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The micrometeorite flux at Dome C (Antarctica) with the CONCORDIA collection

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The flux of extraterrestrial material on Earth is dominated by sub-millimeter particles, however the mass distribution and absolute value of this cosmic dust flux at the Earth surface is still uncertain due to the difficulty to monitor both the collection efficiency and the exposure parameter (*i.e.* the area-time product in m^2.yr). Thanks to the exceptional conditions encountered in central Antarctic regions, we recently succeeded to measure there the micrometeorite flux down to 30 µm (Rojas et al., 2021).

During the last 2 decades, we performed several field trips at Dome C to recover micrometeorites by melting and sieving large volume of ultra-clean snow using a dedicated protocol (IPEV program #1120, Duprat et al. (2010); Duprat et al. (2007)). The CONCORDIA station is operated by the French and Italian polar institutes (IPEV and PNRA) at Dome C (Antarctica). The regular precipitation rate and the exceptional cleanliness of the snow at Dome C allow a unique control on both the exposure parameter and the collection efficiency, mandatory to derive the micrometeorite flux.

The thorough inspection of the filters for many years allowed us to recover thousands of particles. Each one was individually imaged by Secondary Electron Microscopy and its bulk composition was determined by Energy-Dispersive X-ray spectra. Micrometeorites were classified in two main types: the unmelted micrometeorites (uMM) that went through the atmosphere without melting and the cosmic spherules (CSs) that have totally melted during the atmospheric entry. Based on the inferred size/mass distribution, we derived the statistical uncertainties expected for collections with exposure parameters ranging from 0.1 up to 10^5 m^2.yr. Within the 30-350 µm diameter range, we measured mass fluxes of 3.0 $\mu g.m^{-2}.yr^{-1}$ for uMMs and 5.6 $\mu g.m^{-2}.yr^{-1}$ for CSs. Extrapolated to the global flux of particles in the 12-700 µm diameter range, the corresponding annual mass flux of extraterrestrial dust at Earth surface is 5,200 $tons.yr^{-1}$ (1,600 and 3,600 $tons.yr^{-1}$ of uMMs and CSs, respectively). The flux of altered and unaltered carbon carried by heated and un-heated particles at Earth surface is estimated to range from 20 to 100 $tons.yr^{-1}$. The results obtained in this study allow to put constraints on the origin of the micrometeorite mass flux (Plane, 2012).

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