Spatially Aggregated Predicted Environmental Concentrations (PECs) for Geo-Referenced Exposure Assessment

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By means of GREAT-ER (a Geo-Referenced Exposure Assessment Tool for European Rivers) accurate chemical fate simulations can be performed for the aquatic environment. However, the resulting digital maps with predicted concentrations for individual river stretches contain too much local detail for practical risk assessment applications and decision making. To apply GREAT-ER in a (regional) ecological risk assessment context, its geo-referenced output has to be aggregated to a single value (or at most a frequency distribution), which is representative of chemical exposure within the catchment.

Two spatially aggregated PEC types were developed. $PEC_{initial}$ is defined as the unweighted spatial aggregation of initial river concentrations just downstream of each waste water emission in the catchment. $PEC_{catchment}$ is defined as the weighted spatial aggregation of all average stretch concentrations. To obtain an aggregated exposure value representative of the entire catchment, all stretches (both polluted and unpolluted) have to be considered. In this case, weighting by flow increment is needed to resolve scale-dependency. To produce an aggregated exposure value representative of the polluted parts of the catchment, only the polluted stretches should be considered. In this case, weighting by stretch length or volume are required to resolve scale-dependency.

The spatially aggregated PEC definitions were tested using simulations for 2 case study catchments (Calder and Went, Yorkshire, UK). This confirmed the theoretical considerations which led to the different definitions, and it illustrated the need for weighted averaging to resolve scale-dependencies.