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Modeling the micrometeor influx into the Mesosphere/Lower Thermosphere using radar measurements

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We discuss initial results from an effort to model the annual micrometeor influx into the Mesosphere/Lower Thermosphere (MLT) atmospheric region based on very precise meteor head-echo radar observations. The principal goal of this effort is to construct a new and more precise sporadic meteoric input function needed for the subsequent modeling of the atmospheric chemistry of the meteoric material and the origin and formation of metal layers in the MLT region. Modeling this function requires precise knowledge of the meteor directionality, velocity distributions, mass flux and diurnal and/or annual variability of the sporadic micrometeoroid environment. The meteor observations presented here were obtained using the 430 MHz dual-beam Arecibo (AO) radar in Puerto Rico and the 50 MHz Jicamarca (JRO) radar in Peru and are produced by particles with sizes between one to a few hundred microns in radii. The particle size and mass distributions are derived from very precise measurements of meteor velocity and deceleration and assuming meteoroid shape and bulk density. The observed results show that these radars, and probably every other high power/large aperture radar, only detect an Apex-centered dust population with no evidence of additional meteoroid populations with other radiant distributions. We show that in order to explain the diurnal and seasonal variability of the meteor rate detected at AO an atmospheric filtering effect must exist which seem to be produced by the early and higher ablation of micrometeors, which enter the atmosphere a low elevation angles. These particles probably reach high temperature at higher altitudes and deposit some or all their material before they penetrate deep into the MLT region. Comparison between theory and data of the initial observed meteor altitude are also presented and seem to agree with the early ablation argument. Furthermore, we present specular meteor trail measurements from the quasi-all-sky meteor radar system installed in 2001 at the geographic South Pole with the purpose to measure the horizontal wind field in MLT region. The diurnal and seasonal variability of the meteor flux observed over the South Pole indicate that most of the activity occurs during the Antarctic summer around a very concentrated region of the sky in elevation and azimuth. These results agree with previous Arctic meteor observations and suggest that most of the flux is concentrated around the ecliptic plane.