Integration of MOHID model and tools with SWAT model

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Like the contracts the small letters have the important things

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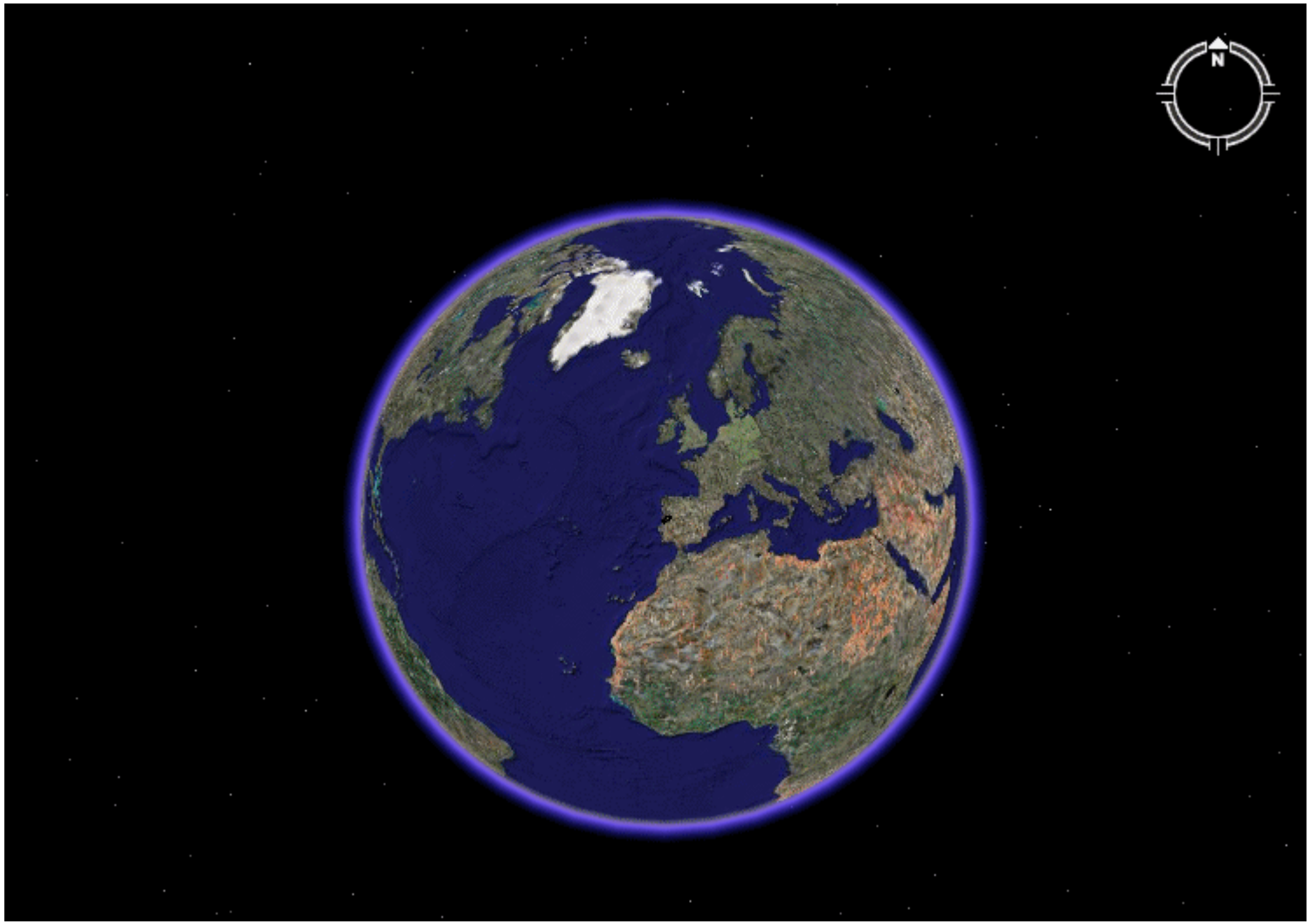
Overview

- Why are watershed models important for us:
  - Mondego Case Study
- SWAT-MOHID
  - MOHID Time Series editor
  - MOHID Time Series Analyzer
  - MOHID HDF
  - Coupling SWAT with Mohid River Network
- SWAT-MOHID application
  - Mondego Case Study
- Conclusions

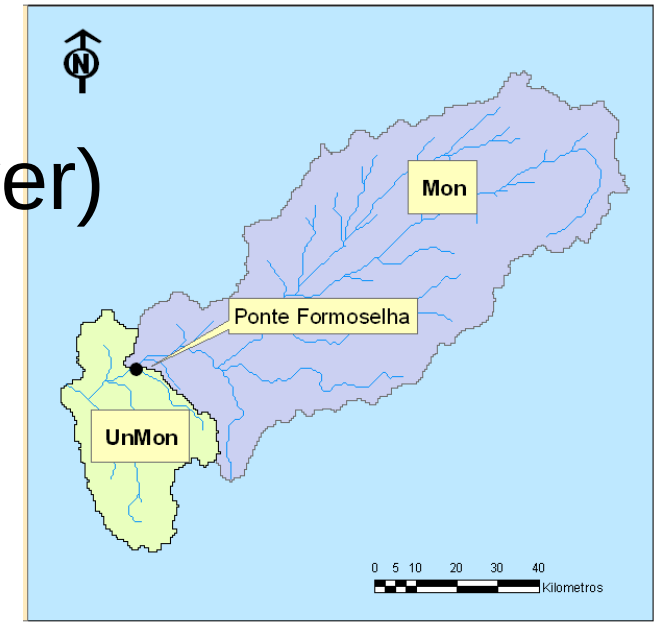
Mondego Case Study



Nutrient Loads to Estuary HARP guidelines (OSPAR)

Annual quantities

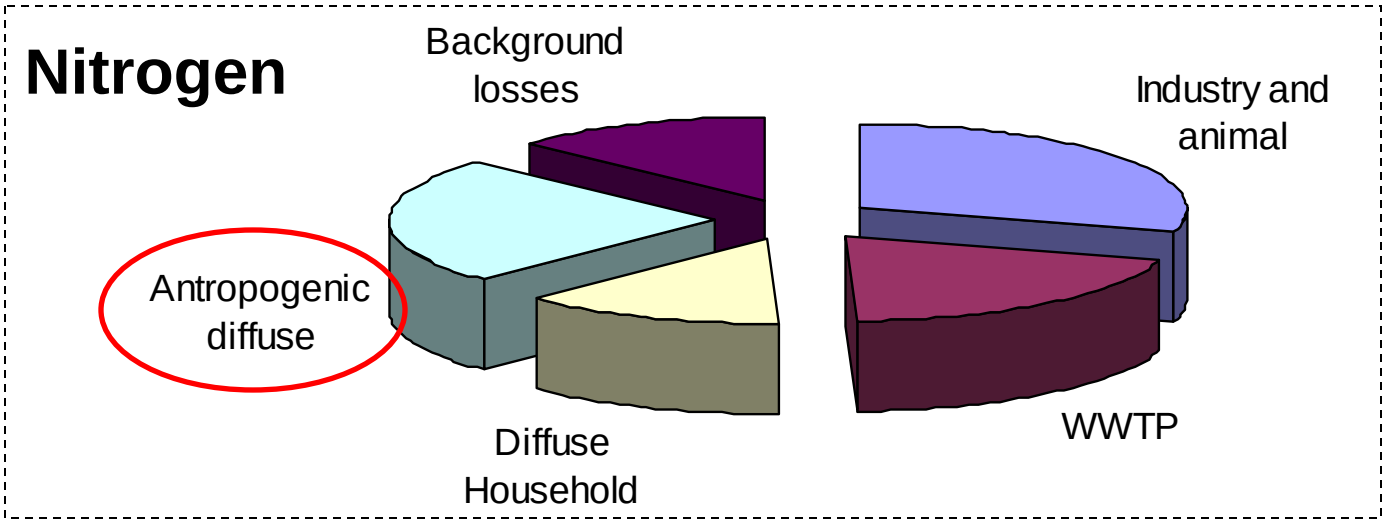
- Values in tons/year
- Source Oriented Approach
  - Nitrogen - 4121
  - Phosphorous - 646
- Load Oriented Approach (river)
  - Nitrogen - 3469
  - Phosphorous - 404

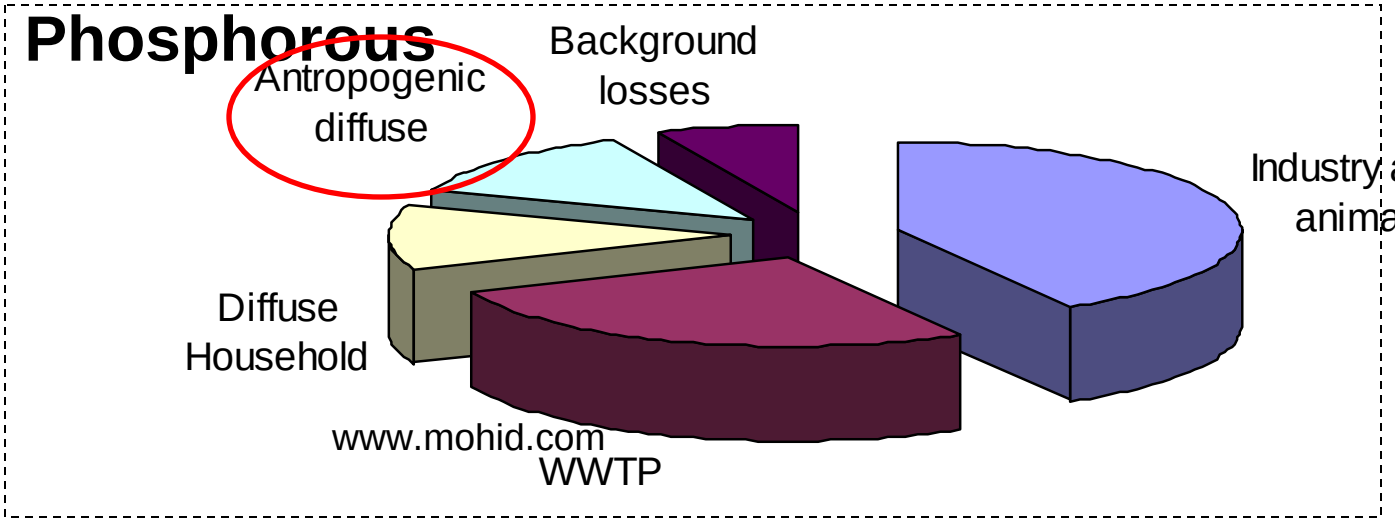


Nutrient Loads to Estuary HARP guidelines (OSPAR)

