Integrated Watershed Modeling

Pedro Bagulho Galvão [1], Ramiro Neves [4], Adelio Silva [2], Pedro Chambel Leitão [3], Frank Braunchweig [5]

[1] Eng., MARETEC / Instituto Superior Técnico, TagusPark Núcleo Central, 349, 2780-920 Oeiras Portugal, pgalvao.maretec@taguspark.pt:
[2] PhD, Hidromod, TagusPark Núcleo Central, 349, 2780-920 Oeiras Portugal, asilva.hidromod@taguspark.pt:
[3] MsC, MARETEC / Instituto Superior Técnico, TagusPark Núcleo Central, 349, 2780-920 Oeiras Portugal, pedro.chambel.maretec@taguspark.pt:
[4] PhD, Prof / MARETEC /Instituto Superior Técnico, Av. Rovisco Pais 1, 1096 Lisboa Portugal, ramiro.neves.maretec@taguspark.pt
[5] MsC, Maretec / Instituto Superior Técnico, TagusPark Núcleo Central, 349, 2780-920 Oeiras Portugal, frank.maretec@taguspark.pt:

INTRODUCTION:

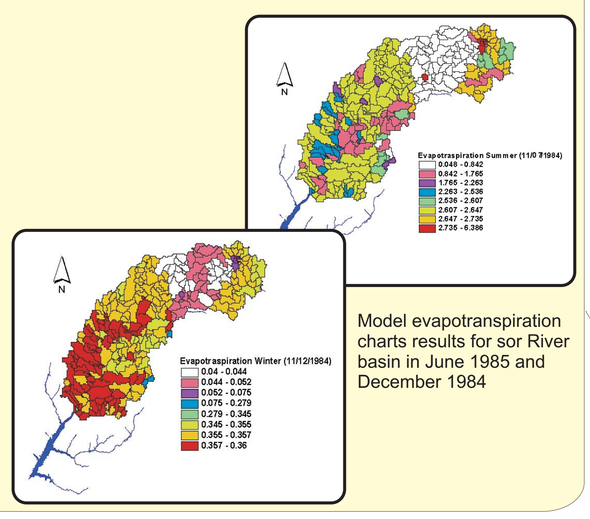
Over the past 20 years, national environmental managers and policy makers have repeatedly complained about the lack of adequate information: information that was often not available in time, and when available was frequently not reliable, or did not meet policy needs.
Watershed management is a perfect example of the difficulties that can be encountered: water quality in large reservoirs and estuaries has a direct relation with land use and agricultural practices. These relations are often complex and the result of both physical and biological processes.
However the combined advances in modeling, monitoring techniques and in information technologies have dramatically increased the ability to deal with environmental problems. On one hand computational models can integrate a diversity of processes exposing the relation between them. On the other hand EO data can interact with models.

Methodology

The BASINS system (EPA http://www.epa.gov/OST/BASINS/) combines under a GIS Framework data from local measurement and modeling tools (HSPF, SWAT, PLOAD, QUAL2E)
Both existing watershed models and MARETEC developed ones MOHID Land (still in development status) are coupled to three-dimensional model (MOHID WATER) for reservoirs.
The results shown in this poster are from the SWAT model used under the BASINS interface linked to the MOHID water (simulating water flow and quality in the Montargil reservoir subject site for interreg IIB icrew project). The interaction between integrated watershed models and remote sensed data opens interesting prospective to the validation and improvement of such models.

Inland Processes

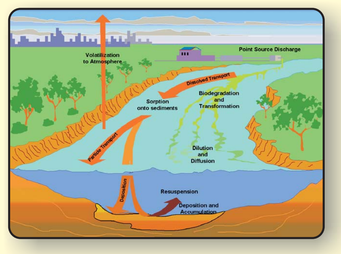
- Surface Runoff and quality is a direct consequence of soil coverage and land use
- The subdivision of the watershed enables the model to reflect differences in evapotranspiration for various crops and soils
- In the soil, transformation of nutrients (nitrogen and phosphorus) from one form to another is governed by the respective cycles.

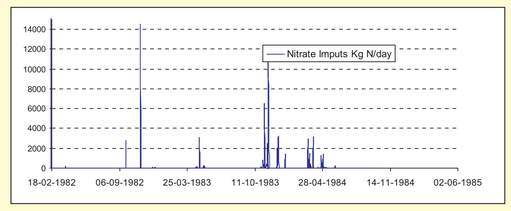


Model evapotranspiration charts results for sor River basin in June 1985 and December 1984

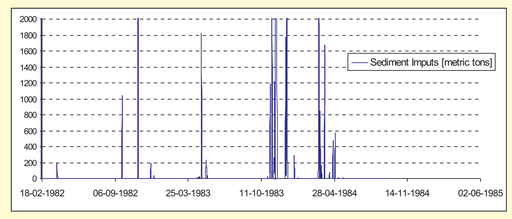
Instream Processes

- Several instream water quality processes are considered
- Integrates point sources with nonpoint sources derived from the Inland Processes

