EFFECT OF MARTIAN SUSPENDED DUST ON ALBEDO MEASUREMENTS FROM THE MGS-TES DATA.

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Introduction: The airborne dust on Mars greatly influences the albedo measurements collected by orbiting instruments, even if this is not necessary related to a real change in surface albedo. The aim of this study is to accurately characterize its effect on the measurement of albedo by remote sensing instruments, using the data acquired by the NASA's Mars Global Surveyor Thermal Emission Spectrometer.

Observations: The data has been acquired over three different regions of Mars, with different surface albedo: Syrtis Major has a very low albedo (< 0.12), Protei has albedo of roughly 0.15, while Solis Planum is a typical bright region (albedo > 0.25). The use of the DCI parameter described by [1] made it possible to group data on the basis of their surface dust load, a good indicator of surface albedo. The data so grouped are then lineraly fitted for low atmospheric opacities. The linear fit has been chosen since in clear atmospheric conditions the single-scattering approximation can be used [2]. For larger opacities this approximation is not valide anymore and, hence, a 2nd order degree polynomial has been used to fit the data. It is worthy to note that, in order to have data at very low opacities (hardly to be found on Mars) the point at τ = 0 retrieved by the linear fit has been added to the data for the polynomial fit.

Even if for Protei and Solis the 2nd order degree polynomial fits work well (Fig. 1), over Syrtis a different behaviour is shown. In particular when the atmospheric opacity returns low after a very dusty period the albedo remains higher than that measured before the storm. This phenomen has been already observed by [3] using Viking IRTM dataset and a different dust amount on the surface was hypothesized to explain it.

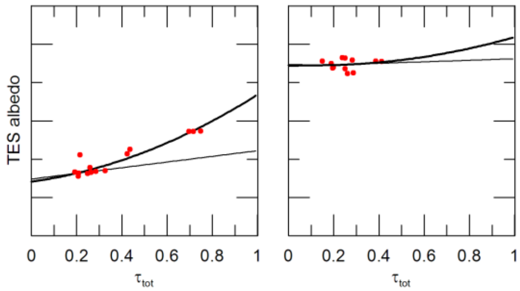

Figure 1: Comparison between data (red points), linear fit (thin line) and polynomial fit (thick line) for Protei (left) and Solis (right)

However at that time no DCI analysis was performed. On the contrary, using this parameter we have been able to show that the amount of dust on the surface before and after the storm is different. This is well shown in Fig. 2 where the last point of the period immediately after the storm, albeit showing low τ has a very low DCI value and, consequently, relatively high albedo.

Hence the hypothesis made by [3] can now be robustly confirmed. The dust deposited by the storm remains for some months after the end of the storm, when it is finally removed by winds.

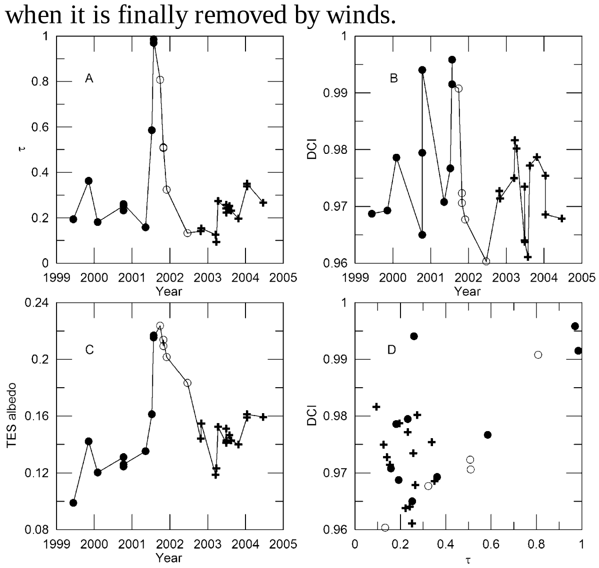

Figure 2: Variation of atmospheric dust opacity, DCI and albedo over Syrtis region. A) τ vs time; B) DCI vs time; C) albedo vs time; D) DCI vs τ. Black dots are for P1 data (before the storm), white dots for P2 (immediately after the storm) and crosses for P3 (after the storm).

Hence using for Syrtis only data acquired before the storm and with high DCI (i.e. low surface dust) the 2nd order degree polynomial fit work well. In addition it can be noted that, as predicted by theory, for data with low atmospheric opacity the linear fits approximate well the polynomial fits used over the entire range (Fig. 1).

Model: We then used a radiative transfer model designed for Mars [4] to compare the results of observations with synthetic data. The model use optical constants by [5] for dust and surface characteristics taken by [6]. We investigated the effect that different aerosol grain sizes have on the retrieving of albedo, by running the model with two different grain sizes (i.e. 0.5 and 1.2 μm).

Results: In Figure 3 the comparison between model and the polynomials describing data is shown. It is clear that the model with small grain size best fits the data for both dark and bright surfaces.

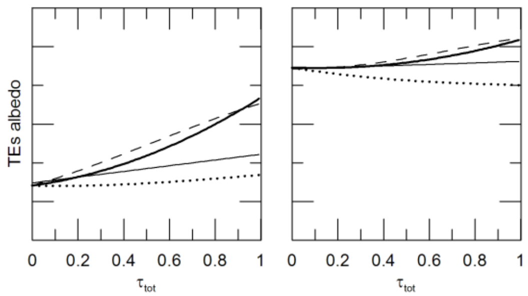

Figure 3: Comparison between the fits to the data and the models. On the left: Protei. On the right: Solis. Thin line is linear fit, thick line polynomial fit, dashed line model with 0.5 μm dust and dotted line model with 1.2 μm dust.

References: [1] Ruff, S. W. and Christensen, P. R. (2002), *JGR*, 107 (E12). [2] Erard, S., Mustard, J., Murchie, S., Bibring, J.-P., Cerroni, P., Coradini, A. (1994), *Icarus*, 111, 317-337. [3] Christensen, P. R. (1988), *JGR*, 93(B7). [4] Ignatiev, N. I., Grassi, D., Zasova, L. V. (2005), *Planet. Space Sci.*, 53, 1035-1042. [5] Ockert-Bell, M. E., Bell, J. F., Pollack, J. B., McKay, C. P., Forget, F. (1997), *JGR*, 102 (E4), 9039-9050. [6] Erard, S. And Calvin, W. (1997), *Icarus*, 130, 449-460.