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# Mapping of the optical depth of aerosols above the south polar cap of Mars using OMEGA near-IR data.

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We have performed the mapping of the optical depth of aerosols at 2.6$\mu$m above southern surfaces of Mars covered with $CO_2$ ice free of dust using OMEGA. From mid-spring to mid-summer, the south seasonal cap of Mars has been extensively observed in the near-IR range by the OMEGA imaging spectrometer on board Mars Express. Southern ice-covered regions of Mars are predominantly composed of $CO_2$ ice with a saturated band at 2.6- 2.65$\mu$m [1]. The atmospheric $CO_2$ gas band at 2.7$\mu$m has no impact on OMEGA reflectance data before 2.65$\mu$m. Observations at different incidence angles and EPF sequences demonstrate that the signal at 2.6-2.65$\mu$m is almost entirely due to the light scattered by aerosols in most places of the cap, with only a minor contribution of the surface. This is not observed when the surface is significantly contaminated by dust, e.g. in the cryptic region [2]. Using look-up tables populated by a Monte-Carlo based model of radiative transfer [3], it is then possible to map the total optical depth of aerosols at 2.6$\mu$m above clean regions of the cap from mid-spring ($L_S \sim 220^\circ$) to mid-summer ($L_S \sim 300^\circ$). The temporal scale of the mapping ranges from 2$^\circ$ of $L_S$ to 0.5$^\circ$ of $L_S$ ($\sim$1 Martian day). The spatial resolution ranges from 1 to 10 km depending on the altitude of Mars Express. The extent of the regions where we can infer the optical depth decreases as the recession of the seasonal cap goes on from 65$^\circ$S to the perennial cap. The optical depth of aerosols shows complex variations with time and location. The mean optical depth is low at $L_S \sim 220^\circ$, ranging from 0.1$^\circ$ to 0.2$^\circ$. A transient dust cloud (optical depth of $\sim$ 0.4) is observed during this period. After $L_S \sim 240^\circ$, the optical depth significantly increases at the edge of the cap whereas it remains lower above the perennial cap which is at high altitudes. During this period strong variations of the optical depth are observed in short time scale (e.g from 0.2 to 0.7 in 1 martian day).

[1] Langevin et al., *J. Geophys. Res.*, accepted (2007). [2] Langevin et al., *Nature*, 442, 7104, 790 (2006). [3] Vincendon M. et al., *J. Geophys. Res.*, accepted (2007).