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# Wavelike hydration patterns in the Mars North polar region retrieved from Mars Express/OMEGA data

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C channel of the imaging spectrometer OMEGA onboard the Mars Express spacecraft is capable of mapping NIR spectra of the outgoing radiation in the range of 1-2.65 $\mu$m, where spectral features characteristic of both water vapor and condensed forms of water (bound water, frost and ice) are located. We have analyzed data related to mapping of the North polar region of Mars during the aphelion season, when most intense equatorward water transport is taking place in the Mars climate system. After comprehensive atmospheric corrections, which include elimination of $CO_2$ features based on the European Mars Climate Model and water vapor absorption according to both GCM modeling and MGS/TES observations, spectral indices of surface water ice, based on 1.03, 1.2, 1.5 and 2 $\mu$m bands, with the relationships between $H_2O$ ice features implying the estimate of ice grain size have been retrieved. Based on 1.41 $\mu$m and 1.93 $\mu$m features, we have mapped bound water in the polar region. The zonal distribution of the retrieved indices of ice and bound water around the North pole and its seasonal evolution suggest the strong contribution of stationary and quasi-stationary planetary atmospheric waves with zonal wavenumbers of 2 and 3, 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. In addition to planetary scale wavelike features, bound water reveals small-scale irregular wavelike patterns with wavelength ranging from 50 to 250 km, probably reflecting highly nonlinear processes of water exchange between the atmosphere and surface/subsurface inventory.

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