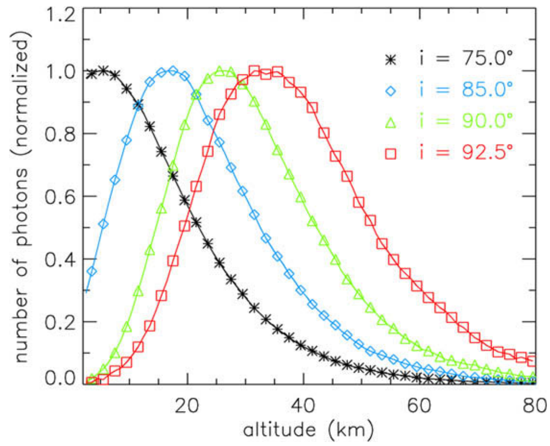

Fig. 9. Altitudes at which photons that reach the surface have been scattered by aerosols, for four solar zenith angles *i*. Aerosols properties corresponding to martian dust are used (see Table 1; the dust scale height is 11.5 km). The total optical depth is 0.5. The altitude of interaction of photons increases with the solar zenith angle. At ±3° of the terminator, photons that are collected by the instrument have been first scattered high in the atmosphere (∼20–40 km).

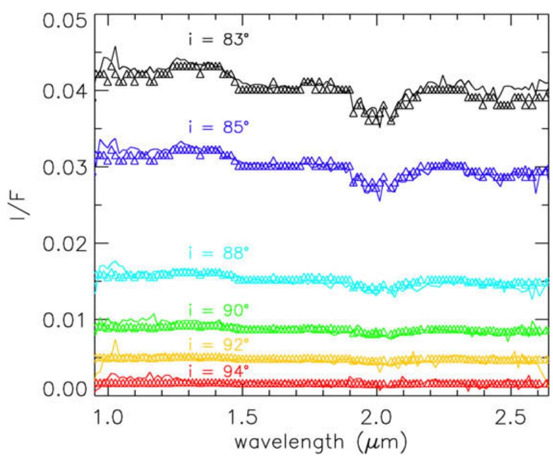

Fig. 10. Observed near-IR spectra extracted from the observation of Fig. 8b (thin lines) for six solar zenith angles (from top to bottom, 83°, 85°, 88°, 90°, 92°, 94°). These observations can be reproduced with the model (symbols) with an optical depth of 0.19 at 1 μm that linearly decreases to ∼0.1 at 2.5 μm, a scale height of 6 km for all wavelengths and a surface albedo spectrum extracted from a previous observation at low aerosols contribution.

3.3.3. Surface retrievals

In Section 3.3.1, we were able to simultaneously retrieve the surface albedo and the aerosol properties because we selected observations for which the surface albedo is approximately constant for the observed range of solar zenith angles. To retrieve a surface albedo map of an inhomogeneous region observed around the terminator, we need to first constrain the aerosols properties of such a region, and then to apply the model over a broader region by assuming no major change in the aerosol properties. An example of this approach is shown in Fig. 12. The selected data was obtained a few days before the southern fall equinox, during which time the Sun is a few degrees above or below the horizon at the highest latitudes. We first retrieve the aerosols properties by focusing on the larger solar zenith angles of the observations (similarly to Fig. 8a), as the aerosol contribution dominates in that range: an optical depth of 0.1 and a scale height of 6 km are derived. These parameters are then used to retrieve the albedo map of the surface for all elements in the observation. As shown by Fig. 12, the surface albedos as corrected for the aerosol contribution are quite consistent with those at lower incidence angles (obtained earlier in the season, but during other martian years). This suggests that no major interannual or seasonal changes appear to have occurred in that region.

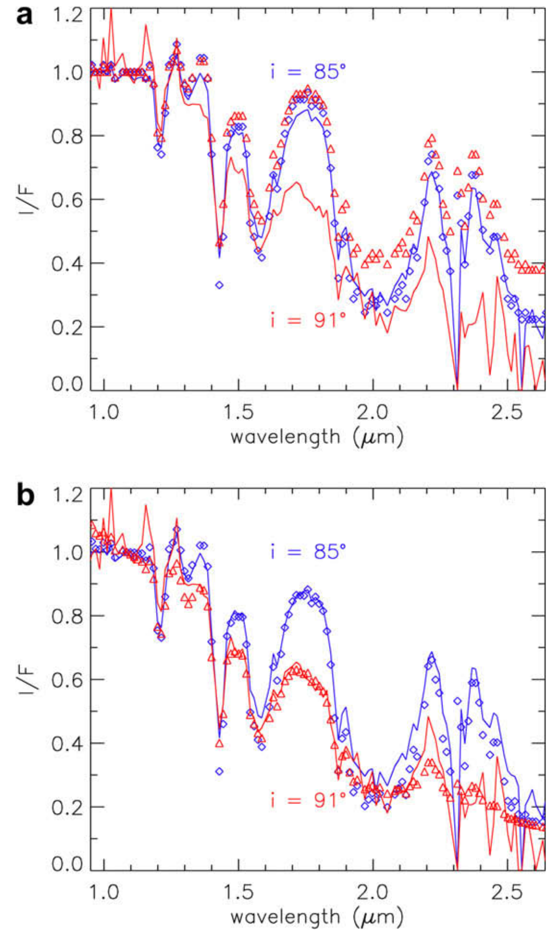

Fig. 11. A similar CO_2 ice surface is observed at $i = 85°$ (blue diamonds) and at $i = 91°$ (red triangles). The observation has been obtained in the south polar regions of Mars at L_S 175°. Observations are in thin solid line, and model results in symbols. Two different hypotheses regarding the scale height are implemented: (a) constant scale height of 6 km; (b) the scale height linearly decreases from 6 km at 1 μm to 5.7 km at 2.5 μm. Observations cannot be simultaneously reproduced with a constant scale height (Fig. 11a), while a decreasing scale height with wavelength provides a better match (Fig. 11b). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

3.4. Titan

The observed reflectance (I/F) variations of a dark region of Titan with solar zenith angles ranging from 60° to the terminator are shown in Fig. 14. The observed region covers longitudes between 25°E and 55°E at 5°S and appears effectively homogeneous. The observation was taken on September 7 of 2006. Solving for the optical depth, the albedo of the surface and the scale height of aerosols produces a good model fit at all near-IR wavelengths (Fig. 13). The ''best-fit'' scale height is 80 ± 10 km. This number is compatible with the mean value of 65 km ± 20 km at altitudes higher than 80 km retrieved by Tomasko et al. (2008), particularly considering our use of the simplifying assumption of a constant scale height. The retrieved surface albedo and optical depth spectra are shown in Fig. 14. The retrieved optical depth at 1.08 μm is 2.3 ± 0.5, which is consistent with the value of 2.6 derived from Huygens probe entry dataset of January 2005 (Tomasko et al., 2008). Fitting the retrieved optical depth spectrum with a power