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East Antarctic Megadunes: overview of field and satellite results

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We synthesize past field data, weather data, and satellite information on structure and roughness to provide an overview of East Antarctic megadune characteristics and present a conceptual formation model for the spectrum of megadune-related landforms. Antarctic megadunes are large (km's in extent and wavelength) linear snow antidunes produced by prolonged air-snow interaction in a persistent katabatic wind environment. Continent-wide remote sensing analyses shows that they are found exclusively in mid- to upper- elevations of the East Antarctic ice sheet, in low-accumulation areas that never melt. Field work and in situ meteorologic data together with satellite measurements and climate model results enable characterization of the full range of megadune forms as well as the relationship of megadune morphology to climate and topograhic setting. Fundamental characteristics of megadunes include wind-transverse crests, very low height-to-width ratio (∼1:200) and higher windward-face accumulation relative to lower to near-zero (e.g., wind glaze) or even slightly negative (wind scour) lee-side suface mass balance. This leeward-side range in SMB produces a range of radar profile forms scaling with mean slope in the wind direction and regional surface snow input. Megadunes and related wind-scour features represent an additional facies of Antarctica's ice sheet firn, a distinct sub-facies of the dry snow zone in which air-snow interactions dominate and melt- or near-melt processes do not occur. We present a case for their formation related to atmospheric standing-wave events in the near-surface inversion layer.