Hydrology and Earth System Sciences
An Interactive Open Access Journal of the European Geosciences Union

Hydrol. Earth Syst. Sci., 7, 609-617, 2003
www.hydrol-earth-syst-sci.net/7/609/2003/

Assessing emission reduction targets with dynamic models: deriving target load functions for use in integrated assessment

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Abstract. International agreements to reduce the emission of acidifying sulphur (S) and nitrogen (N) compounds have been negotiated on the basis of an understanding of the link between acidification related changes in soil and surface water chemistry and terrestrial and aquatic biota. The quantification of this link is incorporated within the concept of critical loads. Critical loads are calculated using steady state models and give no indication of the time within which acidified ecosystems might be expected to recover. Dynamic models provide an opportunity to assess the timescale of recovery and can go further to provide outputs which can be used in future emission reduction strategies. In this respect, the Target Load Function (TLF) is proposed as a means of assessing the deposition load necessary to restore a damaged ecosystem to some pre-defined acceptable state by a certain time in the future. A target load represents the deposition of S and N in a defined year (implementation year) for which the critical limit is achieved in a defined time (target year). A TLF is constructed using an appropriate dynamic model to determine the value of a chemical criterion at a given point in time given a temporal pattern of S and N deposition loads. A TLF requires information regarding: (i) the chemical criterion required to protect the chosen biological receptor (i.e. the critical limit); (ii) the year in which the critical limit is required to be achieved; and (iii) time pattern of future emission reductions. In addition, the TLF can be assessed for whole regions to incorporate the effect of these three essentially ecosystem management decisions.

Keywords: emission reduction, critical load, target load, dynamic model, recovery time

Final Revised Paper (PDF, 564 KB)

Citation: Jenkins, A., Cosby, B. J., Ferrier, R. C., Larssen, T., and Posch, M.: Assessing emission reduction targets with dynamic models: deriving target load functions for use in integrated assessment, Hydrol. Earth Syst. Sci., 7, 609-617, 2003. Bibtex EndNote Reference Manager