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Detection of cosmic iron in soils and global meteorological simulations of deposition patterns (part 2)

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Iron fluxes in soils may originate from the deposition of iron-rich dust from space. These dust particles are left over from the early formation period of the solar system, originate from impacts in the solar system or melt free from the ices in comets. Their fiery passage through the atmosphere ablates a significant portion of this dust, but estimates of survival rates and collection studies suggest yearly global influxes of ∼50.000 metric tons. Many studies dealing with distribution patterns have focuses heavily on the Antarctic region, in spite of being an isolated location in terms of atmospheric circulation patterns. We simulate the last 30 km (10 hPa level) of a dust particle's descent through the atmosphere. From a spatially homogeneous distribution starting condition we used the available meteorological records with global coverage to establish how cosmic dust particles are influenced and redistributed by meteorological processes. Deposition of this dust (called 'micrometeorite' once deposited) occurs within 48 hours after it reaches the 10 hPa level. The majority of incoming meteoritic dust has a small diameter and is therefore most susceptible to effects of precipitation and winds. These processes cause significant spatial differences in deposition that generally adhere to daily monsoon and orographic patterns. Most noticeable is the increased deposition in Europe. In order to test if these observed deposition patterns are also detectable in soils, we sampled the upper 10 cm of Late-glacial coversand and Holocene drifts in The Netherlands that are covered by a layer of mormoder humus. These deposits are known to be rich in quartz without many other hydrolysable minerals. Known material properties of micrometeorites were used to extract them from the soil. This involved wet kinematic sieving and heavy liquid separation to separate the particle from the mostly quartz matrix. After separation possible meteoritic particles were identified based on their optical and magnetic properties, embedded in resin and cross-sectioned to measure their elemental composition using SEM-EDX. The discriminative power of this separation process has identified several particles that conform to meteoritic elemental compositions and seem to confirm that cosmic dust is a potentially important factor in the chemical development of soils over longer periods of time.