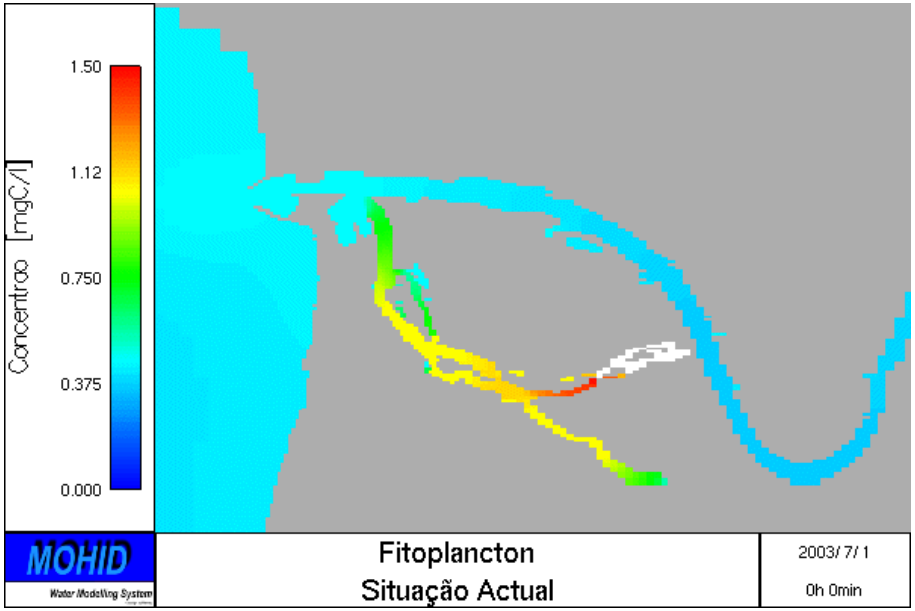
Origin

Preliminary results show agriculture is responsible for 25% of total nitrogen and 13% of total phosphorous





Estuary modeling - Water quality



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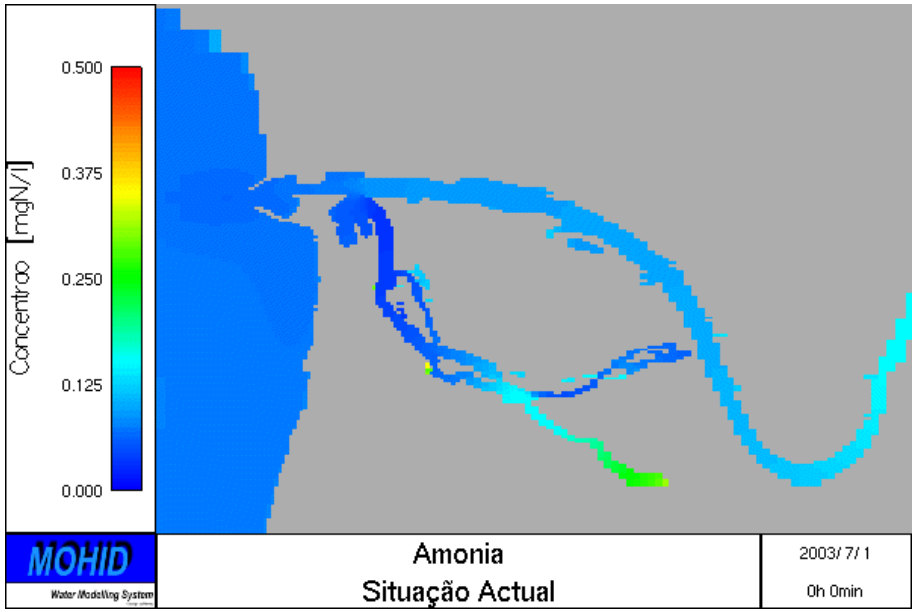

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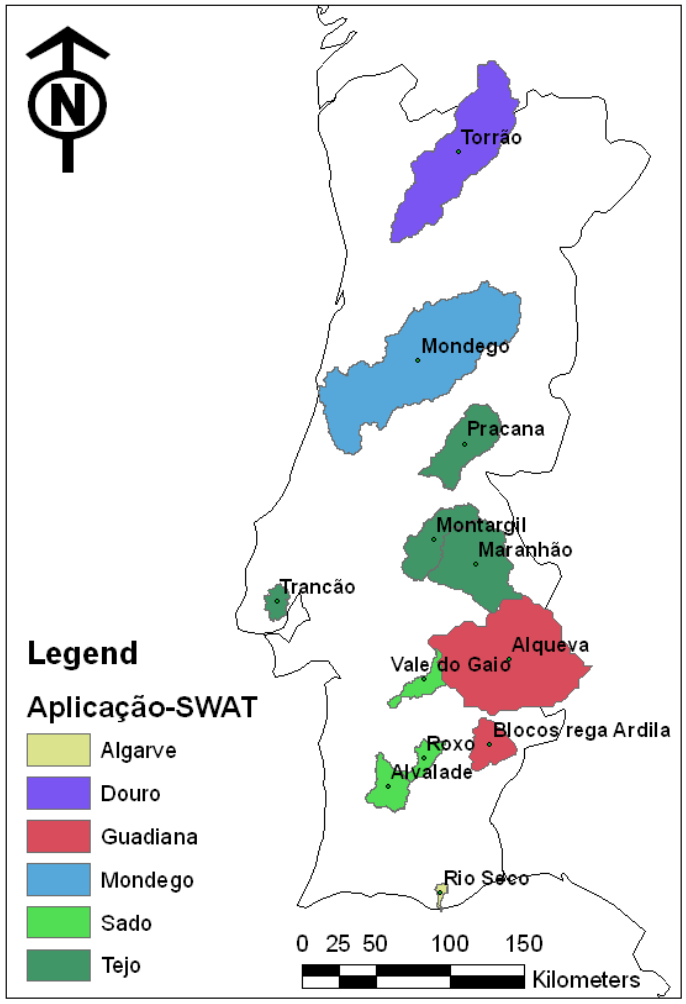
Other Case Studies

- Case studies used mainly publicly available internet data:
  - NASA DEM
  - Corine LU/LC
  - Europe soil map
  - National Water Institute Precipitations and flows



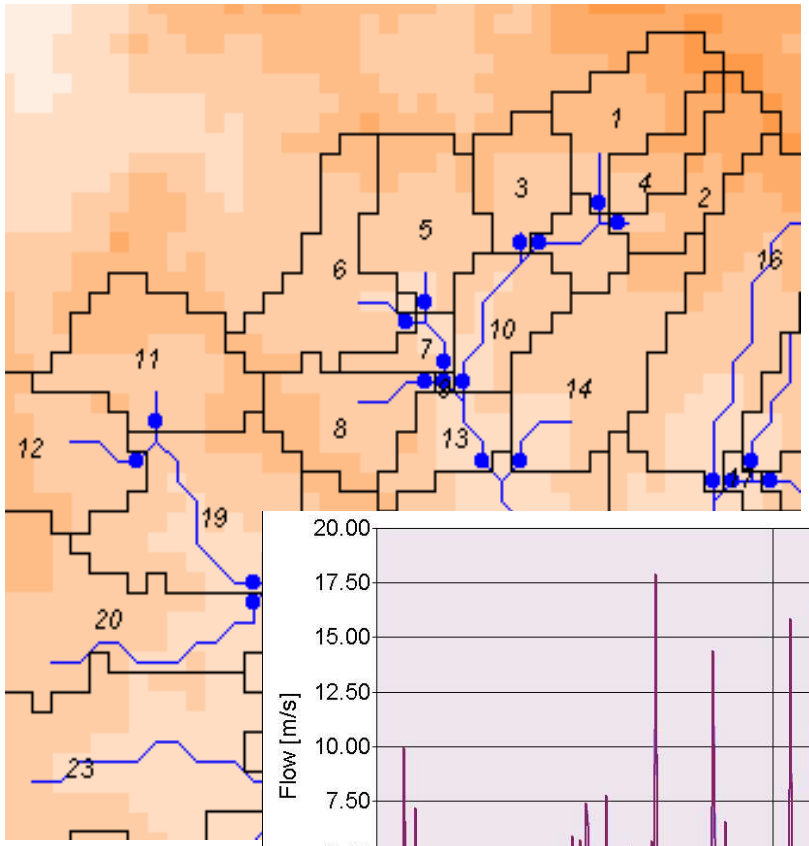
What is MOHID about?

