

UNDERSTANDING THE NEAR-EARTH MICROMETEOR ENVIRONMENT USING RADAR MEASUREMENTS

Janches, D.¹, Chau, J.L.², Heinselman, C.⁴, Erickson, P.J.⁵, Palo, S.E.³

¹NWRA, CoRA Div., USA

²Jicamarca Radio Observatory, Lima, Peru

³Dept. of Aerospace Engineering, University of Colorado, USA

⁴SRI International, Palo Alto, USA

⁵MIT Haystack Observatory, Westford, Ma, USA

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. 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 model is constructed based on meteor radar observations obtained with the 430 MHz dual-beam Arecibo (AO) radar in Puerto Rico and the 50 MHz Jicamarca (JRO) radar in Peru. We also compare the modeled fluxes with observations from Sondrestrom and Millstone-Hill radars, thus utilizing the entire NSF ISR chain. The observed meteors 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 strong evidence of additional meteoroid populations with other radiant distributions. We also 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. Furthermore, we present specular meteor trail measurements from the quasi-all-sky meteor radar system installed in 2001 at the geographic South Pole. 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.

Abstract Submission Form

2006 National Radio Science Meeting

Abstract: janches31156

Date Received: September 11, 2005

1. (a) Diego Janches
NWRA/ CoRA Div
3380 Mitchel Lane
Boulder, CO
80301 United States
diego@cora.nwra.com
(b) 303-415-9701
(c) 303-415-9702
2. G - Ionospheric Radio and Propagation
3. (a)
4. I - Invited Paper, Program chair:
John D. Mathews
5. No special instructions