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A SPECTRAL SYNERGY METHOD APPLIED TO PFS AND SPICAM NADIR OBSERVATIONS TO CONSTRAIN NEAR-SURFACE WATER CONTENT IN THE MARTIAN ATMOSPHERE

Abstract

In this study we have applied a novel spectral synergy method in the retrieval of water vapor on Mars with measurements from nadir-pointing instruments. Water vapor column abundances were retrieved simultaneously with PFS (sensing the thermal infrared range) and SPICAM (sensing the near-infrared range) on Mars Express, yielding distinct yet complementary sensitivity to different parts of the atmospheric column. We show that by exploiting a synergy retrieval approach, we obtain more accurate water vapor column abundances compared to when only one instrument is used, providing a new and highly robust reference climatology from Mars Express. The synergy also provides a rough resolution of the vertical distribution of water vapor, which remains out of the scope of classical nadir observations. Special attention is given to the polar regions, with extra focus on the sublimation of the north seasonal polar cap. The results are compared to the Mars Climate Database, and significant differences were discovered. Deviances between synergy and model in both magnitude and meridional variation suggesting that certain aspects of the transport and dynamics of water vapor are not fully captured by current models.