A modeling and observational comparison of the diurnal, seasonal, and latitudinal variability of the meteor input function detected by HPLA radars in the northern hemisphere.

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In this work, we present an observational and theoretical study of the diurnal, seasonal and latitudinal variability of the micrometeoric activity in the Mesosphere and Lower Thermosphere (MLT) atmospheric region. The principal goal of this effort is to construct a precise model of the sporadic Micrometeor Input Function (MIF) needed for the subsequent modeling of the atmospheric phenomena related to meteoric ablated material (i.e. metallic layers, NLCs, meteoric smoke, etc). For this purpose, we compare High Power and Large Aperture (HPLA) radar meteor observations with a recently developed semi-empirical model of the MIF. The observations used were obtained during different years and seasons using the 430 MHz radar in Arecibo, Puerto Rico and the 449 MHz Poker Flat Incoherent Scatter Radar (PFISR) in Alaska. The model includes an accepted mass flux provided by the known six main meteor sources (i.e. orbital families of dust) as well as detailed modeling of the meteoroid atmospheric entry and ablation physics. In addition, we simulate the differences in radar sensitivity by setting a minimum threshold for the amount of electrons a meteoroid is required to produce in order to be detected by a particular radar. This threshold is currently calibrated for the radars using the initial observed altitude as a function of measured meteor radial velocity. The comparisons show excellent agreement between the predicted diurnal, seasonal, and latitudinal variability of the detected meteor rate with those observed by Arecibo and PFISR. Representative radial (i.e. line-of-sight component) velocity distributions derived from both radars for different months are also compared with model outputs showing, once again, excellent agreement. Hence, the model accurately reflects the observed radar detections and accounts for the seasonal variation of the observed meteor sources reflected in the radial velocity distributions. These results demonstrate our current ability to model the MIF and accurately characterize the way in which different HPLA radars detect meteor events.