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Diurnal and annual Variations of Meteor Rates at high, middle, and low Latitudes

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Meteors are an important source for the metal atoms of the upper atmosphere metal layers and for condensation nuclei, the existence of which are a prerequisite for the formation of noctilucent cloud particles in the polar mesopause region. For a better understanding of these phenomena, it would be helpful to know accurately the annual and diurnal variations of meteor rates and their latitudinal variation. All-sky meteor radars are a powerful tool to observe meteoroids 24 hours each day throughout the year under all-weather conditions. We have used 5 SKiYMET meteor radars at locations between 69˚N and 35˚S to measure the meteor rates and meteoroids entry velocities for periods between one and three full annual cycles.

We report on the observed diurnal variations (averaged over one month) of meteor rates and their significant variations throughout the year. The ratio of maximum over minimum rates throughout one diurnal cycle is increasing with decreasing latitude and reaches values of about 2.3 at 69˚N, of 4.6 at 54˚n, of 5.5 at 35˚S, and of 7.3 at 22˚S. The annual variation of meteor rates is described as follows: A strong peak of meteor rate is found for the month June at high and middle Northern latitudes, whereas the meteor rates peak at low Southern latitudes in June and December.

Observations at 69˚N with the antenna axis pointing towards the North ecliptic pole showed that the rate of deposition of meteoric dust is substantially larger during the Arctic NLC season than the annual mean deposition rate. The daylight meteor showers of the Arietids, Zeta Perseids, and Beta Taurids supposedly contribute considerably to the June maximum of meteor rates. In June and under “North ecliptic pole-close-to-

zenith" conditions, almost all of the meteors are detected at altitudes below 100 km with their rate maximizing close to 90 km altitude. A large number of the echoes occur at elevation angles at and below 35˚. These altitude and elevation distributions seem to suggest that the meteors observed in June come from sporadic meteoroids arriving from the North ecliptic hemisphere with reasonably large ecliptic inclinations and low to moderate atmospheric entry velocities. The contribution of the daytime showers is probably not larger then 10%.