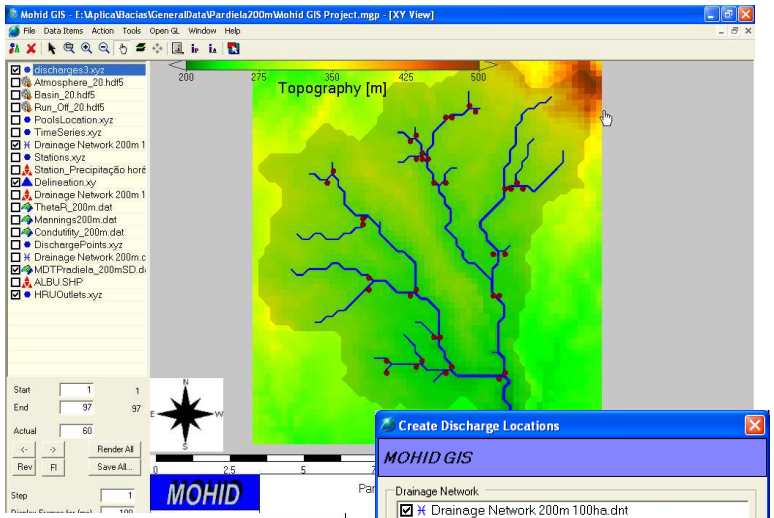
- Object oriented programing:
  - Models - Fortran 95
  - Interfaces – dot Net, VB, C#, etc
- Models:
  - Grid based
  - Variable Time Step
  - Water and properties mass conservation
- Solving water related problems

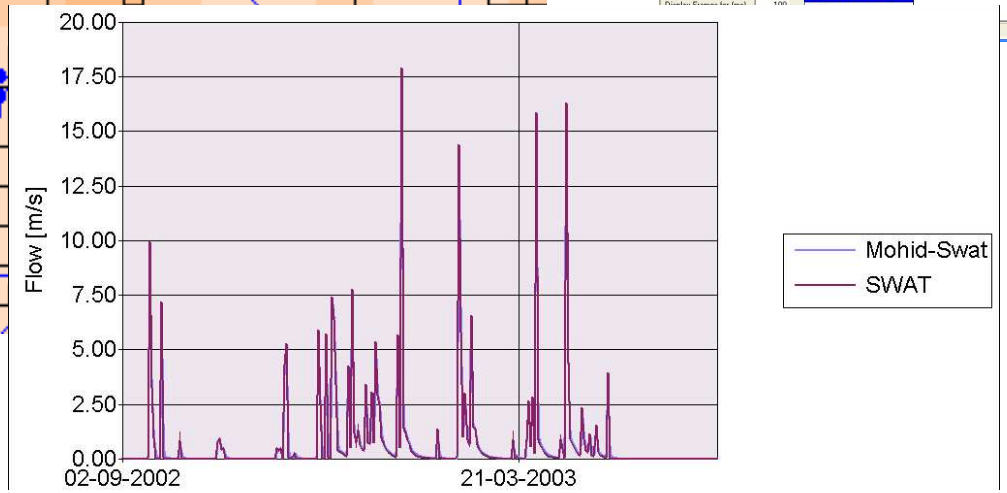
Why to link MOHID & SWAT?

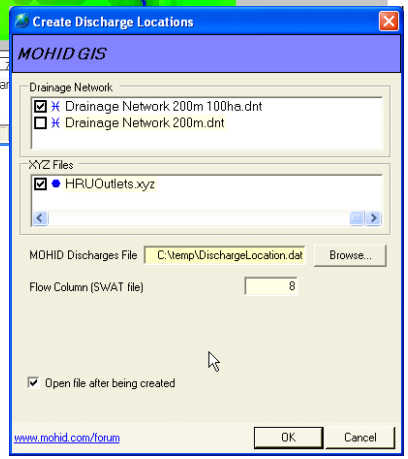
- SWAT is the sum of many simple solved processes => Complex model
- Mohid tools allow exploring easily SWAT results to find:
  - Input errors
  - Concept errors
  - Compare with data
  - Trends
  - Study in high detail some processes

