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Ammonium stable isotopes in Ice Core: volatile versus thermic emissions in Europe

Content

Ammonium is a proxy of ammonia. As the latter is fundamental in controlling the formation and production of inorganic aerosols through acid-base reactions, it plays a role in soil acidification and health hazards. Yet, through the last century, emissions have tripled and are thought to double by 2050 with the rapid emergence of Haber-Bosch fertilizers and manure application. To better constrain natural and anthropogenic sources of ammonia at the European scale, an ice core from the Col du Dôme glacier (4,250 m above sea level, Mont-Blanc massif), drilled in 2016 in the framework of the Ice Memory programme, is used to reconstruct the past variability of ammonium. With this in mind, we have developed a method to measure nitrogen stable isotope in ammonium. Here we present the very first data of 120 m of $\delta^{15}\text{N}(\text{NH}_4^+)$ in an ice core revealing seasonal cycling and multi-decadal trends. Our data both show the minor impact transport has on isotopic composition and the change of ammonia emissions from a two-emission source system at the beginning of the 20th century - natural background and thermic emissions -, to a three-emission source system in which volatile and thermic emissions outweigh natural background.

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