Geophysical Research Abstracts, Vol. 8, 02634, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02634

Stochastic controls on biogeochemical and hydrological processes in river basins

T. Settin (1), **G. Botter** (1), M. Marani (1), A. Rinaldo (1)

(1) Dept. IMAGE and International Center for Hydrology "D. Tonini", University of Padova, Padova, ITALY

A stochastic framework for modelling catchment-scale biogeochemical and hydrological processes in river basins is developed and applied to model the nitrates cycling, transport and leaching in a heterogeneous catchment of north-eastern Italy, where complex land-use distribution and geomorphology demand suitable descriptions. In particular, we focus on the stochastic nature of the underlying hydrologic, climatic and biogeochemical processes (which stems from the randomness of the rainfall fields) and on their interaction through the soil moisture dynamics. The model is based on a geomorphological scheme of the hydrologic response coupled with suitable Lagrangian transport models (mass-response functions) applied in a Montecarlo framework, which explicitly addresses the random character of the rainfall processes controlling the nitrate generation to the hydrologic cycle. The influence of random climatic variables on key hydrologic fluxes (e.g. evapotrasnpiration) and on biogeochemical processes affecting the nitrogen cycling in the soil-water system (e.g. plant uptake, nitrification and denitrification, mineralization) is considered. Special attention is also devoted to the spatial and temporal variability of nitrogen sources of agricultural origin and to the effects of the relative timing and intensity of the forcing rainfall fields on the ensuing nitrate leaching through runoff waters. Besides its conceptual interest, the relevance of the model stems from the capabilities of determining the probability distribution of the hydrologic and chemical variables computed (e.g. nitrate concentrations in the soil-water system and the soil moisture). We found that large-scale patterns of the spatially-averaged soil water content can be adequately described by effective upscaled soil and vegetation properties. Furthermore, the return period of the water volumes and of the nitrate loads released downstream (in this case into the Venice lagoon) can be determined and directly linked to the ongoing climatic and agricultural

regimes. The results achieved show that the modes of nitrogen injection through fertilization significantly affect the form of probability distribution of nitrate contained in soil moisture even when the total amount is fixed, with implications for sustainable management practices.