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P33I-06: Global Albedo Variations on Mars from Recent MRO/MARCI and Other Space-Based Observations

Wednesday, 13 December 2017
14:55 - 15:10
New Orleans Ernest N. Morial Convention Center - R04-R05

Dramatic changes in Mars surface albedo have been quantified by telescopic, orbital, and surface-based observations over the last ~40 years. These changes provide important inputs for global and mesoscale climate models, enabling characterization of seasonal and secular variations in the distribution of mobile surface materials (dust, sand) in the planet's current climate regime. Much of the modern record of dust storms and albedo changes comes from synoptic-scale global imaging from the Viking Orbiter, Mars Global Surveyor (MGS), Hubble Space Telescope (HST), and Mars Reconnaissance Orbiter (MRO) missions, as well as local-scale observations from long-lived surface platforms like the Spirit and Opportunity rovers. Here we focus on the substantial time history of global-scale images acquired from the MRO Mars Color Imager (MARCI). MARCI is a wide-angle multispectral imager that acquires daily coverage of most of the surface at up to 1 km/pixel. MARCI has been in orbit since 2006, providing six Mars years of continuous surface and atmospheric observations, and building on the nearly five previous Mars years of global-scale imaging from the MGS Mars Orbiter Camera Wide Angle (MOC/WA) imager, which operated from 1997 to 2006.

While many of the most significant MARCI-observed changes in the surface albedo are the result of large dust storms, other regions experience seasonal darkening events that repeat with different degrees of annual regularity. Some of these are associated with local dust storms, while for others, frequent surface changes take place with no associated evidence for dust storms, suggesting action by seasonally-variable winds and/or small-scale storms/dust devils too small to resolve. Discrete areas of dramatic surface changes across widely separated regions of Tharsis and in portions of Solis Lacus and Syrtis Major are among the regions where surface changes have been observed without a direct association to specific detectable dust storm events. Deposition following the annual southern summer dusty season plays a significant role in maintaining the cyclic nature of these changes. These and other historical observations also show that major regional or global-scale dust storms produce unique changes that may require several Mars years to reverse.

Plain Language Summary

We are using time-lapse images from instruments like the Mars Color Imager (MARCI) on the Mars Reconnaissance Orbiter mission to study surface albedo changes on scales > 1 km over the past six Mars years. In this presentation we summarize the recent historic record of surface changes on Mars, characterize the nature of these changes in terms of various hypothesized surface/atmospheric interaction processes, and qualitatively conjecture on the implications of these processes for ongoing surface changes and future human exploration of the Red Planet.

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