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Interannual variations of ice clouds and ozone from SPICAM nadir measurements

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Abstract

The SPICAM UV spectrometer measurements onboard Mars Express have been collected for more than two Martian years. The Martian ozone column and water ice cloud optical thicknesses were retrieved from SPICAM UV nadir mode measurements. An interannual comparison and some cases of correlation in ozone and cloud distributions were analysed.

Introduction

The Martian ozone is one of the most important minor species in the Martian atmosphere. The ozone content is closely related to the odd hydrogen species abundance and, hence, to the Martian water vapour cycle. The Martian water ice clouds are also connected with the water vapour cycle. Here we compare ozone and water ice cloud distributions obtained from more than two Martian years of SPICAM UV spectrometer measurements in nadir mode.

SPICAM spectrometer onboard Mars Express has been operating from 9 Jan. 2004 (MY 26, solar longitude L_s=331°) till 10 Feb. 2008 (MY 29, solar longitude L_s=30°) (Fig.1). The wavelength range of measurements was 118-320 nm but the 118-200 nm CO_2 band was always saturated in case of the nadir mode and only the domain 200-300 nm was used. The domain contains ozone Hartley band centred at 255 nm that permits ozone retrieval. Water ice clouds can be easily detected as bright features on the dark Martian surface background due to the low surface UV albedo and absorptive properties of the Martian mineral dust in the UV domain [1].

The retrieval procedure

The following factors must be taken into account in ozone retrieval procedure: the surface albedo, dust, clouds and ozone. Here we introduce a simplification and consider the surface albedo as wavelength independent in the domain 200-300 nm. The Martian dust absorbs in the domain showing wavelength dependent optical properties [1]. The domain 200-300 nm was divided in sub-domains: 210-215 nm, 250-260 nm and 295-300 nm that are particularly sensitive to dust, ozone and albedo. These parameters were consequently retrieved by fitting the reflectance in the three domains. The ice clouds were retrieved by using the reflectance in the sub-domain 295-300 nm [2]. The surface albedo values utilized in the cloud retrieval procedure were obtained using non-cloudy orbits. The areas covered by seasonal ices were excluded.

Summary

The retrieved zonally averaged ozone column (in µm-atm) and water ice cloud optical thicknesses as function of time are presented on the Figs 2 and 3 below. The MY 27 ozone map was presented in [3]. We will present the results of two MY: 27 and 28 with interannual comparison. In some cases the ice clouds show correlation with ozone as it is possible to see from Figs 2 and 3. All such cases will be carefully analysed.

References

[1]Mateshvili, N. et al. (2007), *Adv. Space Res., 40,* DOI:10.1016/j.asr.2007.06.028

[2] Mateshvili, N. et al. (2007), *JGRE 112,* DOI:10.1029/2006JE002827;

[3] Perrier, S., et al., (2006), *JGRE*, *111*, DOI:10.1029/2006JE002681.

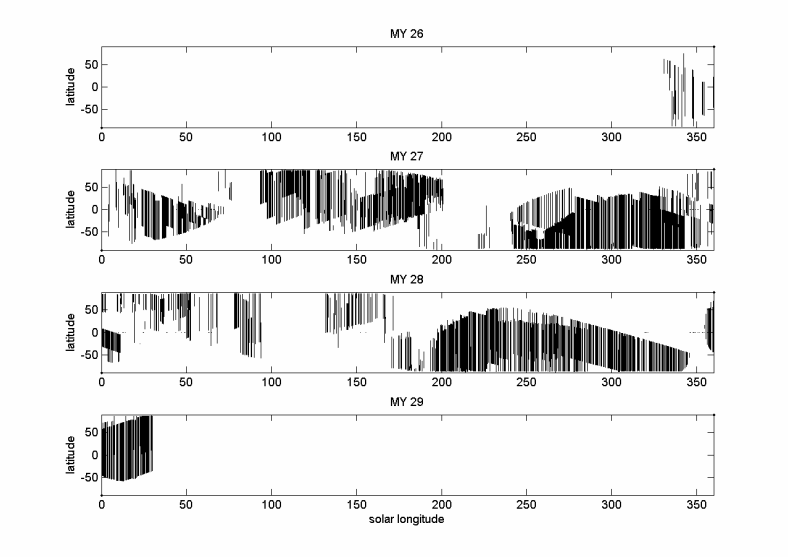

Fig. 1 SPICAM orbit distribution

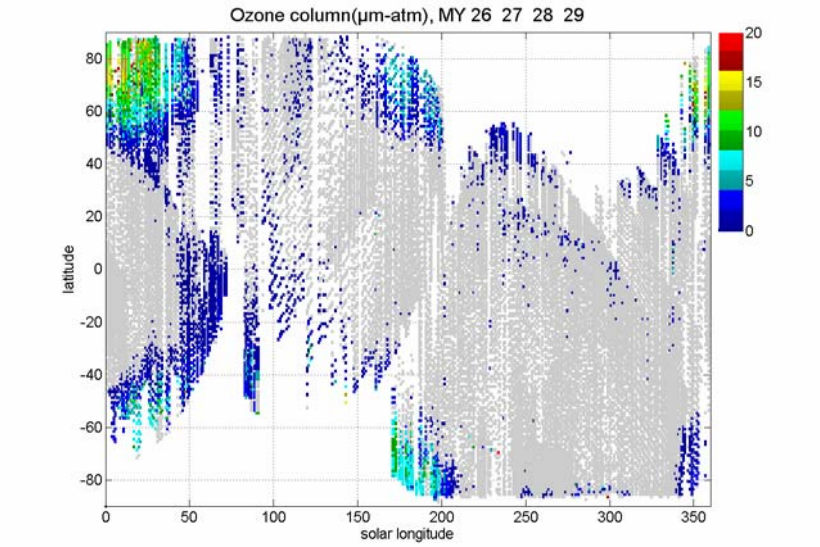

Fig. 2 Ozone spatial and temporal distribution (grey colour shows orbit distribution)

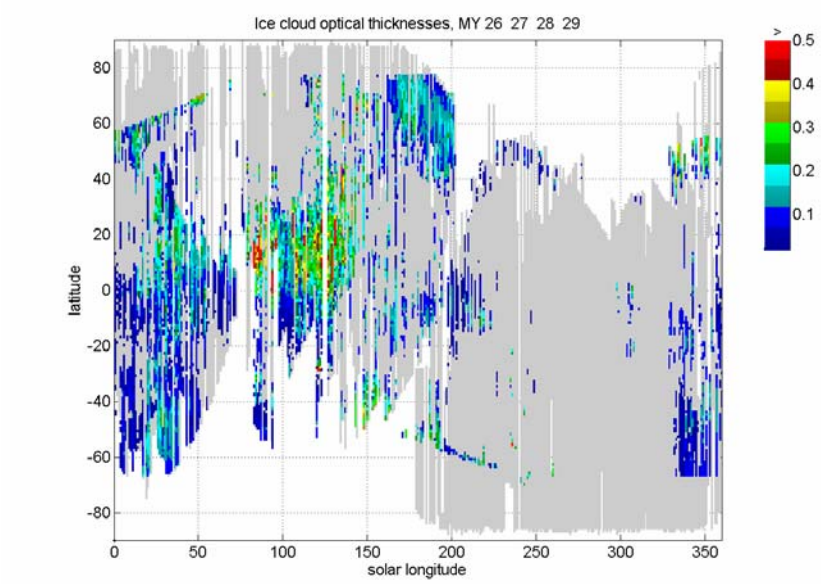

Fig. 3 Ice cloud spatial and temporal distribution (grey colour shows orbit distribution)