Geophysical Research Abstracts
Vol. 19, EGU2017-82, 2017
EGU General Assembly 2017

A Comparison of Terrestrial GCM Data to Wind Streaks

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'Wind streaks' is a collective term for a variety of aeolian features that when viewed from above appear as distinctive albedo surface patterns. They have been widely studied, particularly on Mars and Venus and to a much lesser extent on Earth. In imagery, these streaks appear as elongated features that are easily distinguishable from their surroundings. Geomorphologically, these streaks have thus far been interpreted as the presence or absence of small loose particles on the surface, deposited or eroded respectively, by wind. Like other aeolian features, wind streaks are evidence of prior aeolian activity and indicate the prevailing wind direction at the time of their formation; as such, they were used to map near-surface winds and to estimate atmospheric circulation patterns on Mars and Venus. Earth is the only planet for which in-depth field studies and climate data can readily be obtained. Lacking comprehensive study of wind streaks on Earth, there is almost no way to validate previous results of other planets. Therefore, the purpose of this study is to validate climate data using Earth wind streaks.
Wind streak orientations from the Earth wind streaks database were statistically correlated to Resultant Drift Direction (RDD) values calculated from reanalysis and weather stations wind data. Results show high correlation to the reanalysis RDD – r=0.78, and a moderate correlation to the weather stations – r=0.47. Higher correlations in favor of the reanalysis were demonstrated when segmented by continent as well. For most sites displaying incompatibility, seasonal and diurnal variations in the wind flow explained the deviation from the global pattern. The remaining sites can be explained either by the influence of local topography or that these wind streaks were not formed under the current wind regime. The results indicate that wind streaks are comparable to climate data and are indeed indicative of prevailing wind direction on global and regional scales. Therefore, this study supports previous planetary results.