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An Assessment of the potential impact of the Gothenburg Protocol on surface water chemistry using the dynamic MAGIC model at acid sensitive sites in the UK

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Abstract. The MAGIC model has been systematically calibrated to 12 sites in the UK, which form part of the UK Acid Waters Monitoring Network, using best available data. The model successfully simulates observed changes in major ions and acid neutralising capacity over the period 1988 to 2000. Predictions for the future are made assuming no further emission reductions from present day (constant deposition at current level) compared to reduced sulphur and nitrogen emission agreed under the Gothenburg Protocol (reduced sulphur dioxide emission by c.80%, nitrogen oxides by c.45% and ammonia by 20% by 2010). In addition, uncertainty in our understanding of future nitrogen dynamics is assessed using "best" and "worst" cases of nitrogen leaching in the model. The results clearly indicate the need to achieve further emission reductions in sulphur and nitrogen beyond present day levels to prevent continued surface water acidification. The predictions further indicate that if the emission reductions agreed under the Gothenburg Protocol are achieved by 2010 this will promote a recovery in acid neutralising capacity by 2020 at all sites. Differences between "best" and "worst" case nitrate leaching are relatively small, emphasising the need to achieve the sulphur reductions in the shorter term. In the longer term, beyond 2020, increased nitrogen leaching under the "worst case" leading to further acidification is likely indicating a need for further reduction of nitrogen emissions.

Keywords: acidification, recovery, model, Gothenburg Protocol, nitrogen

[Final Revised Paper](#) (PDF, 488 KB)

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