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ANALYSIS OF THE HISTORIC METEORITE FALLS

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This study was done using meteorite falls data available in the Meteoritical Bulletin Database (MBD). From the total number of falls the damaging subset of the last century was discriminated. A calculation of the frequency of falls was done as a function of the day of the year and the Sun's longitude.

The distribution of observed meteors along the year has two main components: sporadic meteors and those associated with meteor showers. The meteor showers peaks in very specific dates (Jenniskens & Jenniskens 2006), but they do not pose a threat to human beings because they are associated with the fluffy particles sprinkled by a comet during the perihelion passages. Among the sporadic meteors, we highlight those producing bright fireballs and delivering meteorites on the Earth surface. Those cases are definitively related to a rocky meteoroid.

A concentration of meteorite falls in a particular date could be an indication of the existence of a stream of rocky asteroids sharing a similar orbit. The stream should be the outcome of a recent fragmentation process, possibly even during the 'near-Earth-asteroid'-phase (Koschny & Borovicka 2017). A few of the more abundant small fragments might have already fall to the Earth, but a larger body could still be waiting to be discovered (Micheli & Tholen 2015).

In order to test this hypothesis, we make use of the existence information on meteorite falls. The worldwide accepted clearing-house of meteorites is the Meteoritical Society, which maintains the MBD, a collection of information about recovered meteorites from all over the world. Up to 07/03/2021, there are 65780 registered meteorite names with their respective taxonomic classification.

Meteorites recovered following observed passage through the atmosphere are called falls; while those which are serendipitously found or they cannot definitely be associated with a passage are called finds. In the MBD there are 1202 registered meteorites falls with official names. The database includes information of falls extended for several centuries, but with a uniform coverage over the last century.

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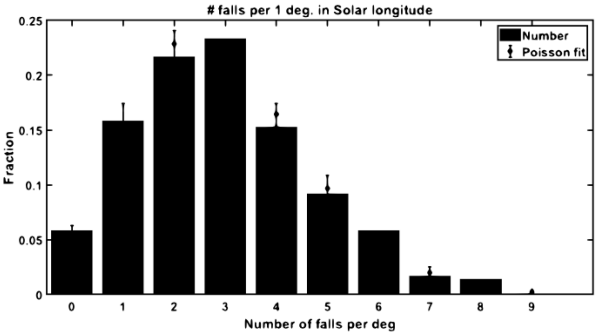

Fig. 1. Fitted Poisson distribution for the registered meteorite falls data in the MBD.

A subset of the falls that generate a lot of concern are those meteorites that directly impact human beings or their belongings ("damaging falls", Atkinson et al. (2000)). From an analysis of the registered meteorite falls and the damaging subset in the last century, we calculate an average rate of 8.1 falls and 2.1 damaging falls over the urban land per year registered in the database. We estimate ∼6230 falls per year over the entire Earth and ∼1840 over the land.

We then compute the frequency of falls as a function of the day of the year and the Sun's longitude. The frequency is compared with a Poisson process to look for dates with a frequency larger than expected; which it could be a signal of a meteoroid stream.

Our results showed that the frequency of meteorite falls follows a Poisson distribution (1), and consequently, no peaks in the tail where observed.

In conclusion, we cannot affirm for the presence a meteoroid stream. If there were any meteoroid stream masked behind the Poisson distribution, it probably would not consist of a large population of meteoroids.

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