EPSC Abstracts
Vol. 10, EPSC2015-579, 2015
European Planetary Science Congress 2015


# Use of the IMEX model to characterise meteor showers in the inner solar system

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## Abstract

The Interplanetary Meteoroid Environment for Exploration (IMEX) is an ESA funded project that aims to model recently produced cometary dust trails and meteoroid streams in the inner solar system. The result is a database of these trails that is relevent for studying (1) meteor showers at the Earth and other planets, (2) dust trails observed in the vicinity of comets, and (3) the impact hazard these streams pose to spacecraft and spacecraft subsystems. Here we discuss how this model can be used to understand meteoroid streams that intersect Earth, Mars, and other planets.

## 1. Introduction

Dust in the inner solar system is comprised of a static interplanetary dust cloud along with time-variant cometary and asteroidal dust streams in the vicinity of the orbits of these parent objects. The Interplanetary Meteoroid Environment for Exploration (IMEX) aims to extend ESA's Interplanetary Meteoroid Environment Model (IMEM) (which describes the interplanetary background dust cloud [1]) by characterising recently created cometary trails. The goal therefore is to understand where and when strong meteor showers of recent dust can occur anywhere in the solar system - including at the loctions of planets and spacecraft. Although designed for impact hazard assessment, the model can be applied to numerous scientific applications.

## 2. The IMEX model

Our IMEX model provides trajectories for a large number of dust particles released from $\sim$ 400 short-period comets. These are produced by emitting particles from the orbits of Halley-type, Jupiter family and Encke-type comets, and integrating their trajectories under solar and planetary gravity, radiation pressure and the Poynting-Robertson effect. These integrations are performed by the Constellation distributed computing platform (http://aerospaceresearch.net/constellation), in which the computational load of integrating millions of particle trajectories is divided between many individual computers. The dust trajectories can be retrieved from the database on a given date 1980-2080, either for all particles from one comet, or for all particles near a position in the inner solar system.

Because the model only deals with very recently emitted dust (for Halley-type comets from calender year 1700, and for Jupiter family and Encke-type comets from calender year 1850), the structures produced by the model at Earth are more analogous to meteor storms than meteor showers. Studies of individual showers can help constrain comet parameters (such as the emitted dust mass distribution and comet dust emission speeds), as well as providing information on storm events that occur at other planets or locations in the solar system. We are applying the model to understand meteor storms at various planets. Here we present initial results at Earth, Mars, and Mercury.

## Acknowledgements

This work was funded under ESA contract, and supported by Constellation, a young academics group supported by the German Society for Aeronautics and Astronautics DGLR in Stuttgart, Rechenkraft.net e.V. and Selfnet e.V. We thank all individual Constellation users for their computing time.


## References


[1] Dikarev V., Grün E., Baggaley J., Galligan D., Landgraf M., Jehn R., The New ESA Meteoroid Model., Adv. Space Res., 35, 1282–1289, 2005.