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Wave activity in the circumpolar water cycle during the MY26 aphelion season inferred from Mars Express/OMEGA data

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Imaging spectrometer OMEGA onboard the Mars Express spacecraft has been operational on Mars orbit since November 2004 and has delivered numerous bright discoveries. In particular, the instrument is capable of mapping NIR spectra of the outgoing radiation in the region 1-2.65 μm, where spectral features characteristic of both water vapor and condensed forms of water (bound water, frost and ice) are located. In this work we are focusing on the MY26 aphelion campaign that resulted in continuous mapping of the North polar region of Mars with excellent coverage at Ls=93^o -150^o . After comprehensive atmospheric corrections, which include elimination of CO2 features based on the European Mars Climate Model and water vapor absorption according to MGS/TES observations, the data of OMEGA NIR channel have been treated to retrieve spectral indices of surface water ice, based on 1.03, 1.2 and 1.5 μm bands, with the relationships between three H2O ice features implying the estimate of ice grain size. Bound water has been mapped based on 1.93 μm feature. The zonal distribution of the retrieved amounts of ice and bound water around the North pole and, frost microphysical structure and its seasonal evolution suggest the strong contribution of stationary and quasi-stationary planetary atmospheric waves residing in the circumpolar vortex, to the water cycle during the aphelion season. The results are consistent with simulations of the Mars water cycle we carried out with help of the GFDL General Circulation model. Changing phase and leading zonal wavenumber of the circumpolar traveling wave occurring at Ls=97^o and 120^o results in enhanced transport of bulk water out of the North polar cap within several thin corridors. A por-

tion of advected water is brought back by the Hadley cell circulation producing fresh, fine-grained frost deposits. Bond water is also evolving according to the atmospheric water cycle, revealing more inertial behavior and more asymmetric distribution.

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