RADAR SIGNATURES OF WIND STREAKS: PRELIMINARY SIR-A ANALYSIS

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Radar images have been applied to various geological problems for more than two decades, especially in regard to the analyses of tectonic features. The highly successful Shuttle Imaging Radar experiment, SIR-A, has demonstrated the potential for a much wider range of geological applications (1) and has yielded unexpected results in regard to the penetration by radar of sand deposits to reveal underlying topography (2).

Wind streaks are surface patterns which are visible on air photos, often as a result of albedo contrasts due to differences in sediment cover, particle sizes, particle compositions, or other surficial properties. Typically, they form in the lee (downwind) of topographic obstructions to the wind, such as hills, scarps, and craters. As such, they are good 'wind vanes' and have been used as local wind direction indicators on Earth and Mars; mapping their occurrence and orientation on Mars has been used for developing models of global atmospheric circulation.

As part of a general study of aeolian features using SIR-A images, we have identified several areas where wind streaks are visible. The following areas are of particular interest: (1) Syria; centered at 37°E, 33°N, about 50 km east of Damascus. Wind streaks in this area are associated with cinder cones and lava flow margins oriented ENE and appear to be associated with westerlies from the Mediterranean (3). (2) Rio Lauca Valley, Bolivia; centered at 69°W, 19°S, this area is in the lee of the Andes and the streaks may be associated with orographic winds spawned from westerlies crossing the Andes. The streaks are about 20 km long and appear to be associated with parallel zones of turbulence shed from bedrock knobs. (3) 60 km SE of Laskar Gan, Afghanistan, centered at 65°E, 31°N; these streaks are up to 37 km long and appear to be formed on relatively smooth sand/gravel plains.

Although data on these areas are limited, insight into radar-visible wind streaks can be gained by analysis of the Amboy lava field in the Mojave Desert where several wind streaks occur. Although not imaged by SIR-A, the field has been imaged by airborne radar systems (Goodyear X-band, JPL LHH; courtesy of T. Farr, 4) and by SEASAT. The field consists of well-preserved basaltic lava flows partly mantled by windblown sands. Wind streaks 1 m to 3 km long are visible on air photos as dark zones and represent exposed basalt 'bedrock' and areas of desert pavement, swept free of sand in turbulent zones associated with topographic obstructions. Although not prominent on radar images, the streaks tend to show as radar bright areas evidently as a result of the greater reflectivity of the exposed rock surfaces, and the relatively flat, but radar reflective desert pavement. In contrast, zones where sand is concentrated (a function of the wind flow field) appear dark on radar images, representing areas of low radar reflectivity.

SIR-A images demonstrate the feasibility of detecting wind streaks via radar imaging and may be an additional means for interpreting surficial geology. Moreover, if wind streaks occur on Venus they could serve a similar function as streaks on Mars in the derivation of wind patterns. Future work will involve analyses of SIR-A data to determine the important parameters involved in the detection of wind streaks. SIR-B may afford the opportunity to assess the radar signatures of wind streaks through the application of multiple depression angles.

This study is being conducted through a contract from the Jet Propulsion Laboratory.

REFERENCES

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2. *McCauley et al. (1982), Science, 218, 1004.*
3. *NOAA (1981), Monthly climatic data for the world.*
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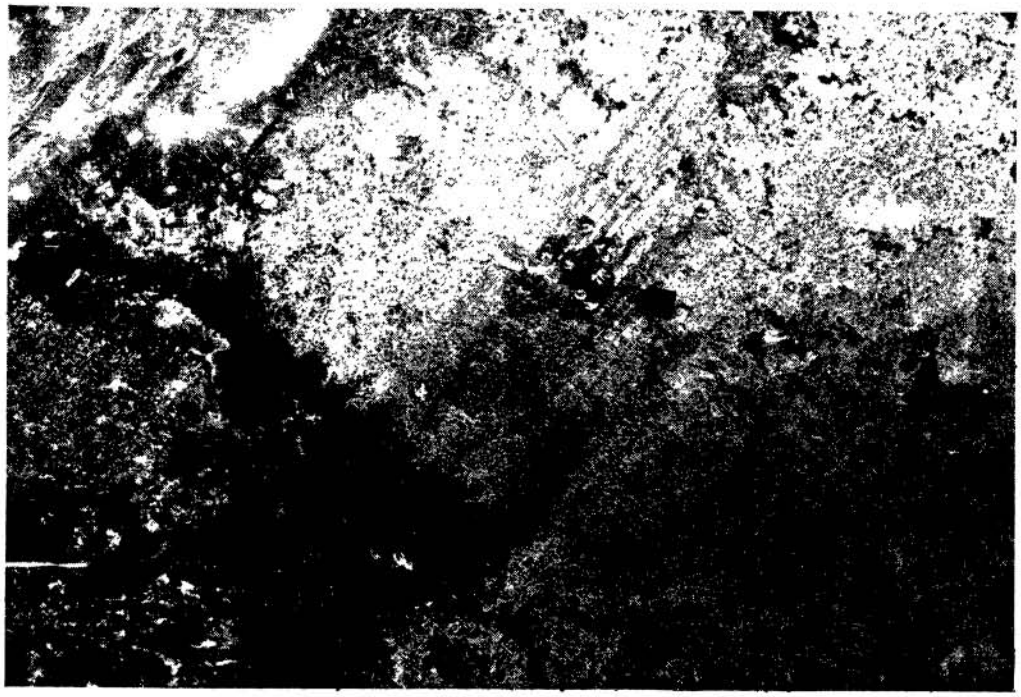

Figure 1. SIR-A image of wind streaks in Syria, east of Damascus. Streaks are aligned with prevailing 268° winds from the Mediterranean and appear to be associated with the lava floor margin (flowsareas are bright) and enhanced by cinder cones (arrow). Image covers area 45 x 75 km; north is to the upper left.

Figure 2. SIR-A image of wind streaks in southwestern Bolivia, in an intermountain valley within the eastern Andes. Streaks are apparently related to the aeolian flow field generated by winds around bedrock knobs prevailing from the WNW (from the Pacific). Area shown is 45 x 75 km; north is to upper right.