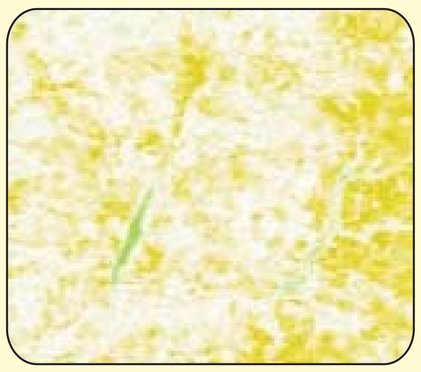




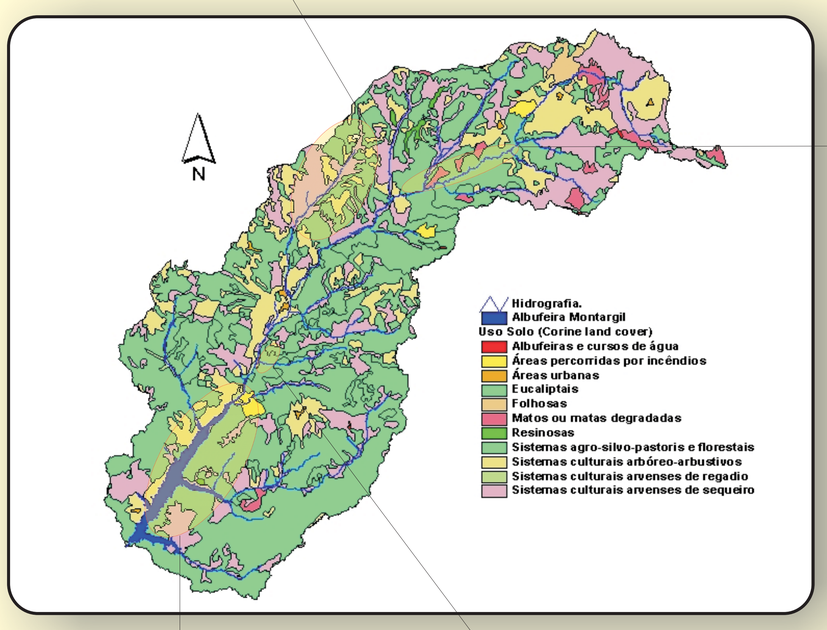
Model results for Nitrate and sediment Imputs via Sor River to the Montargil reservoir between 1980 -85



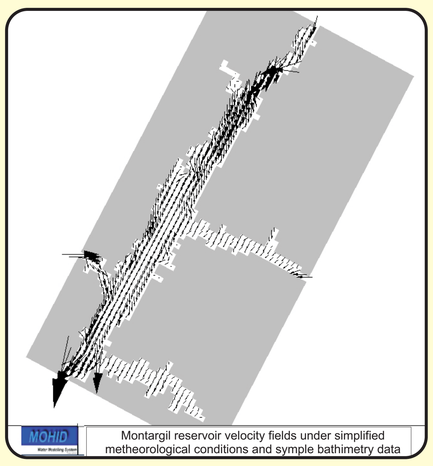
Montargil Reservoir and Sor River Watershed



Montargil Reservoir and catchment[(Clorophille (Meris)]

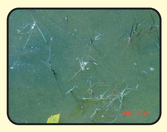


Reservoir Hydrodynamics and water quality



Montargil reservoir velocity fields under simplified metheorological conditions and symple bathimetry data

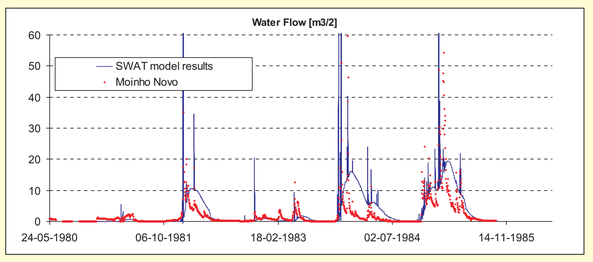
- Water quality models such as WASP and Ce-Qual-w2 are coupled to MOHID hydrodynamic results to simulate water quality in reservoirs
- If a correct hidrodinamic model is obtained the efects of stratification and physical dispersion and transport can be taken into account in the water quality models
- Coupled with watershed models the effects of diffuse pollution is taken into account



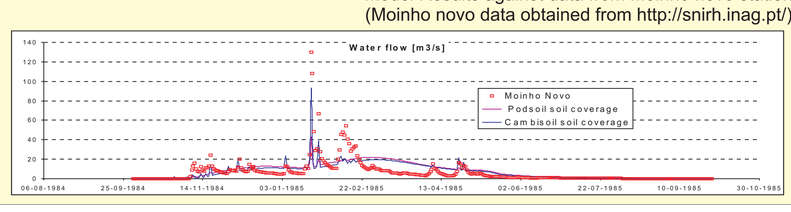
Cyanobacteria in Montargil Reservoir

Moinho novo hydrometric station daily runoff curves vs SWAT Model results (1980 - 1985)

Moinho Novo Station



Model Results against data from Moinho novo station (Moinho novo data obtained from http://snirh.inag.pt/)



Conclusions

Even tough watersheds are complex systems, if different modeling tools are used the processes that affect water quality can be exposed.
Using available data (corine land cover chart and FAO soil charts, no specific data campaigns were used) the watershed model results follow the tendency show in moinho novo Hydrometric station with reasonable accuracy.
Once water quality and flow are correctly calibrated in the watershed, diffuse pollution can be taken into account for models that simulate the reservoir.
Coupled with data campaigns and EO data to update and calibrate the land cover model and reservoir water quality, this is a system that can bring benefits to watershed management.