

The role of air-sea exchange in the global selenium cycle

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The biogeochemical cycling of selenium (Se) is important given that current atmospheric anthropogenic inputs are a substantial fraction of the total, and that Se can be both toxic and limiting to lower food chain marine organisms depending on concentration. It also has complex exchange dynamics between the atmosphere and the ocean given that it can be emitted as gaseous forms such as dimethylselenide (DMSe), which are rapidly oxidized in the atmosphere. Preliminary modelling suggests that a large fraction (>60%) of the Se deposited to the ocean surface is evaded to the atmosphere. In the surface ocean, Se is present as reduced organic Se, produced biotically, dissolved gaseous Se, and the inorganic forms (Se(IV) or Se(VI), which are oxyanions in water). As most Se in atmospheric deposition is inorganic, its rate of interconversion between oxidized and reduced forms has an important impact on Se fate and bioaccumulation in the ocean. To examine this cycling more closely, we have performed incubation experiments to probe the photochemical redox chemistry of inorganic and organic Se in seawater, and the stability of the various forms. We have also adapted an existing box model framework to simulate the biogeochemical cycle of Se using information from our incubation experiments in conjunction with literature data on the sources and speciation of Se in the biosphere. We will present the results of these measurements and discuss insights from the model. We will further discuss the important processes controlling Se cycling at the air-sea interface, and its role in the global Se cycle.