Connection of SWAT and MOHID River Network

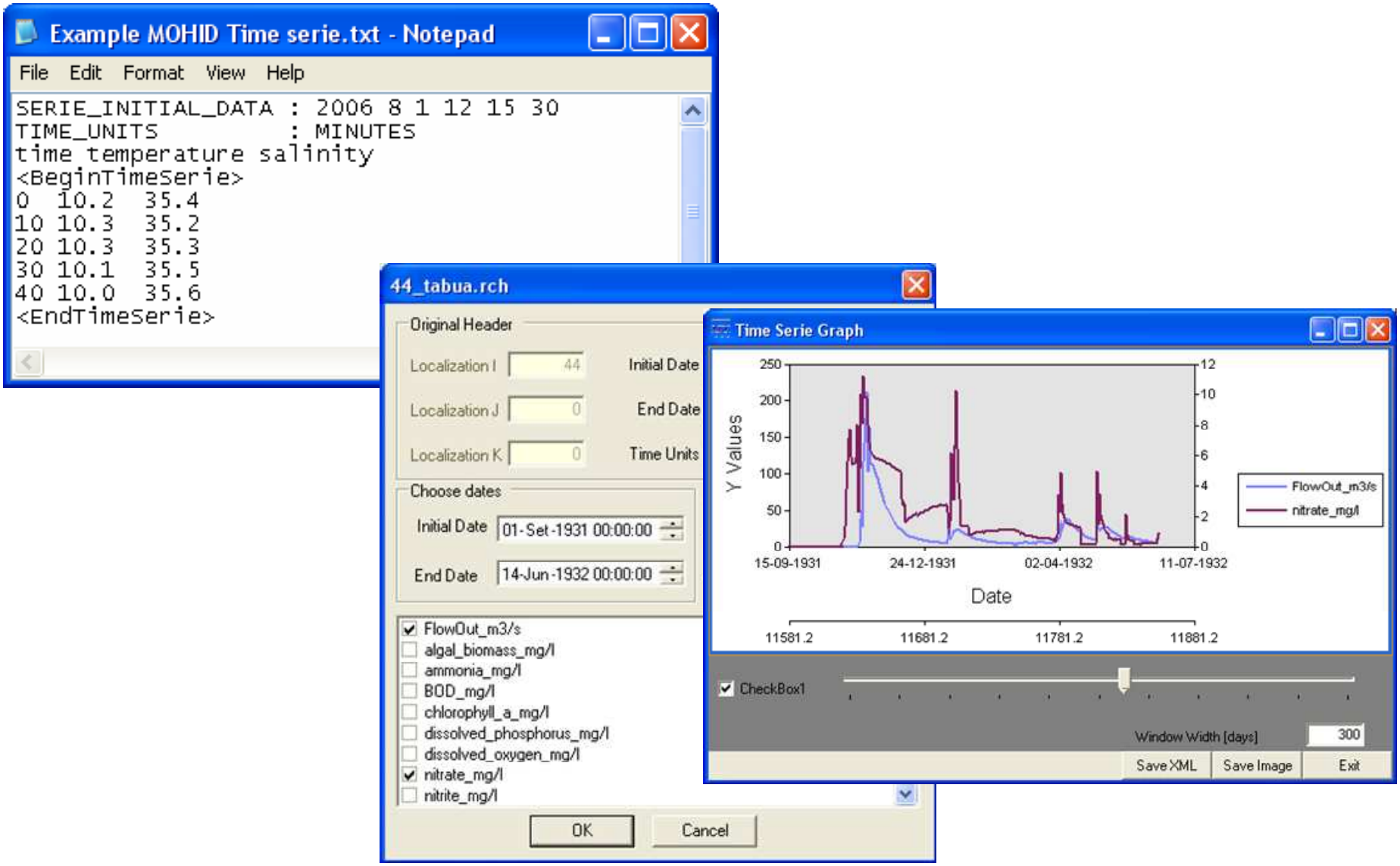




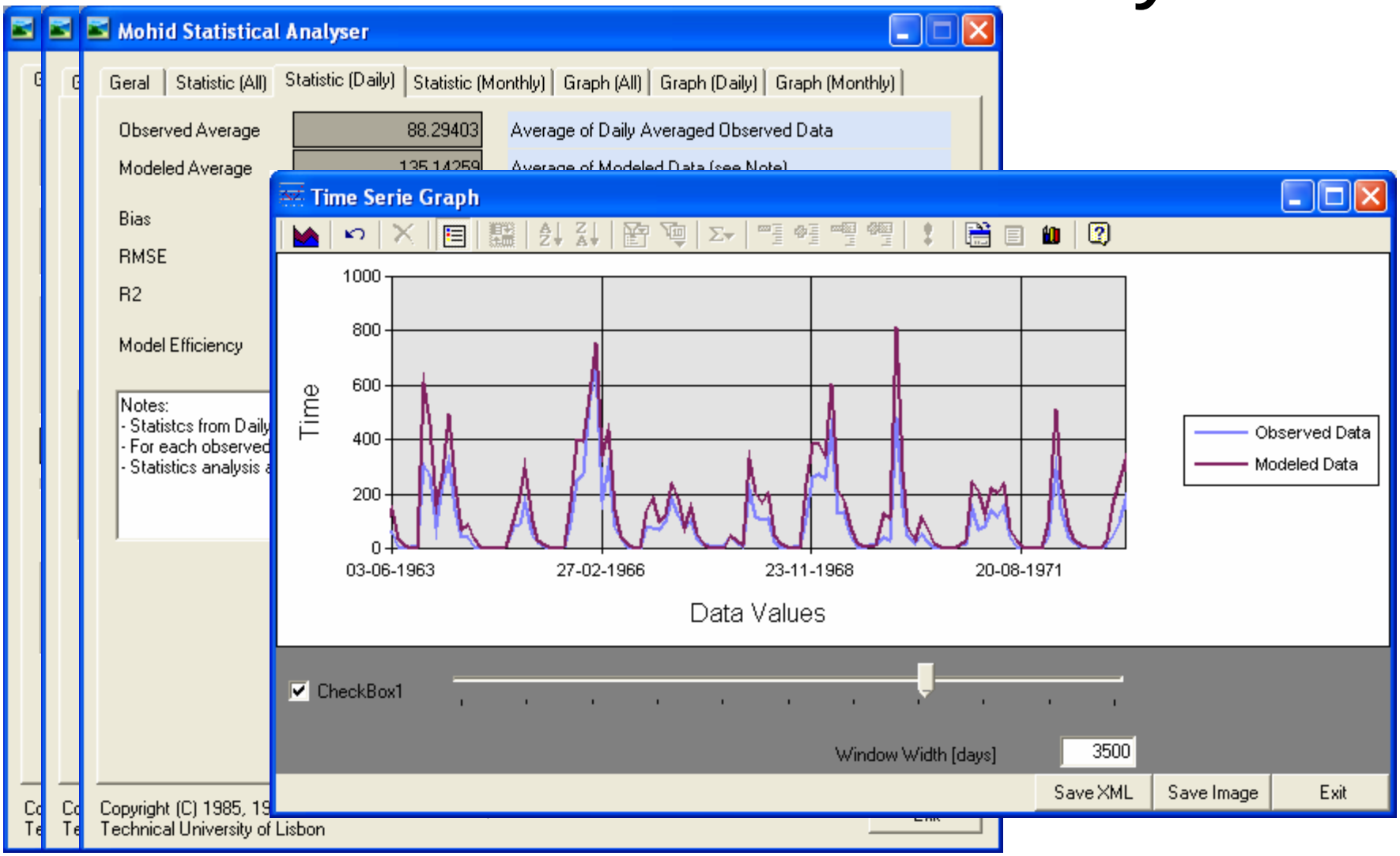




MOHID Time Series Viewer



MOHID Time Series Analyzer



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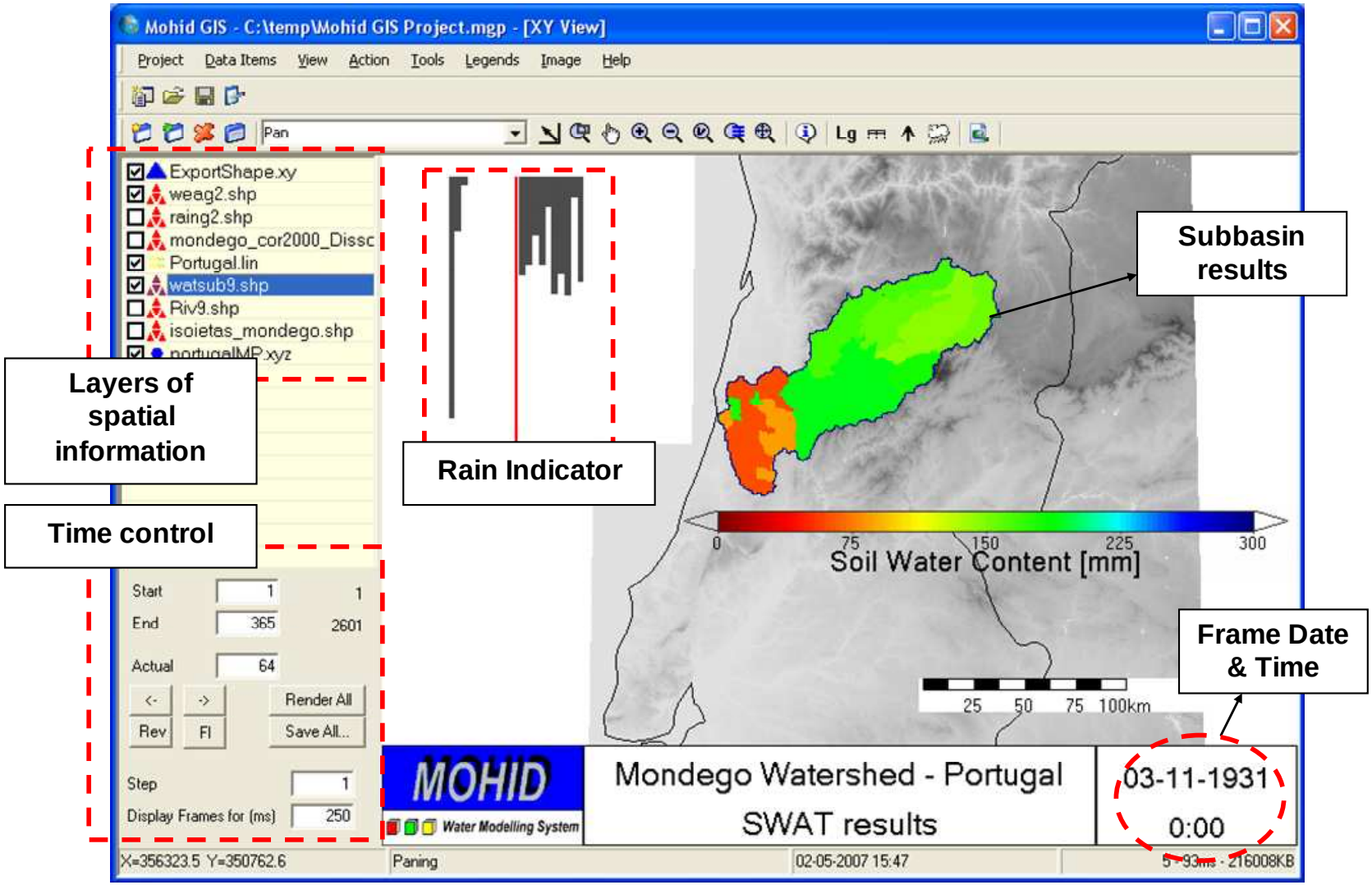
MOHID GIS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Time control
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75
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300
Soil Water Content [mm]
25
50
75
100km
Frame Date & Time
MOHID
Water Modelling System
Mondego Watershed - Portugal
SWAT results
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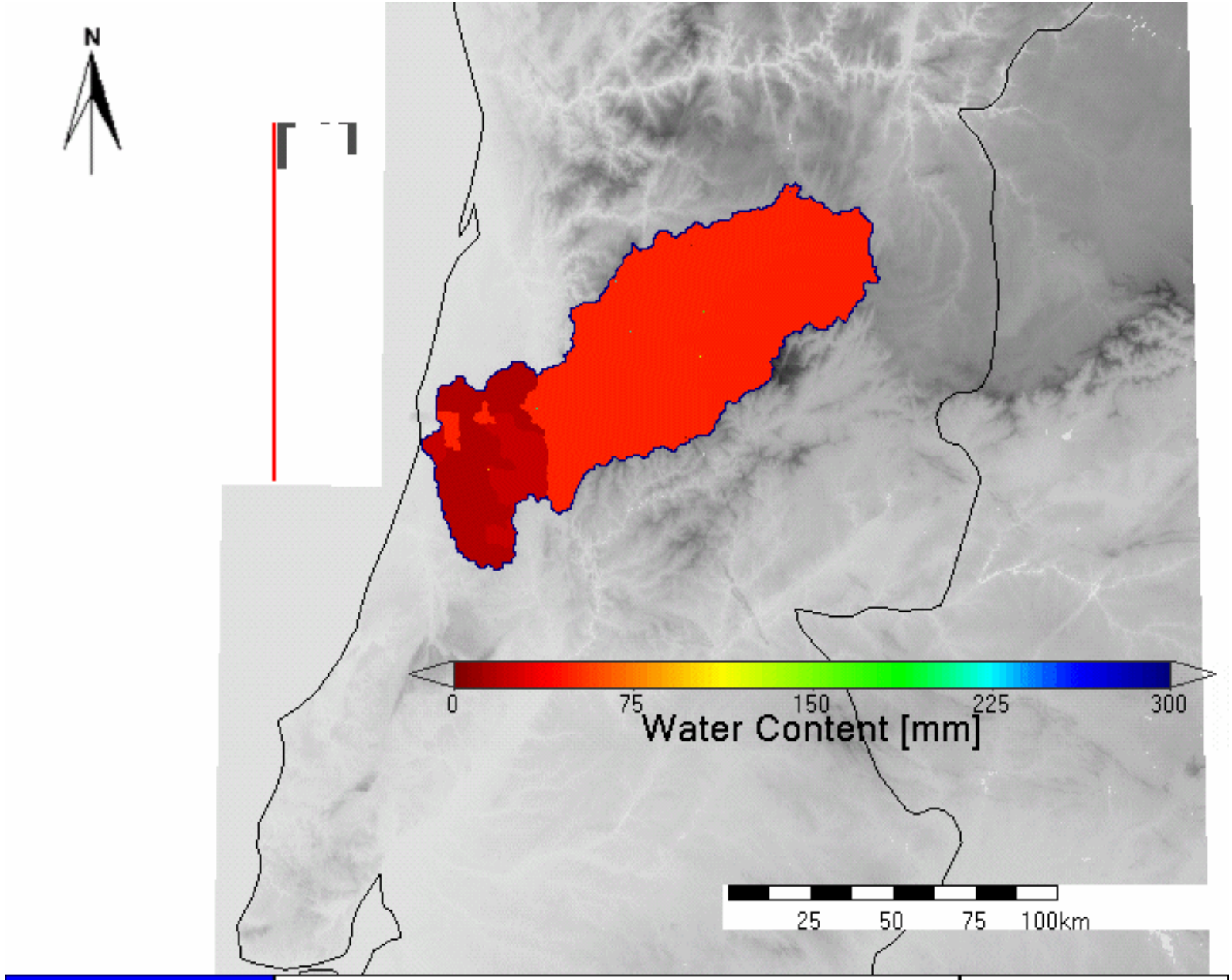
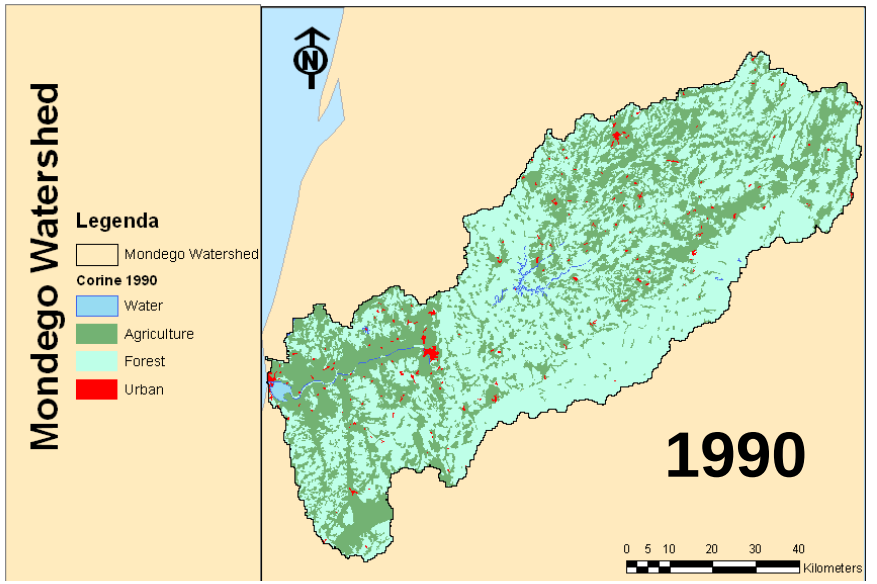
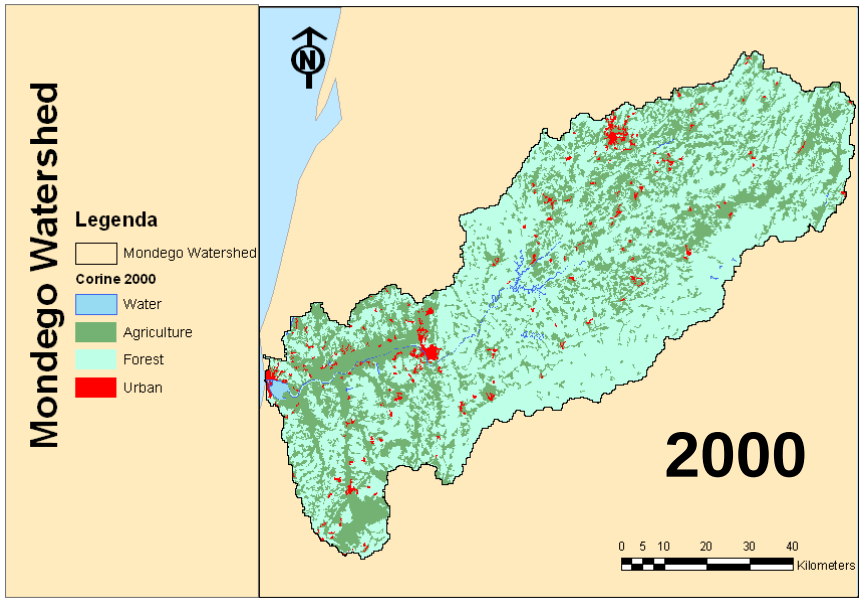


