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Search for signature of the atmosphere-surface interactions in the seasonal Martian water cycle based on OMEGA/Mars Express data.

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Abstract

OMEGA/Mars Express instrument is operating at the Martian orbit since 2004. We present the analysis of OMEGA data collected by detector C (1-2.6 μm range) during 2 Martian years of observations. Atmospheric contribution to the observed spectra has been eliminated for each spectrum observed using GCM and observations results. We mapped water ices and frosts using synthetic spectral indices at 1.25, 1.5 and 2 μm, CO_2 ices - using 1.43 μm index, and hydrated minerals using 1.93 μm.

Hydrated mineral index behavior shows significant seasonal trend: spring-to-summer global migration from medium latitudes to poles was observed. In turn water ice reveals evident changes in the microstructure during summer season both for North and South polar caps.

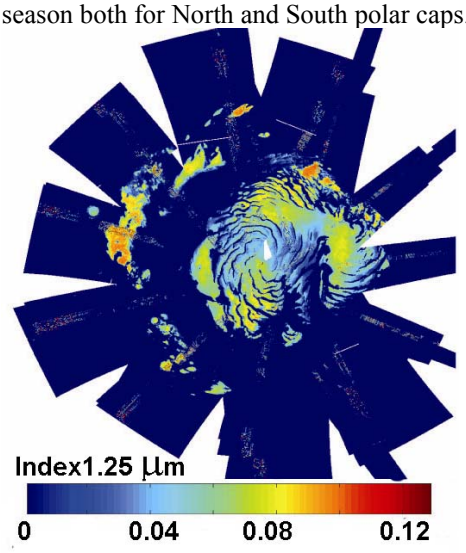

Figure 1: Water ice index 1.25 μm distribution at the residual North polar cap region.

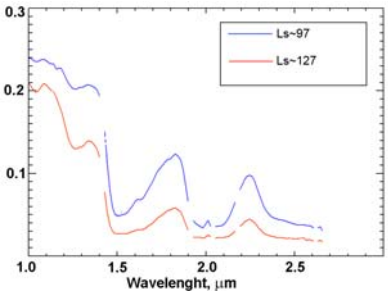

Figure 2: Evolution of spectra in the northern polar cap region (~ 84º N, 20º E)

To analyze the changes in the microstructure we calculated synthetic spectra of granulated ices using two approaches: the discrete dipole approximation (DDA) and a multiple scattering approximation without taking into account near-field effects. Both simulations show the sensitivity of 1.25 μm index to grain size. DDA result in effectively smaller ice grains than calculation based on simple multiple scattering, so that aggregates of small grains act as single granules while producing the effective reflectance spectrum.

The spectrum seasonal evolution demonstrates increase of the effective particle size during summer period that can reflect the sublimation and re-crystallization processes. Non-uniform distribution of the index 1.25 μm value, sensitive to water ice grain size, resembles wave-like structures for some periods during north and summer season (Ls=120º, 145º, 180º, 225º), when GCM simulations predict remarkable wave activity.

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References

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