Characterizing the 2016 Perseid Meteor Shower Outburst

R.C. Blaauw[1], D.E. Moser[2], S.R. Ehlert[3], A. M. Kingery[4], S. Molau[5], C. Schult[6], G. Stober[6]
[1]APL/Jacobs ESSSA, NASA MSFC Meteoroid Environment Office (MEO), Huntsville, AL, 35812, rhiannon.c.blaauw@nasa.gov, [2]Jacobs ESSSA, NASA MSFC MEO, Huntsville, AL, 35812, [3]Qualis/Jacobs ESSSA, NASA MSFC MEO, Huntsville, AL, 35812, [4]ERC/Jacobs ESSSA, NASA MSFC MEO, Huntsville, AL, 35812, [5]International Meteor Organization, Abenstalstr. 13b, D-84072 Seysdorf, Germany, [6]Leibniz Institute of Atmospheric Physics, Rostock University, Keuhlungsborn, Germany.

Introduction: The Perseid meteor shower has been observed for millennia and known for its visually spectacular meteors and occasional outbursts. The Perseids were expected to outburst in 2016, primarily due to particles released during the 1862 and 1479 revolutions of Comet Swift-Tuttle. NASA's Meteoroid Environment Office predicted the timing, strength and duration of the outburst for spacecraft risk using the MSFC Meteoroid Stream Model [1]. A double peak was predicted, with an outburst displaying a ZHR of 210 ± 50 at 00:30 UTC Aug 12, and a traditional peak ~12 hours later with rates still heightened from the outburst [2]. Video, visual, and radar observations taken worldwide by various entities were used to characterize the shower and compare to predictions.

Observations: Most of North America was in daylight during the peak of the outburst, thus the International Meteor Organization (IMO) video observations over Europe, and IMO worldwide visual observations were heavily relied upon to characterize the outburst peak. The IMO visual observations resulted in ZHRs, converted to fluxes to a limiting mass of 3×10^{-4} grams [3]. The IMO video observations gave ZHRs and fluxes to 10^{-3} grams [4].

Daily meteoroid fluxes are measured by NASA's Widefield meteor cameras located in Northern Alabama [5]. While Alabama was primarily cloudy in August 2016, Perseid fluxes were measured on clear nights to a limiting mass of 6.2×10^{-4} grams. Meteor activity was also constrained using the NASA Allsky Fireball Network.

The Middle Atmosphere Alomar Radar System (MAARSY) is an HPLA radar employing an active phased array antenna suitable to monitor the Perseid radiant and was modified to conduct continuous meteor observations and meteor shower studies [6,7]. The system has a limiting mass of 10^{-6}-10^{-7} grams. In 2015 and 2016, MAARSY detected enough Perseid meteors to produce an activity curve every 6 hours.

Results: The 2016 Perseids were observed to outburst, and a double peak was confirmed. Preliminary results give ZHRs of 246 and 245 from IMO video and visual reports, respectively, measured close to the predicted peak time (Figure 1). Heightened activity was also seen at the traditional peak in the IMO video fluxes. The 2016 Perseid activity in MAARSY was compared to 2015 counts, to validate the peak was earlier and stronger than in a non-outburst year.

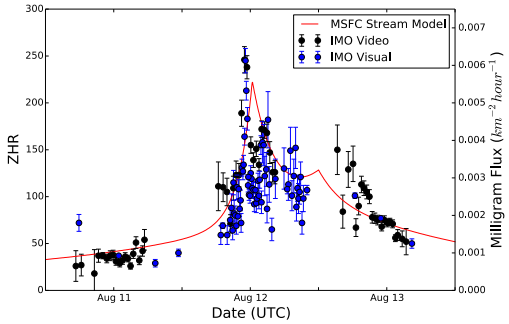

Figure 1. ZHRs from the IMO Visual reports and IMO Video Network against predictions from the MSFC Meteoroid Stream Model.

Acknowledgments: The authors would like to thank Dr. Bill Cooke and Dr. Althea Moorhead of NASA's MEO for their suggestions, and members of the IMO for visual observations. This work was supported by NASA Contract NNM12AA41C, and grant STO 1053/1-1 (AHEAD) of the DFG (for MAARSY).

References: [1] Moser, D.E. and Cooke, W.J. (2008) *EM&P, 109,* 285-291. [2] Moser, D.E. and Cooke, W.J. (2015) *Stanford Meteor Environment and Effects Workshop*. M16-5103 [3] Koschack, R. and Rendtel, J. (1990) *WGN, 18,* 119-140. [4] Molau, S. and Barentsen, G. (2014) *Meteoroids 2013 Proceedings*, 297-305. [5] Blaauw, R.C., Campbell-Brown, M. and Kingery, A. (2016) *MNRAS, 463(1)*, 441-448. [6] G. Stober, C. Schult, et al. (2013) *Ann. Geophys.*, 31, 473-487. [7] C. Schult, G. Stober, et al. (2016) *ICARUS, submitted*.