MOHID Water Modelling System	Mondego Watershed - Portugal SWAT results	01-09-1931 0:00

Aplication of SWAT-MOHID

- **Land Use Land Cover – CORINE**





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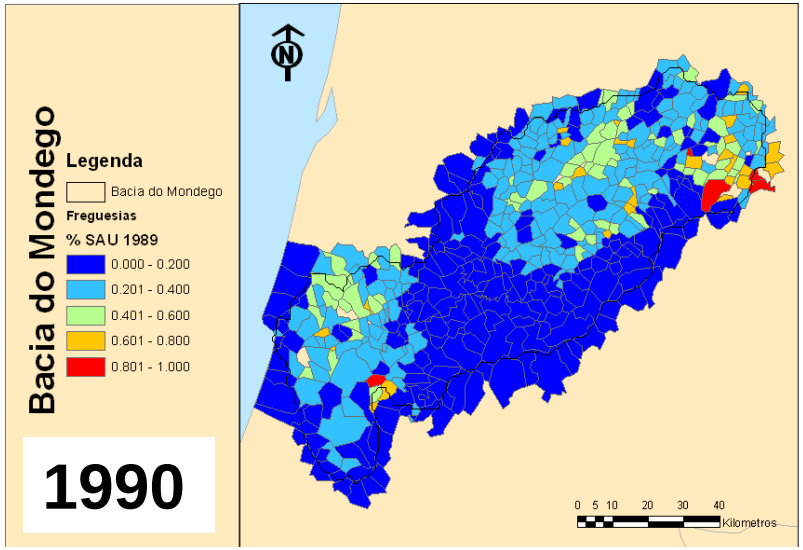
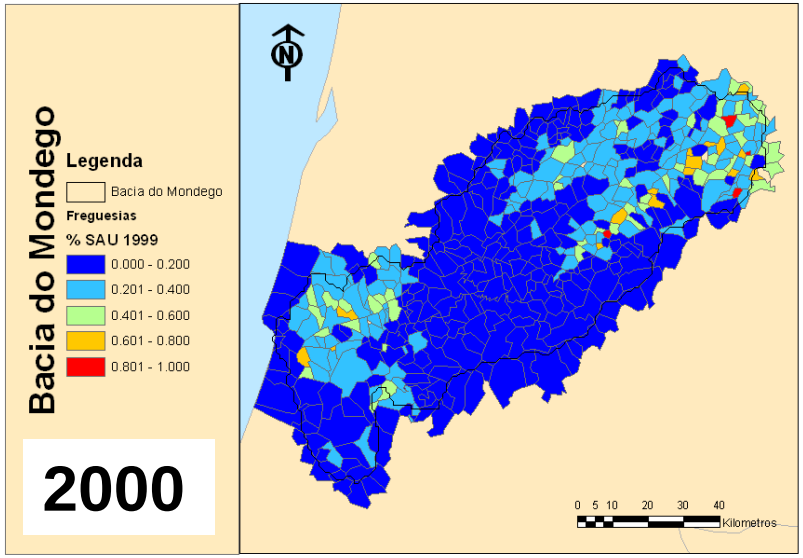
Agriculture census data

% of agriculture area





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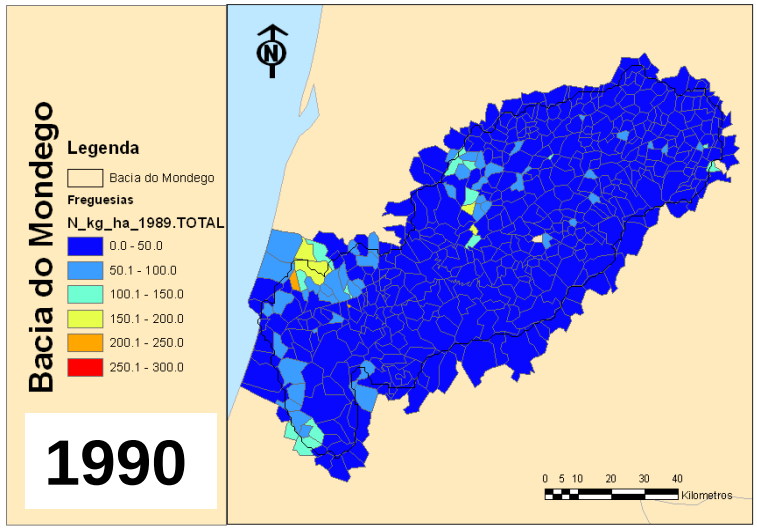
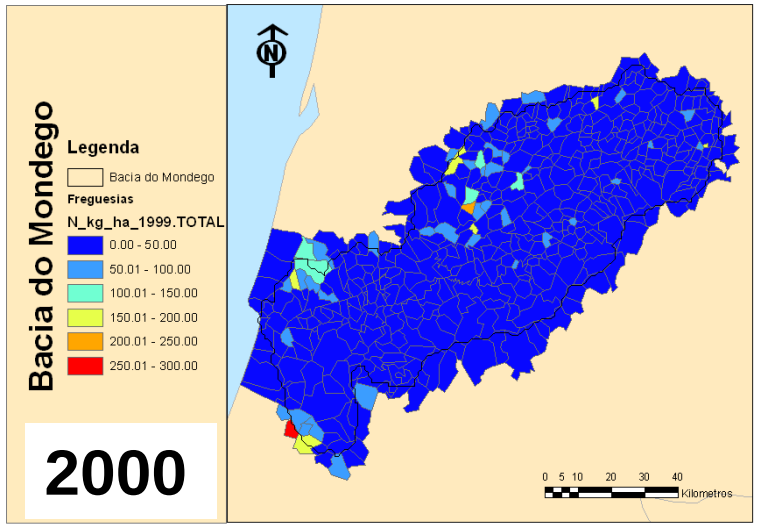
Animal Pressures

N Kg / hectar / year

- 0.0 - 50.0
- 50.1 - 100.0
- 100.1 - 150.0
- 150.1 - 200.0
- 200.1 - 250.0
- 250.1 - 300.0



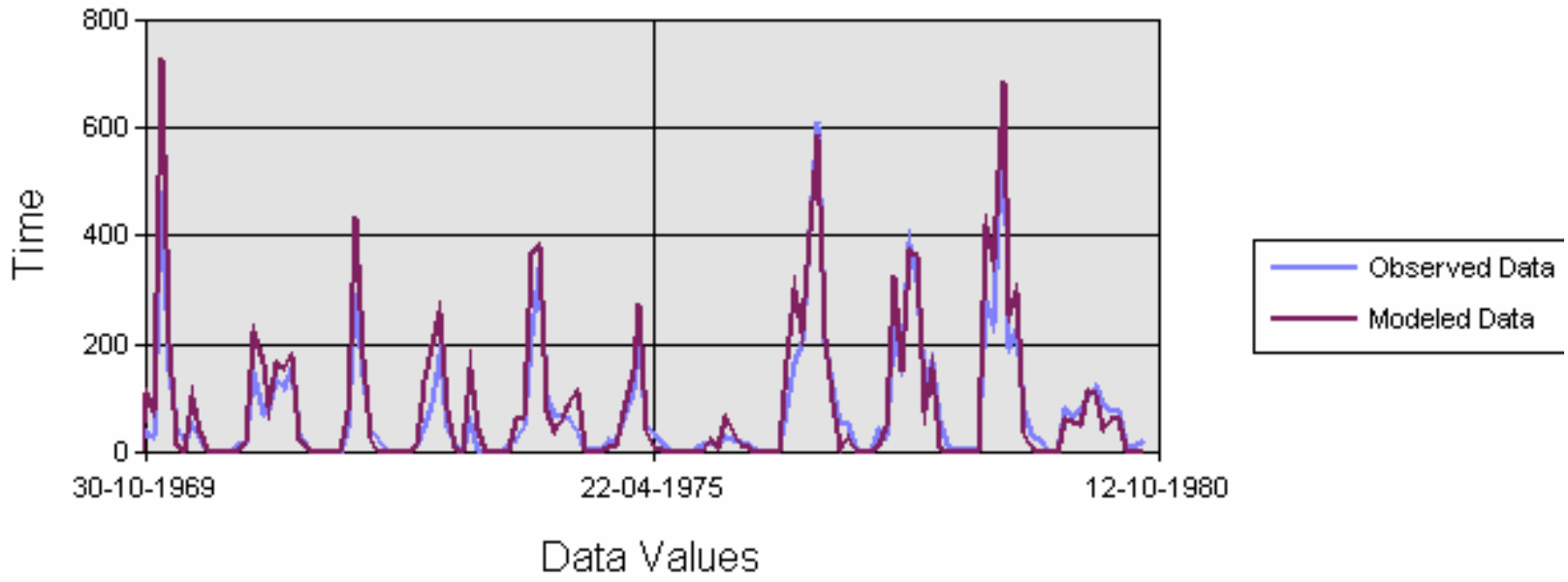


www.

