Sea salt concentrations over Europe: Measurements and modelling

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Sea salt aerosol can reach high concentrations over the ocean. There, it has a significant effect on climate and weather due to its impact on the radiation budget and cloud formation. Over land, the concentrations rapidly decrease with increasing distance to the coast. Still, sea salt can make up a significant part of observed Particulate Matter (PM10) concentrations there. Due to adverse health effects of PM10, legislation has been imposed and recently the composition of aerosol has gained attention. As a consequence, sea salt measurements have become available.

We will present the first compilation of measurements of sea salt concentrations over Europe. Measurements originate from several countries and campaigns. Both annual mean concentrations and time variability were investigated.

We also present modelled sea salt concentrations (LOTOS-EUROS model) to complete the picture. They were compared with observations, revealing a good time correlation but an overestimation for the higher concentrations. It is well known that the sea salt source functions and deposition parameterizations are quite uncertain. Some sensitivity experiments were done to illustrate the consequences of these uncertainties. The observations can be used to constrain them.

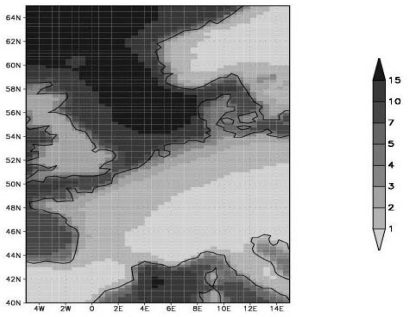

Figure 1 Modelled annual mean sea salt concentrations in $\mu g/m^3$, scaled with observations.

Formation and transformations of pyromorphite nanocrystals in the environment: Review

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Pyromorphite $Pb_5(PO_4)_3Cl$ is a stable, insoluble, crystalline phase which precipitates very easily when Pb^{2+}, PO_4^{3-}, and Cl^- ions meet in the solutions within contaminated soils and wastes. It's formation is the basis of *in situ* immobilization of Pb – a modern metod of reclamation. The nanocrystals with well ordered apatite structure are very hard to find and identify in the field samples. Most of our knowledge comes from laboratory experiments. Pyromorphite (PY) forms through homogeneous or heterogeneous precipitation from aqueous solutions. Heterogeneous nucleation is observed when a source of Pb^{2+} or PO_4^{3-} ions (dissolving mineral containing Pb or P as well as desorbing surface of a mineral or bacteria in suspension) releases ions to the solution slower than the kinetics of precipitation. Various cationic substitutions for Pb are possible. Recently, anionic substitutions for PO_4 were studied extensively which are especially critical for understanding of AsO_4 mobilization.

Similarly to precipitation, the kinetics of PY dissolution is very fast. Solubility of PY strongly depends on pH being lowest between 7 and 9. The results of most recent experiments indicate that the solubility constant of nanocrystals is higher than reported in the literature and equals to $\log K_{sp}$ = -79.6. In contrast to some previous reports, dissolution is exothermic and the solubility increases with temperature. Equilibrium dissolution experiments at various temperatures allowed for more precise determination of thermodynamic constants: $\Delta H°_f$ = -4108 ±60 kJ mol^{-1}, $\Delta G°_f$ = -3764 ±60 kJ mol^{-1}, $\Delta S°$ = 622 ±542 J mol^{-1} K^{-1}. Fluid cell AFM studies of surface features resulting from dissolution indicate surface controlled mechanism of dissolution with strong anisotropy with respect to crystallographic orientation. Solubility of PY increases significantly in the presence of complexing agents (e.g. EDTA, lactic acid, acetic acid) and products of bacterial metabolism (e.g. siderophores). This suggests the possibility of long term Pb-remobilization by PY dissolution induced by the activity of living organisms in the soil. Experiments with bacteria mediated dissolution of PY nanocrystals are in progress.

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