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Watershed modeling tools and data for prognostic and diagnostic

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When eutrophication is considered an important process to control it can be accomplished reducing nitrogen and phosphorus losses from both point and nonpoint sources and helping to assess the effectiveness of the pollution reduction strategy.
HARP-NUT guidelines (Guidelines on Harmonized Quantification and Reporting Procedures for Nutrients) (Borgvang & Selvik, 2000) are presented by OSPAR as the best common quantification and reporting procedures for calculating the reduction of nutrient inputs. In 2000, OSPAR HARP-NUT guidelines on a trial basis. They were intended to serve as a tool for OSPAR Contracting Parties to report, in a harmonized manner, their different commitments, present or future, with regard to nutrients under the OSPAR Convention, in particular the "Strategy to Combat Eutrophication".
HARP-NUT Guidelines (Borgvang and Selvik, 2000; Schoumans, 2003) were developed to quantify and report on the individual sources of nitrogen and phosphorus discharges/losses to surface waters (Source Orientated Approach). These results can be compared to nitrogen and phosphorus figures with the total riverine loads measured at downstream monitoring points (Load Orientated Approach), as load reconciliation. Nitrogen and phosphorus retention in river systems represents the connecting link between the "Source Orientated Approach" and the "Load Orientated Approach".
Both approaches are necessary for verification purposes and both may be needed for providing the information required for the various commitments.
Guidelines 2,3,4,5 are mainly concerned with the sources estimation. They present a set of simple calculations that allow the estimation of the origin of loads. Guideline 6 is a particular case where the application of a model is advised, in order to estimate the sources of nutrients from diffuse sources associated with land use/land cover. The model chosen for this was SWAT (Arnold & Fohrer, 2005) model because it is suggested in the guideline 6 and because it's widely used in the world.
Watershed models can be characterized by the high number of processes associated simulated. The estimation of these processes is also data intensive, requiring data on topography, land use / land cover, agriculture practices, soil type, precipitation, temperature, relative humidity, wind and radiation.
Every year new data is being made available namely by satellite, that has allow to improve the quality of model input and also the calibration of the models (Galvão et. al, 2004b). Tools to cope with the vast amount of data have been developed: data formatting, data retrieving, data bases, metadata bases. The high number of processes simulated in watershed models makes them very wide in terms of output. The SWAT model outputs were modified to produce MOHID compliant result files (time series and HDF). These changes maintained the integrity of the original model, thus guarantying that results remain equal to the original version of SWAT. This allowed to output results in MOHID format, thus making it possible to immediately process it with MOHID visualization and data analysis tools (Chambel-Leitão et. al 2007; Trancoso et. al, 2009). Besides SWAT was modified to produce results files in HDF5 format, this allows the visualization of watershed properties (modeled by SWAT) in animated maps using MOHID GIS. The modified version of SWAT described here has been applied to various national and European projects. Results of the application of this modified version of SWAT to estimate hydrology and nutrients loads to estuaries and water bodies will be shown (Chambel-Leitão, 2008; Yarrow & Chambel-Leitão 2008; Chambel-Leitão et. al 2008; Yarrow & P. Chambel-Leitão, 2007; Yarrow & P. Chambel-Leitão, 2007; Coelho et. al., 2008).

Keywords: Watershed models, SWAT, MOHID LAND, Hydrology, Nutrient Loads

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