NanoFATE Deliverable 6.3

Maps of mean and worst case PEC for catchment; includes rivers in three UK regions and three Continental European river catchments.

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Research Report - Summary

The spatio-temporal variability of nano silver (nano Ag) and nano zinc oxide (nano ZnO) concentrations in surface waters across Europe has been modelled using the GIS-based model GWAVA. Loading of nano Ag and nano ZnO from sewage to rivers is modelled by accounting for connectivity to sewerage, sewage treatment efficiency, and the spatial distribution of sewage treatment plants with their associated populations. The resulting nano Ag and nano ZnO concentrations in lakes, wetlands and rivers are modelled by considering the effect of processes such as dilution, transport, water abstraction, and transformation. GWAVA simulated behaviour of nano-particles in flowing surface waters over the 1990-2000 period using daily rainfall values. Over this 11 year period, the highest predicted concentrations that aquatic organisms could be exposed to in the EU reached up to 6 ng/L for nano Ag and up to 500 ng/L for nano ZnO. These high concentrations were typically found in areas such as the Rhine basin, Po basin, south-east England, and densely populated parts of the Mediterranean.

To convey this message, two maps and one graph are included below.

This report is to be published as a refereed journal paper.

Examples of results

Over a typical 11 year period, the highest concentrations that aquatic organisms are exposed to in most of the EU can reach up to 6 ng/l for nano silver and up to 500 ng/l for nano zinc oxide. Such values are found in the Rhine and Po basin, south-east England, and densely populated parts of the Mediterranean.

These highest expected nano-particle concentrations (6 ng/L for nano silver and 500 ng/L for nano zinc oxide) can be read from the right side of Figure 3 where the curves approach the horizontal axis. The left side of Figure 3 where the curves approach another horizontal asymptote are mostly representative of the large land mass of Scandinavia which has low populations and therefore low nano-particle concentrations.

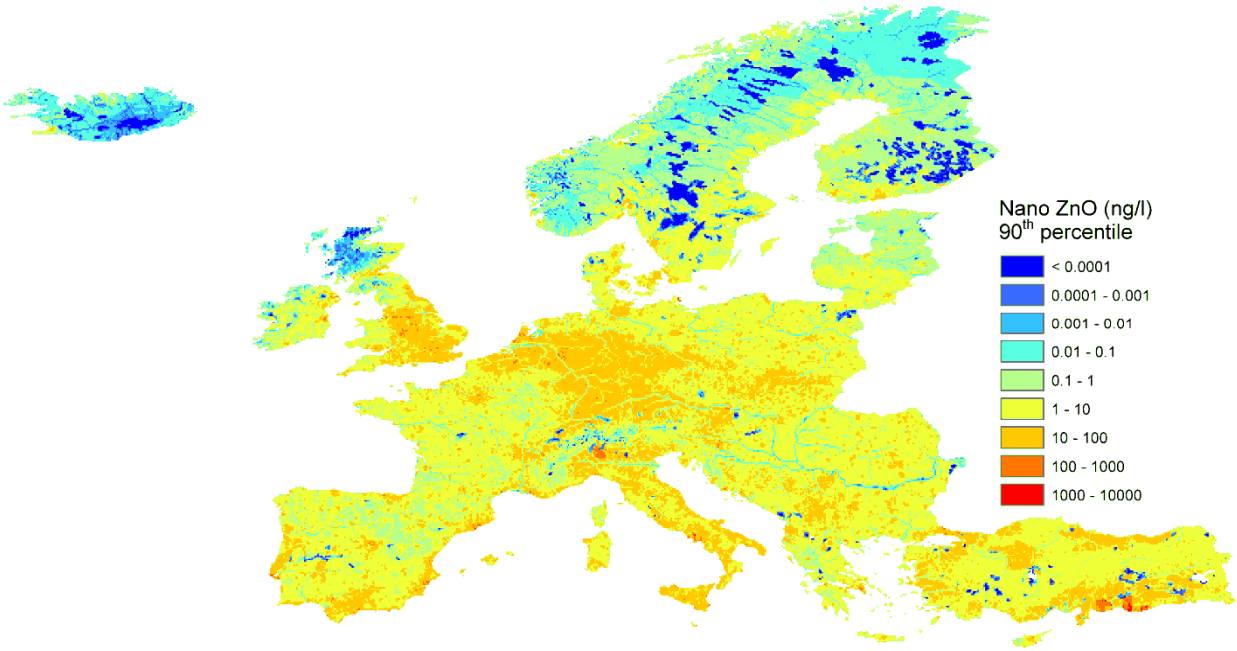

Figure 1 Map of 90th percentile nano ZnO concentrations modelled in the mean scenario

