

Mass Accumulation of Earth from Interplanetary Dust, Meteoroids, Asteroids and Comets

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Abstract

This paper analyses the total mass that reaches the Earth as interplanetary material. For the small sizes the interplanetary flux model by Grün et al. was used, which describes the mass flux at 1 AU for meteoroids in the mass range 10^{-18} g to about 100 g. For the large objects the flux models by Brown et al. were used which is derived for bodies greater than 1 m and is based on sensor data of fireballs that entered the Earth atmosphere. For the intermediate size range interpolations and alternative models based on meteor and fireball data were used. All flux models were converted to an altitude of 100 km above the Earth surface to make them comparable. The total combined flux model covers 37 orders of magnitude in mass. Using recent measurements and alternative flux models the uncertainties of the obtained model was estimated. Recent measurements include in-situ impact data on retrieved space hardware and optical meteor and fireball data. Depending on the models and interpolation used the interplanetary material that enters the Earth atmosphere per day is in the range of 30 -180 tons with a best guess value of 54 tons per day for an upper cut-off size of 1 km. The combined models with interpolations suggest deviations from a simple power law. The flux in the diameter range of 1-10 cm appears not as large as suggested by the power law interpolation.