UNDERSTANDING RADAR METEOR BIASES VIA COMPARISONS OF SPECULAR, NON-SPECULAR TRAILS AND HEAD ECHOS

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We used radar observations from the Coqui II 50 MHz radar, located near Salinas, Puerto Rico, to measure observed counts of both specular and non-specular meteor trails, and observations Arecibo to measure head echos in the E-region ionosphere. The Coqui II observations were made during local times between 18:00 to 08:00 on various days in 1998 and 1999. The Coqui II radar has two sub-arrays, both pointed to the north in the magnetic meridian plane, perpendicular to the magnetic field, at an elevation angle of approximately 41 degrees. Traditional meteor radars require trail specularity (trail perpendicular to radar beam) for a reflection, but over the past decade, two new types of radar meteor reflections, known as meteor head echoes and non-specular trails, have become known or widely used. Many estimates for determining global meteor mass flux have used these traditional meteor radars counting only specular meteor trails. To determine the extent that various trail detections represent a non-biased, full spectrum observation of the meteor flux, we examine the diurnal and seasonal variability of specular trails, non-specular trails, and head echos. We use observations of these three types of meteor reflections from the same location to show that the diurnal variability of specular trails, non-specular trails, and head echos are not equivalent. A revealing comparison comes from comparing the maximum count rate in the morning to the minimum at dusk. Specular meteor trails showed a max/min ratio of 8, that is 8 times more frequent trail observations at maximum than minimum. Non-specular trails show greater increase near 30, while head echos observation have a max/min of many hundred times more meteors at maximum (dawn) then minimum (dusk). We shall examine some of the possible causes of this discrepancy, and discuss what it may teach us about the filtering effects of various radar systems and meteor reflection mechanisms.

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