One martian year observation of H2O ice clouds by OMEGA/MEX.

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Introduction:

The OMEGA imaging spectrometer aboard Mars Express has completed its first mapping year of the Martian surface. As a standard product of the data retrieval, we are able to extract the quantity of water ice that absorbs photons around the 1.5 µm band. As a result, OMEGA is capable of spectrally identifying water ice clouds that evolve in the Martian atmosphere at all seasons and latitudes. In addition, the imaging capability and the spatial resolution offers the possibility to study Martian water ice clouds with an unprecedented wealth of details. Data will be presented and compared to the predictions made by recent LMD/water cycle model (Montmessin et al., 2004).

Method:

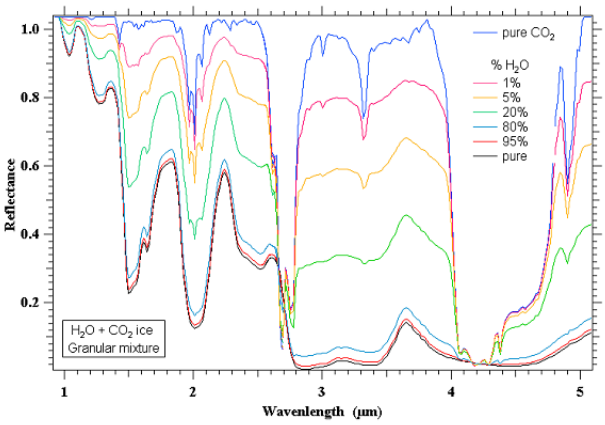
We use the 1.5 µm (typical of H2O ice) band depth, the 1.25µm (typical of the grains sizes) and the 1.35µm band (typical of the CO2 frost) (B. Schmitt, fig 1). In theory, we should be able to discriminate H2O ice clouds from H2O and/or CO2 frosts, as the small crystals that compose water ice clouds should bear a strong signature at 1.5 µm but not at 1.25 µm. In practice, such distinction can not be always made since water ice deposition on the surface sometimes occurs through precipitation of small icy grains and frost can therefore be confused with atmospheric features. The spatial resolution of OMEGA gives the possibility to image clouds, and in particular near topographic features, where clouds are known to concentrate on Mars. In figure 2, one can see an example of clouds forming near the North polar cap in summer. This feature lasted only a few days.

Comparison with model:

The LMD/MGCM (Forget et al., 1999) now incorporates a representation of the Martian water cycle (Montmessin et al., 20 (exchanges with the regol model proves able to repro cycle of the water vapor a tions. With almost a full by Mars Express, OMEGA clouds all over the Martian surface. As an illustration, we map the evoluti strength as a function of proach northern spring and tive motion is taking plac and water that has been r CO2 frost recession and fr self, has been conveyed to the well-known Aphelion Cloud Belt that appears evidently in OMEGA data (Figure 3). While this cloud feature is usually reproduced by models, some discrepancies nonetheless remain in terms of longitudinal structure. We plan to perform a systematic comparison with the model outputs in order to give a thorough interpretation of the OMEGA data. In turn, we will analyze seasons and locations where model Predictions appear contradicted by the observations.

References :

F. Montmessin, F.Forget, P.Rannou ,M.Cabanne. The origin and role of water ice clouds in the Martian water cycle as inferred from a General Circulation Model.



B. Schmitt, S. Douté discrimination between solid, liquid and gaseous H2O and assessment of H2O temperature by spectroscopy using OMEGA imaging spectrometer

Figure 1 : Laboratory simulations of granular mixture of H2O and CO2 snows (B. Schmitt, Laboratoire de Planétologie, Grenoble, France)