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Automated Optical Meteor Fluxes and Preliminary Results of Major Showers

R. Blaauw[1], M. Campbell-Brown[2], W. Cooke[3], A. Kingery[4], R. Weryk[2], J. Gill[2]

1Dynetics Technical Services/MITS, Marshall Space Flight Center, Huntsville, Alabama, 35812
2University of Western Ontario, London, Ontario, N6A 3K7
3NASA Meteoroid Environment Office, Marshall Space Flight Center, Huntsville, Alabama, 35812
4Jacobs/ESSA Group, Marshall Space Flight Center, Huntsville, Alabama, 35812

NASA's Meteoroid Environment Office (MEO) recently established a two-station system to calculate daily automated meteor fluxes in the millimeter-size-range for both single-station and double-station meteors. The cameras each consist of a 17 mm focal length Schneider lens (f/0.95) on a Watec 902H2 Ultimate CCD video camera, producing a 21.7x15.5 degree field of view. This configuration sees meteors down to a magnitude of +6. This paper outlines the concepts of the system, the hardware and software, and results of 3,000+ orbits from the first 18 months of operations. Video from the cameras are run through ASGARD (All Sky and Guided Automatic Real-time Detection), which performs the meteor detection/photometry, and invokes MILIG and MORB (Borovicka 1990) codes to determine the trajectory, speed, and orbit of the meteor. A subroutine in ASGARD allows for approximate shower identification in single-station detections. The ASGARD output is used in routines to calculate the flux.

Before a flux can be calculated, a weather algorithm indicates if sky conditions are clear enough to calculate fluxes, at which point a limiting magnitude algorithm is employed. The limiting stellar magnitude is found using astrometry.net (Lang et al. 2012) to identify stars and translated to the corresponding shower and sporadic limiting meteor magnitude. It is found every 10 minutes and is able to react to quickly changing sky conditions. The extensive testing of these results on the Geminids and Eta Aquariids is shown. The flux involves dividing the number of meteors by the collecting area of the system, over the time interval for which that collecting area is valid. The flux algorithm employed here differs from others currently in use in that it does not make the gross over-simplication of choosing a single height to calculate the collection area of the system. In the MEO system, the volume is broken up into a set of height intervals, with the collecting areas determined by the position of the active shower or sporadic source radiant. The flux per height interval is calculated and summed to obtain the total meteor flux.

Both single station and double station fluxes are currently found daily. Geminid fluxes on the peak night in 2012 (12-14-2012) were 0.058 meteors/km^2/hr as found with double-station meteors and 0.057 meteors/ km^2/hr as found with single-station meteors, to a limiting magnitude of +6.5. Both of those numbers are in agreement with the well-calibrated fluxes from the Canadian Meteor Orbit Radar. Along with flux algorithms and initial flux results, presented will be results from the first 18 months of operation, covering 3,000+ meteoroid orbits.

Borovicka, J. 1990. The comparison of two methods of determining meteor trajectories from photographs. *Bull. Astron. Inst. Czech*. 41. 391-396.
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