Some round numbers

- Area of 6700 km2
- 1000 mm of precipitation
- 2000 meters mountain
- Agriculture area, Corine-35% Census-20%
- About 600 000 people
- 40 000 catle,150 000 pigs, 200 000 sheep, 50 000 goats and 6 000 000 poultry
- 700 year old University (Coimbra)

Flow results



Flow gage station	Coimbra		Tabua		Mucela	
	Daily	Monthly	Daily	Monthly	Daily	Monthly
RMSE - Root Mean Squared Error [m3/s]	88	51	37	25	15	9
R2 - Pearson Product-Moment Correlation Coefficient [-]	0.78	0.91	0.76	0.9	0.69	0.83
E - Model eficiency (Nash-Sutcliffe) [-]	0.69	0.82	0.05	0.27	0.52	0.68

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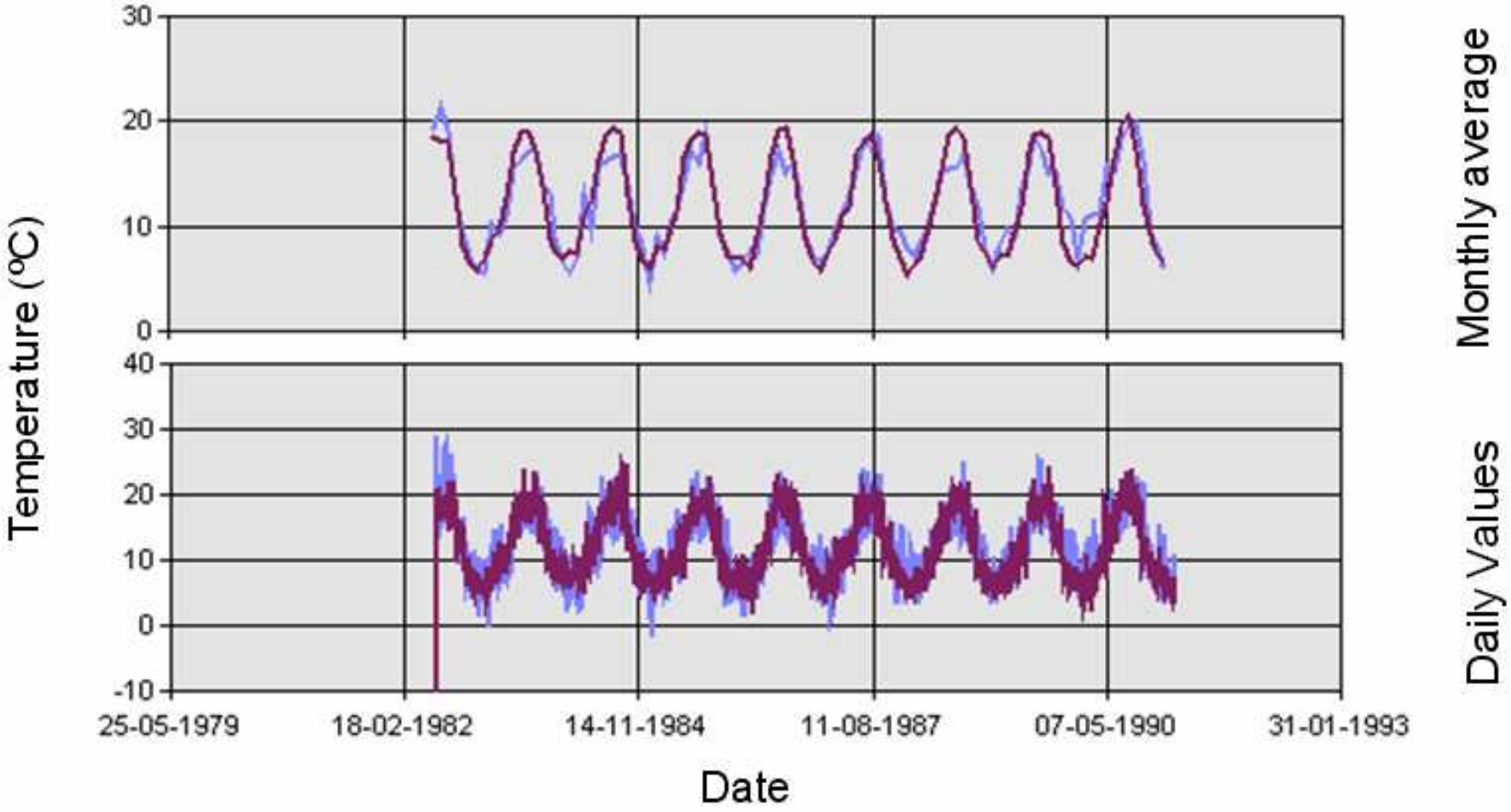
Weather generator vs independently measured temperature



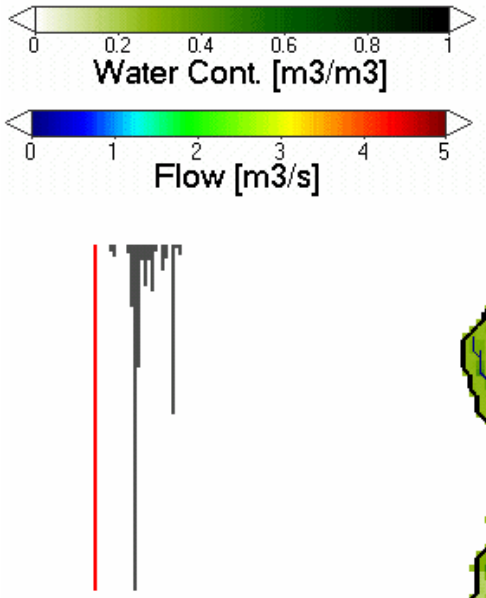
Conclusion

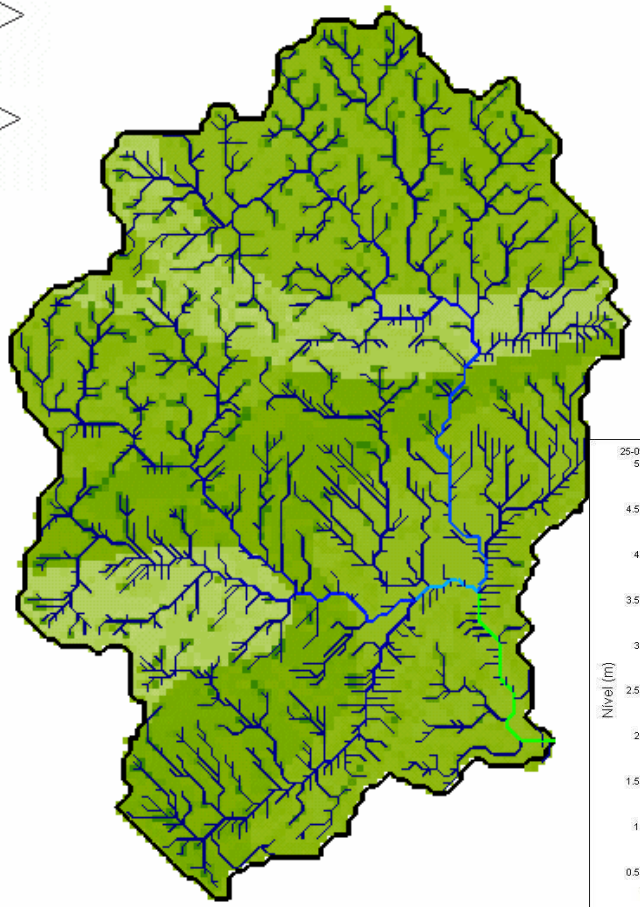
- MOHID and SWAT have free access source code. This has allowed the integration of some aspects of both models.
- The advantage of application of SWAT-MOHID is mainly the improved capabilities to analyze results.
- SWAT seems to be underestimation flows, though the simulation results in the most downstream station (Coimbra) has an monthly Efficiency of 0.82 and of 0.69 for daily results.
- The preliminary results show agriculture as responsible for 25% of total nitrogen and 13% of total phosphorous loads to the estuary

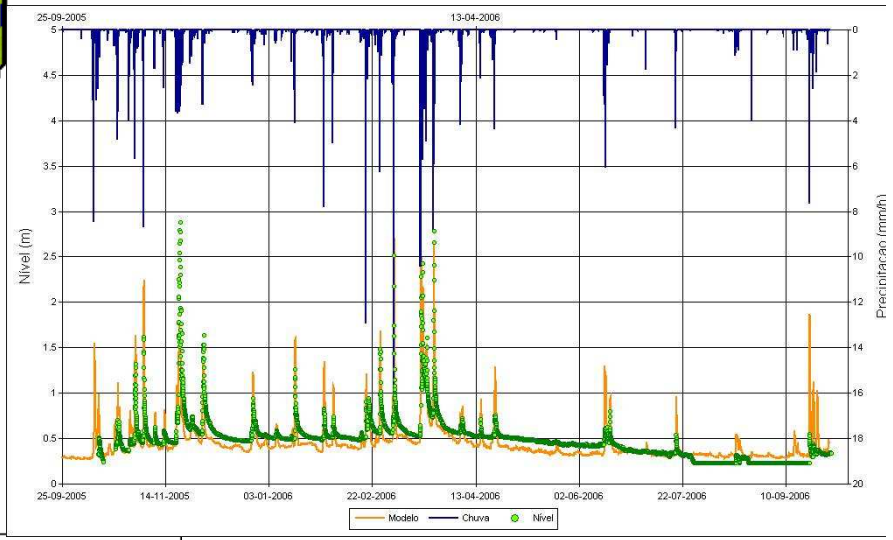
Future work

- Code development:
  - Check-In code changes in to Temple-Texas
  - Design a way to mantain new versions of SWAT and MOHID code compatible
- SWAT aplication:
  - Improve data inputs
  - Comparisson with Mohid-Land model
  - Detailed studies with Mohid-Land model

