The potential global contribution of marine aerosol to the Mo cycling in the critical zone

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We present [Mo] and Mo isotope compositions of c. 60 samples of various types of the Strengbach catchment (eastern France, 440 km of the nearest coast). Here, monitoring of rainfall, vegetation, and soil characteristics was started decades ago. Both stream waters and bedrocks show Mo concentrations at least one order of magnitude lower than global averages. The Mo isotope composition of topsoils and foliage, and roots is rather homogeneous ($\delta^{98/95}$Mo = 0.3-0.5 permil). Net biological fractionation is thus subordinate to the differences in Mo sources. Mass balance models based on these results, supplemented with new and literature Sr isotope data, constrain rock weathering and seawater derived aerosol as the principal Mo sources, indicating a 23 % to 44 % Mo fraction of seawater origin in the dissolved load.

To date, all global Mo isotope cycling models have assumed a continental runoff value based on inferred average continental crust signatures and/or river water averages, where the latter are taken to represent a weathering product of the former. Our finding of a prominent fraction of the Mo in surface waters of the Strengbach catchment being derived from marine aerosols - even hundreds of km away from the seashore - implies that future Mo isotope global cycling models need to take into account the recoupling of airborne Mo. Moreover, as Mo is essential in enzymes of the biological nitrogen cycle, information of the contribution of atmospheric Mo in the global critical zone is fundamental to the knowledge on future evolution of soil fertility in natural environments. A preliminary back-of-the-envelope calculation indicates that about 15% marine aerosol contribution to riverwater Mo would acount for the apparent difference between global average continental crust and average dissolved load. The exact mass balance of contributing Mo sources to the bulk airborne load are unknown at present, however. Further, volcanic exhalations and anthropogenic sources need to be considered.