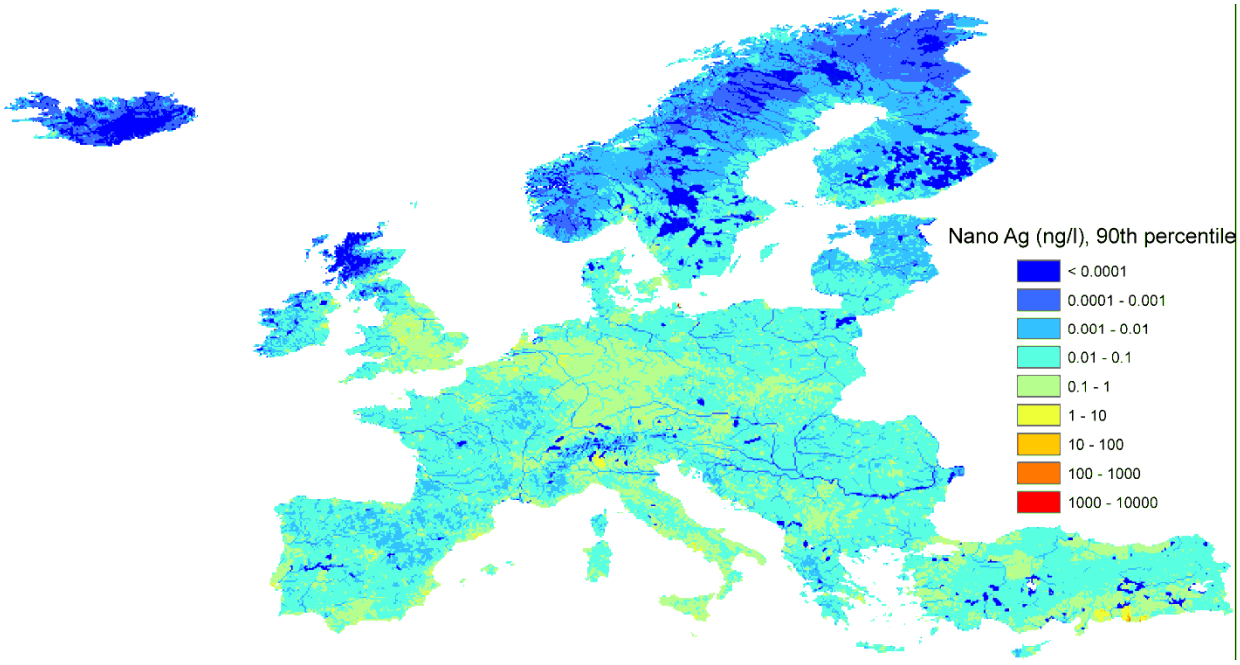

Figure 2 Map of 90th percentile nano Ag concentrations modelled in the mean scenario

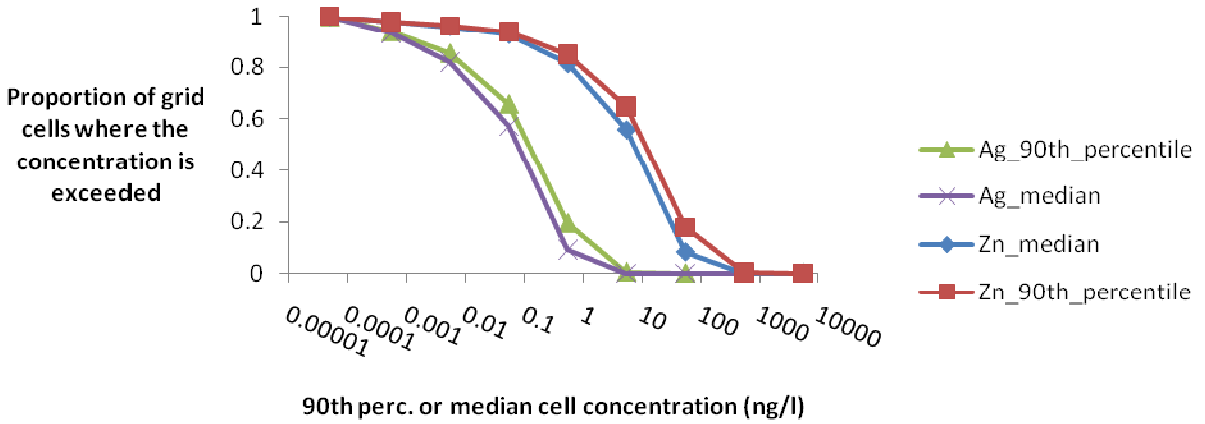

Figure 3 Cumulative frequency curve of nano-particle concentrations modelled in the mean scenario. This curve shows the probability of encountering a grid-cell where a specific median or 90th percentile concentration is exceeded.