MOHID – LAND model







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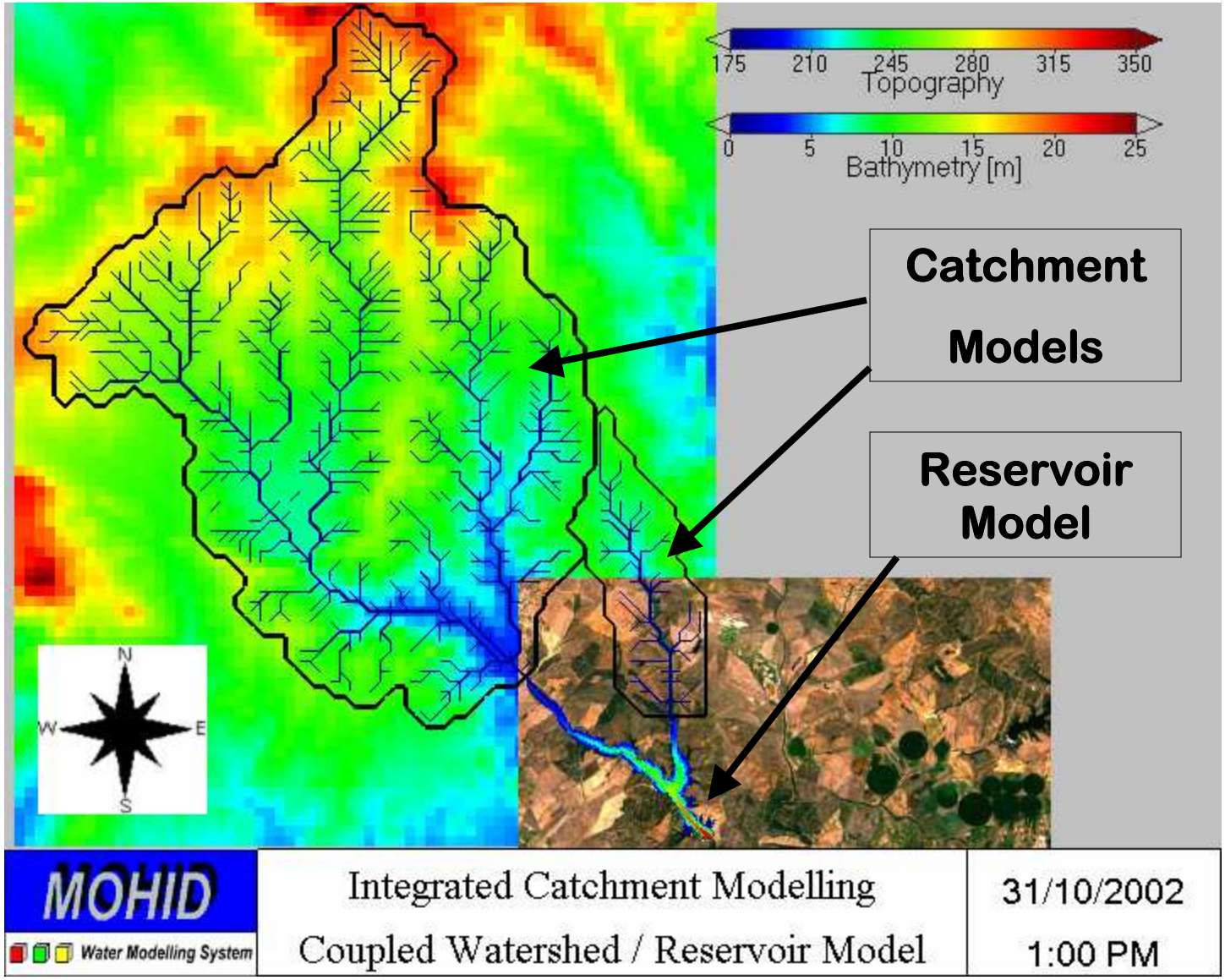
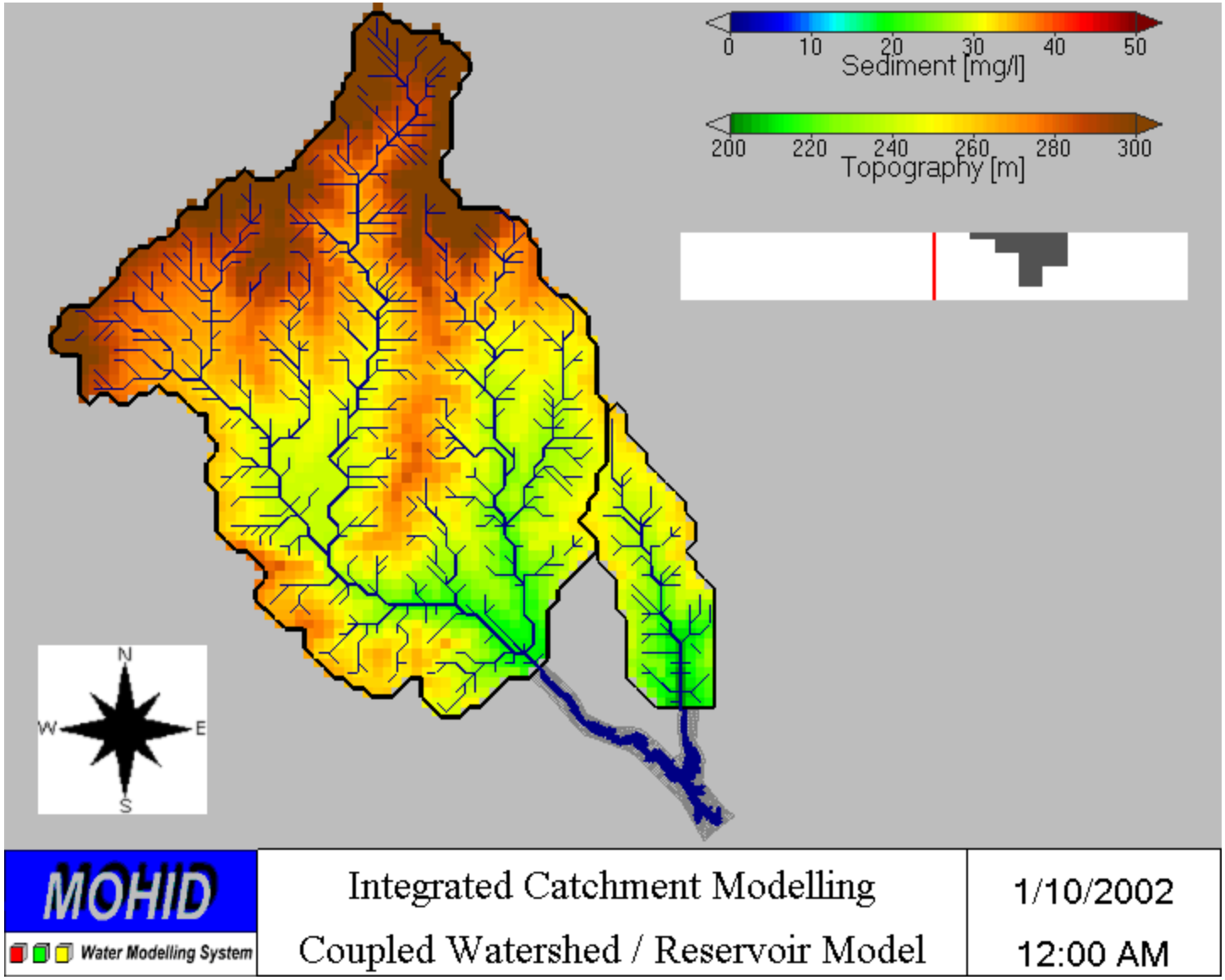
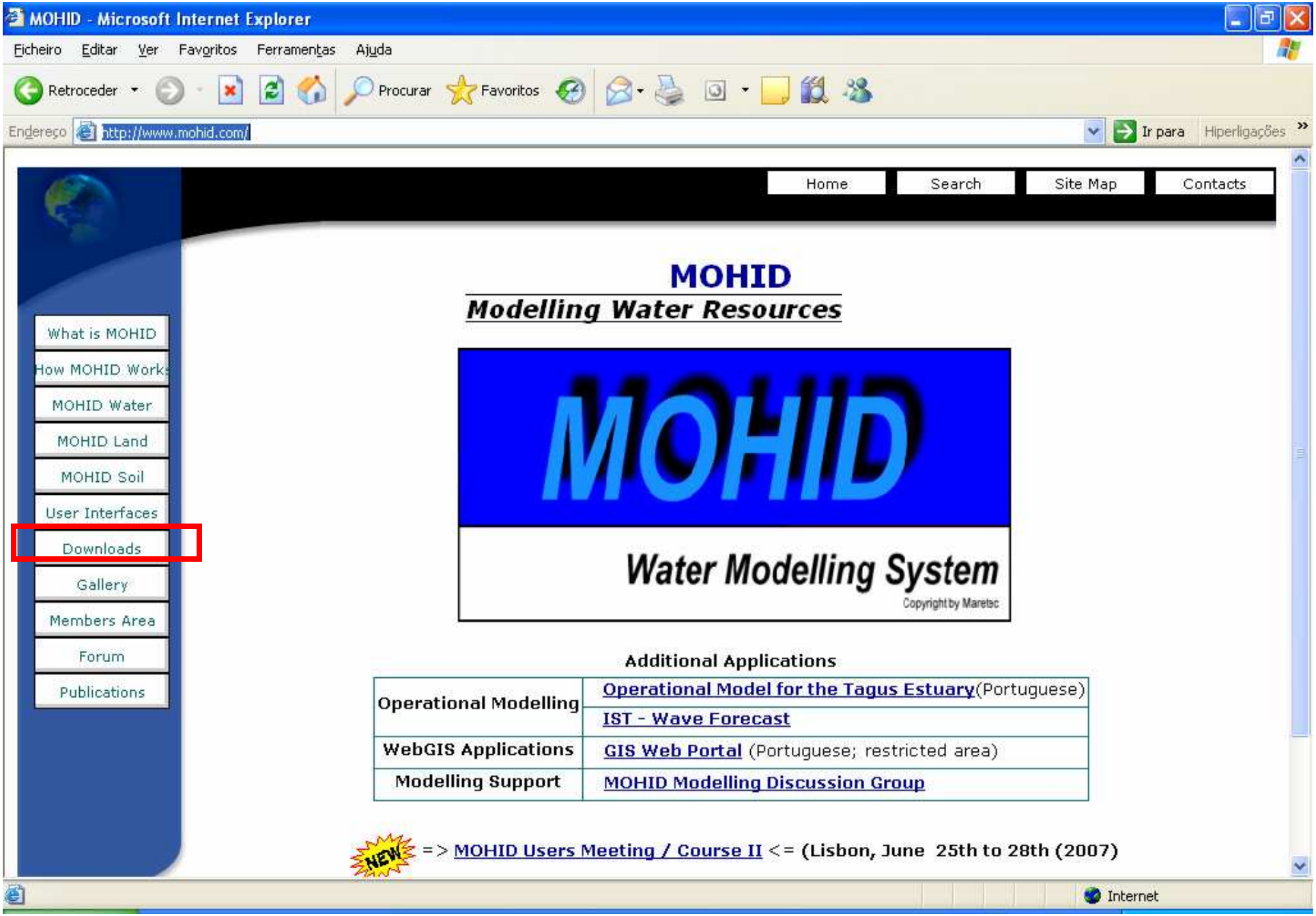
Integrated Catchment Modelling



