"INVERTING" A HYDROLOGICAL MODEL TO FIND A OPTIMISED LAND USE SCENARIO FOR THE MINIMISATION OF NITROGEN LEACHING USING NEURAL NETWORK TECHNIQUES

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In regions with little ground water a major resource for the supply with drinking water is the construction of reservoirs. In the former GDR reservoirs were often built without concerning the land use in the contributing area. Hence, reservoirs were also established in catchments which are mostly used for agriculture, where water quality problems due to nutrient leaching from farmland exist. Additionally, there is nutrient input by untreated waste water from the settlements. To deal with these problems, a complex catchment management is necessary. To improve this management by simplifying and making it more transparent, an integrated management system called IWES (Integriertes Wasserwirtschaftliches Entscheidungsuntersttzungssystem) is developed. The system focuses on the nitrogen input from diffuse nonpoint sources of the agricultural land. IWES combines data from Remote Sensing, GIS-analyses, land use databases and field measurements in order to facilitate a detailed model parameterisation. Aim of this System is to find a good balance between water quality and restrictions for the farming. The land use restrictions to be taken to reduce nutrient leaching affect single fields, hence the model must be able to calculate water and N balances for single patches, link them and route them down to the stream. A further requirement is the ability to simulate land use and climate change scenarios. The chosen model, the WASMOD system (WAter and Substance Model) meets those requirements.
The possibility to find a optimised scenario with the model alone is, due to the enormous range of the parameters which must be considered, intractable in practice. We therefore developed a method witch can be seen as a "straight fore ward" simplification of the model topology into a Neural Network. The method allows not only to simulate land use scenarios like hydrologic models do. Moreover it can search systematically (by "inverting" the hydrological model) for land use scenarios that fulfil the desired properties without worrying about complexity of combinational optimisation. The optimised scenario that is the result of these procedure can be used for a more reasonable distribution of land use restrictions in the catchment.