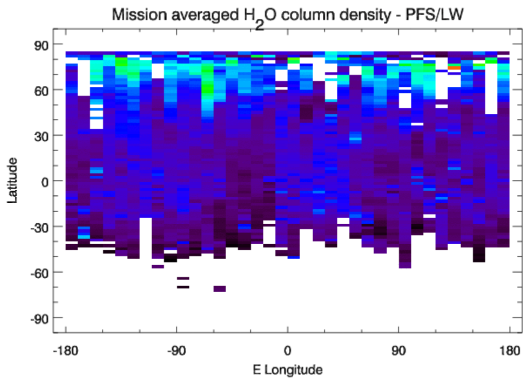

Figure 1: Maps of mission averaged water vapour column abundance retrieved by PFS/LW divided by (psurf/610 hPa) to remove the effect of topography.

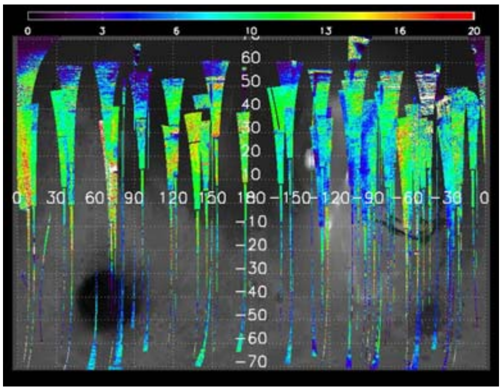

Figure 2: A map of the H_2O column density for Ls = 330 – 40° (OMEGA Orbits 6-520), as a function of latitude and longitude.

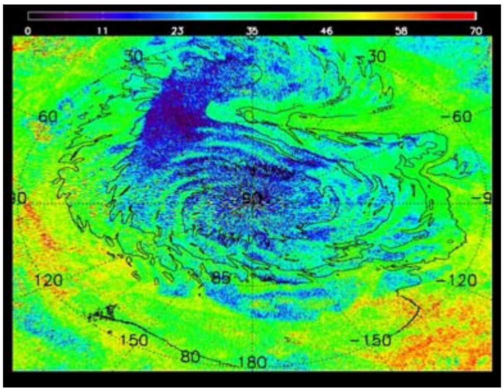

Figure 3: H_2O column density from OMEGA data, over the northern polar cap (lat. > 80N), integrated over the period Ls = 101-115°. The water vapour content over small-grained parts of the water ice cap is underestimated (dark blue regions above latitude of 82°)

References:

- Encrenaz et al. 2005, A & A, 441, L9
- Jakosky and Farmer, 1982, JGR, 87, 2999
- Melchiorri et al. PSS, submitted
- Smith, 2002, JGR, 107, E11, 5115
- Smith, 2004, Icarus, 167, 148