Integrated Catchment Modelling

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Additional Applications
Operational Modelling
Operational Model for the Tagus Estuary (Portuguese)
IST - Wave Forecast
WebGIS Applications
GIS Web Portal (Portuguese; restricted area)
Modelling Support
MOHID Modelling Discussion Group
NEW
=> MOHID Users Meeting / Course II <= (Lisbon, June 25th to 28th (2007)
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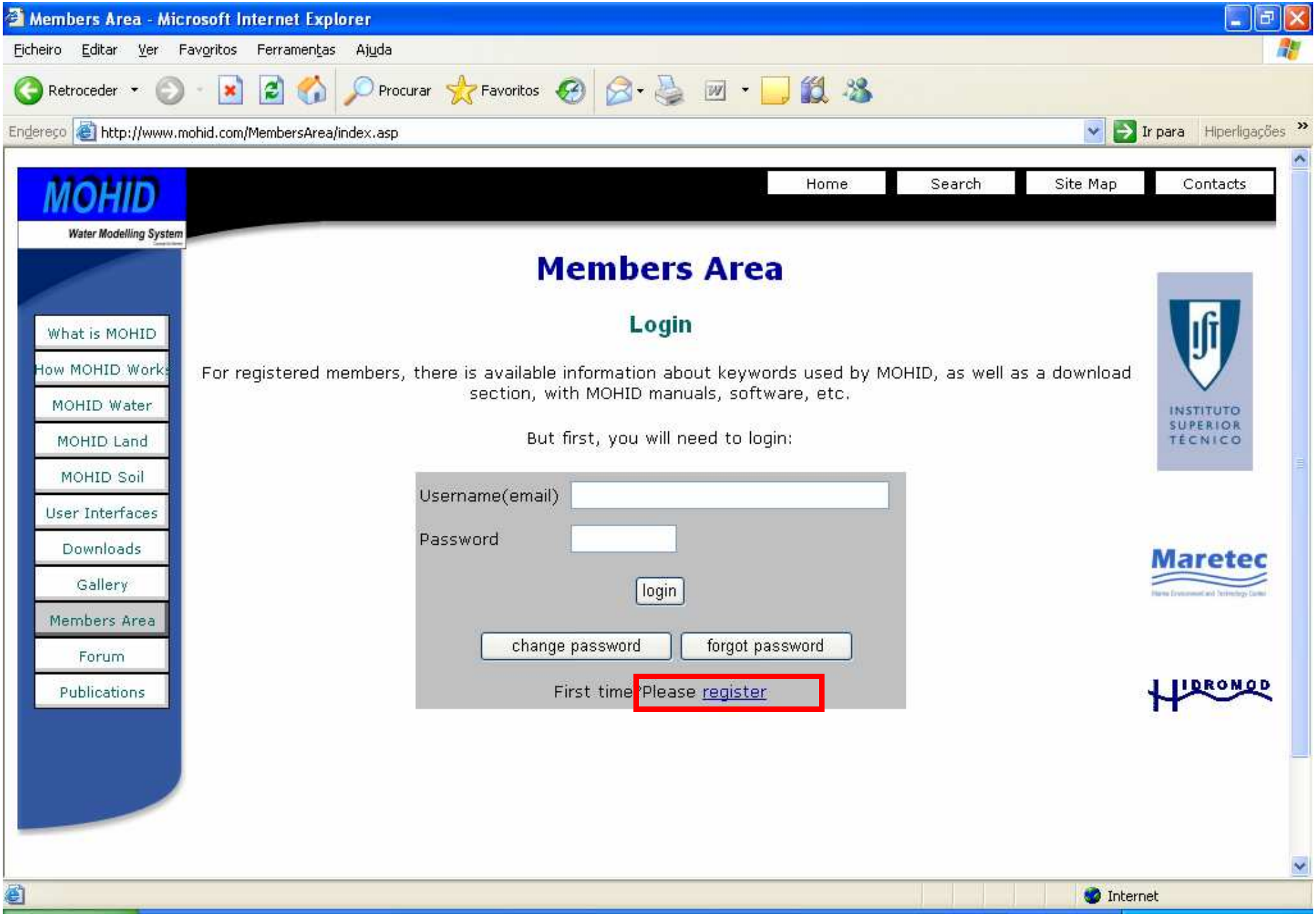
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Password
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change password
forgot password
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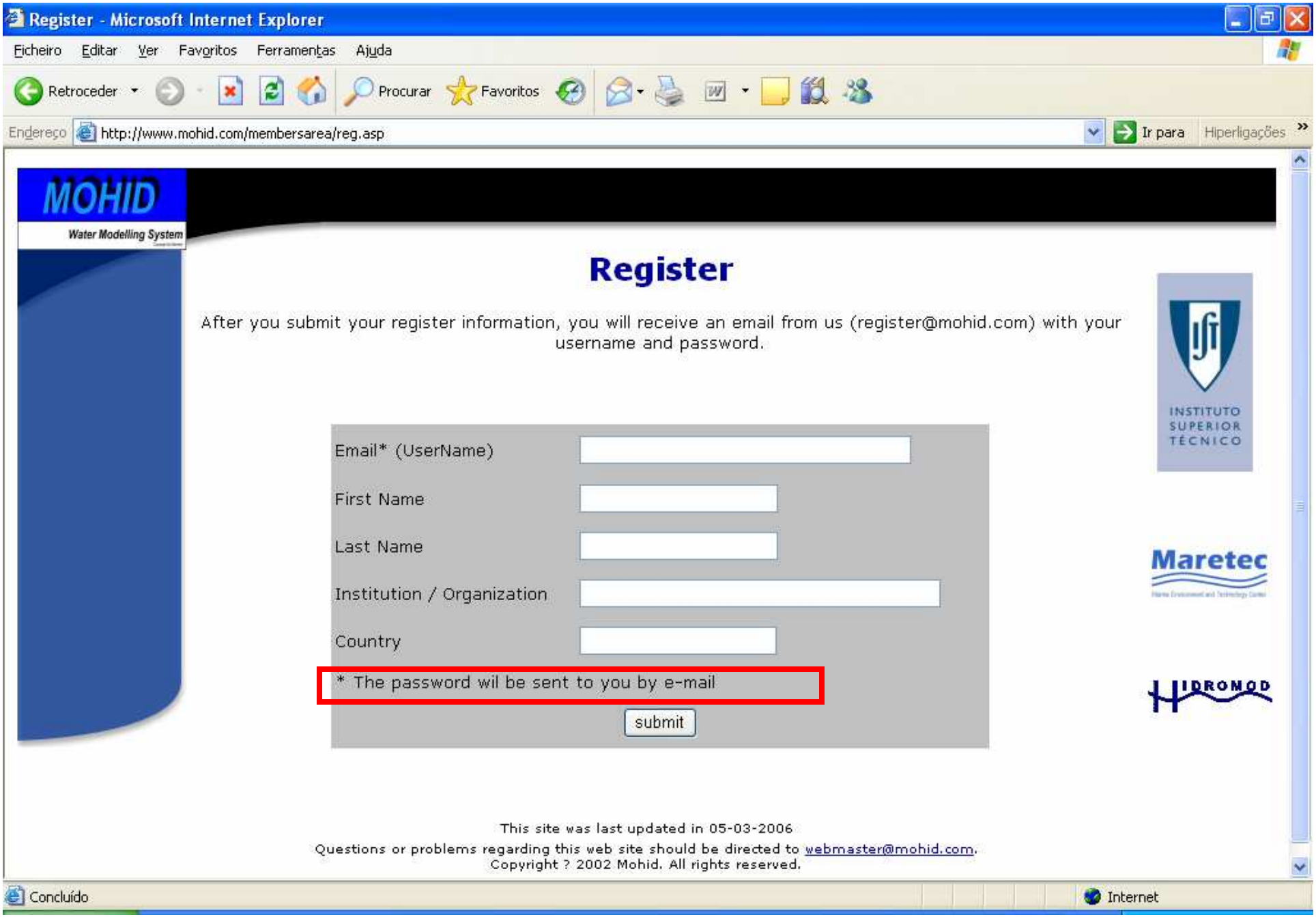
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MOHID Software

Name	Description
MOHID Installer 4.9	Mohid Installer (Complete Package - GUI, GIS & Numerics)
MOHID Installer 4.8	Mohid Installer (Complete Package - GUI, GIS & Numerics)
Mohid Installer v4.7	Mohid Installer (Complete Package - GUI, GIS & Numerics)
Mohid Source Code (v4.9)	Mohid Water and Mohid Land Source Code (version 4.9)
SWAT-MOHID	This Package includes the MOHID-SWAT2000 and MOHID-SWAT2005, the main input files ready to use and small help manual
HDF5Extractor	Software to extract subsets of data in HDF5 format from HDF5 files
Bathymetry Filter	Tool to filter bathymetry