Geophysical Research Abstracts
Vol. 17, EGU2015-9225, 2015
EGU General Assembly 2015

Groundwater and stream threshold values for targeted and differentiated output based regulation of nutrient loadings to ecosystems

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Currently more than 50 % of the European surface water bodies do not meet the objective of good ecological status primarily due to excessive nutrient loadings (mainly N and P) according to recent assessments, and there is a strong need to reduce nutrient loadings to freshwater as well as marine ecosystems. This has been recognized for decades and measures and regulations in many EU member states have been able to reduce the nutrient loadings to e.g. lakes and coastal waters significantly. However, recent assessments also demonstrate that the nutrient loadings to many aquatic ecosystems are still too high. A well known example is the Baltic Sea where the BONUS program has invested significant funds in understanding and reducing nutrient loadings to the Baltic Sea, which is currently considered one of the most polluted seas, globally, and which as a consequence has the largest dead sea-floor area presently known because of eutrophication and oxygen depletion partly due to high nutrient loadings. Hence, further reduction of nutrient loadings to the Baltic Sea is required to improve the ecological status of the Baltic Sea.

The new "Soils2Sea" project ("Reducing nutrient loadings from agricultural soils to the Baltic Sea via groundwater and streams") in the BONUS program for the Baltic Sea, seeks to develop new measures and management techniques that can reduce nutrient loadings to the coastal waters of the Baltic Sea to levels ensuring a future good ecological status of this ecosystem. The Soils2Sea project investigates and assesses nutrient loadings from hillslope/field and sub-catchment scale to the scale of the whole Baltic Sea catchment and focus on development on differentiated regulations and land use that take into account reduction and retention of nitrate in groundwater and surface water systems. We suggest that an important management and governance tool would be to derive groundwater and stream threshold values at both river basin, sub-catchment and perhaps even field scale based on estimated acceptable nutrient loadings to transitional and coastal waters (or any other protected aquatic ecosystem in the river basin) according to the requirements of the EU Water Framework and Groundwater directives, and use these to monitor and plan sustainable water and land use management, e.g. by differentiated practices in farming and land use within sub-catchments. Specifically, we suggest that monitoring of the nitrogen outputs from catchments, sub-catchment and even delineated specific fields with new cost-effective monitoring systems in combination with coupled soil-groundwater-surface water models has a large potential for the development of efficient differentiated measures controlling nutrient loadings to aquatic ecosystems. Here we present initial considerations and suggestions for the development of new governance concepts targeted at differentiated output based regulations using threshold values for N in groundwater and streams derived from acceptable loadings to a small Danish estuary.