Martian atmospheric dust cycle: Transported mass, surface dust lifting and sedimentation rates

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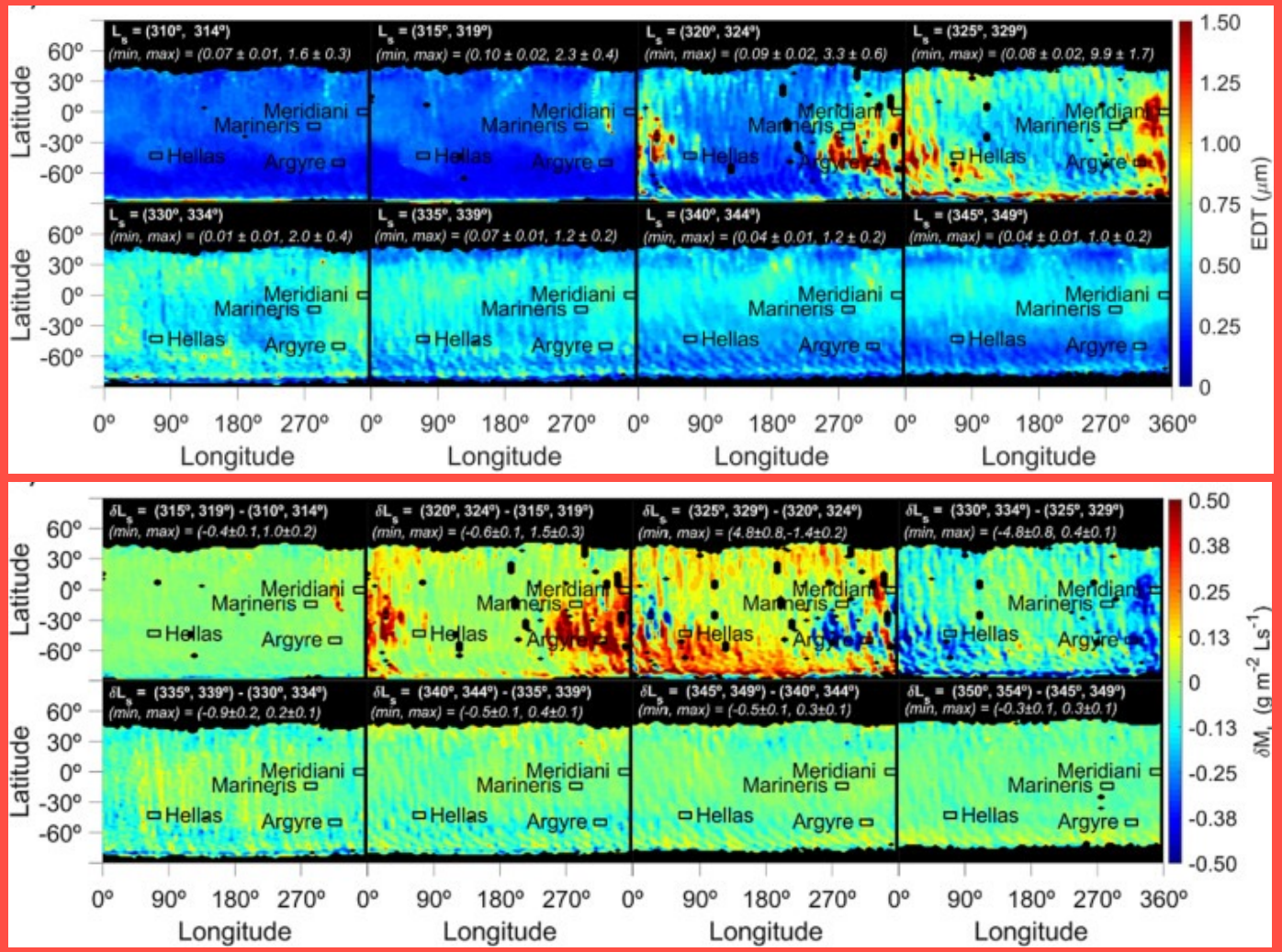

Mars atmospheric dust cycle during a period of dust activity (Top) Equivalent total dust thickness (EDT) (in μm) of atmospheric dust in suspension and (Bottom) dust lifting/sedimentation rates.

The atmospheric dust cycle on Mars plays a dominant role in the planetary radiative balance, atmospheric photochemistry escape, and redistribution of materials on the surface. Although this planetary dust cycle has been extensively modelled and characterized with both orbital and in situ observations, to date little is known about the total mass of dust that is circulated, the actual dust lifting and settling rates, and the main dust sources and sinks. We characterize this cycle using the 9.3 μm infrared observations of the Thermal Emission Spectrometer (TES) aboard the Mars Global Surveyor (MGS).

The analysis shows an estimation of **400 10^{12} g of dust transported globally in the atmosphere for a typical Mars year**, which is comparable with the minimum total annual mass of dust transported on Earth. The analysis of the dust sedimentation cycle suggests that the annual cycle might produce a **sedimented dust layer of about 50–100 μm on the surface** of some particular zones, as Valle Marineris or Meridiani Planum. This estimation agrees with in-situ observations of rovers on Mars. The potential dust sources are mainly located from latitudes of 20ºS to 60ºS. Our results find the 70% of the sources previously identified by the existing planetary circulation models.

LÓPEZ-CAYUELA, M.-A., ZORZANO M.-P., GUERRERO-RASCADO, J.-L AND CORDOBA-JABONERO C. 'QUANTITATIVE ANALYSIS OF THE MARTIAN ATMOSPHERIC DUST CYCLE: TRANSPORTED MASS, SURFACE DUST LIFTING AND SEDIMENTATION RATES'. ICARUS, VOL. 409, FEB. 2024, P. 115854. HTTPS://DOI.ORG/10.1016/J.ICARUS.2023.115854.