Modelling of temporary streams in the Mediterranean

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Presentation overview

Introducing the problem

Introduction of the EU project
- general aspects
- current activities
- SWAT related activities
- actual conclusions

Outline of future priorities
idealized seasonal sequence

necessary innovation and improvement

state of the art

state of the art

time

water level

transport

evaporation accumulation

resuspension

transport

sediment related quality dynamics:

- accumulation
- build up of organic matter
- transformation
- nutrient cycling
- bioturbation

microbiological transformations

sediment

general aspects
Biofilms

Interstitial nutrient concentrations

Sediment processes

Scope of activities
Evaluation and improvement of water quality models for application to temporary waters in Southern European catchments
Objectives tempQsim

• To define requirements to be met by water quality models

• To develop and test hydrological modules

• To develop and adjust sediment modules to assess accumulation, resuspension and transformation processes

• To modify and improve water quality models

• To apply and verify the modified models
Basic information

- duration: Nov 2002 - Oct 2005
- 14 participants (9 countries)

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- part of the CATCHMOD cluster
Workpackages

TempQsim

Assessment: current and improved models

Process analysis:
Hydrology and water quality dynamics at flow periods

Process analysis:
Channel bed processes

programming tempQsim modules and model improvement

general aspects
## Model testing concept

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**general aspects**
Hydrology

Extremely flushy behaviour

Krathis (Greece)

scope of activities
Detritus accumulation, terrestrial erosion

Albujon (Spain)

scope of activities
Irrigation impact

Exfiltration of ground/subsurface water assumed, accumulation of nutrients

Albujon (Spain)

scope of activities
Long term accumulation of nutrients
Albujon (Spain)

instream mass removal

scope of activities
Degebe (Portugal)

Pool formation

intensive biological transformations

lentic systems

scope of activities
Eutrophication

Surface runoff nutrient flushing

Algae blooms

Flumendosa (Italy)

Scope of activities
Providing hydrological basic information

flow period: water quantity and water quality

- acquisition of rainfall, runoff data
- providing basis information for catchment models
- characterisation of dry and wet periods
- specific contraction and expansion studies at Tagliamento (Tockner et al.)

current activities
Processing of available data

Precipitation variability  Albuion, SE Spain

(Data source: Instituto Murciano de Investigacion y Desarrollo Agrario y Alimentario)
• plausibility checks
• detailed studies at Tagliamento (Tockner et al.)
• first characterisation of sediments
Modelling of erosive mass inputs

The PESERA/RDI model

- A physically based model to estimate soil erosion rates at 250-1000 m resolution across Europe
- Based on a partition of precipitation to forecast overland flow runoff etc from
  - Climate, land use and topography
- Embedded in GIS for data layers and visualisation

- Developed since 1985 and in EU projects
  - MEDALUS I, II, III, MODEM
  - DESERTLINKS, PESERA, tempQsim
  (M. Kirkby et al., 2002)

current activities
Main research aims:

- water management and pollution control
- to enhance the water quality of Mulargia reservoir

examples for SWAT application
Processing model input data based on available data

Soil map, Mulargia basin (EAF)

examples for SWAT application
Flumendosa - Campidano hydraulic system

FEATURES

Supplied population: 700,000 in.

Irrigated land: 60,000 ha

Storage capacity: 730 Mm³

Stored water at January 7th 2003: 31,468 Mm³

(E.A. Flumendosa)
Relevancy of surface runoff and mass inputs

examples for SWAT application
SWAT activities for the Mulargia study site

• processing and inclusion of existing time series data from the enduser

• design and execution of specific field campaigns

• analyses of applicability of unmodified SWAT

• contribution to the improvement of the model (WP5)
Example of SWAT relevant activities II

Application of ATHYS-POL and SWAT to the Vene catchment

P8 Hydrosciences  (Univ. Montpellier, IRD, CNRS), France

Marie-George TOURNOUD
Jean-Louis PERRIN
Bernadette PICOT
Christian SALLES
Christine GRILLOT
Claire RODIER

Main research aims :

• water management and pollution control

• to enhance the quality of the Thau lagoon
Overview study site location
extreme runoff events
• detailed field work
• automatic sampler installation
SWAT activities for the Vene study site

• comparison with results of the ATHYS-POL model
• sensitivity of parameters affecting
  - hydrological response of the catchment, at various spatial scales (the whole catchment, on subcatchments)
  - hydrological balance (e.g. interception)
  - water quality dynamics at the outlet.

• limitation of time step concepts for event modelling
• impact of the high degrees of freedom in the model
• investigation of potential resuspension

HYDROSCIENCES Joint Research Unit
Example of SWAT relevant activities III

Application of SWAT to the Degebe catchment (Portugal)

P5 IMAR, Portugal

Ramiro Neves
Pedro B. Galvão
Frank Braunschweig
Sibila Sousa

Main research aims:

• consideration of pool formation and related water quality processes

• to enhance the quality of the Alqueva dam

examples for SWAT application
Guadiana River Basin

Overview study site location

Surface: 67,000 km² (17% in PT)
Flow: 1,900 hm³/year

examples for SWAT application
SWAT application
Ardila irrigation system

Pedro B. Galvão

Serpa reservoir

examples for SWAT application
Provision of data sets for model testing

effects for SWAT application
preliminary model results

Serpa reservoir, Ardila irrigation system

examples for SWAT application
next SWAT activities for the Degebe study site

• validation of runoff modelling at Ardila subsystem

• comparison with Pesera (M. Kirkby, Univ. Leeds) and Cascade (D. Cooper, CEH) results

• processing of hydrological data for Degebe study site

• installation of automatic samplers and process studies

• development of model concepts for consideration of dry period and resuspension dynamics

examples for SWAT application
Terrestrial mass inputs
mass accumulation, erosion, flushing of fertilizers, fecals

Accumulation of mass in sediments by
• remaining and reducing flow conditions
• waste water inflow
• input from non-point sources

Biochemical processes
• formation and decomposition of OM
• nutrient turnover

Resuspension and first flush events

Current results and conclusion
• still difficult to consider wide gradient in specific stream characteristics and water management problems in the Mediterranean adequately in models

• more focus on terrestrial mass accumulation and first flush inputs from organic sediments/adsorbed nutrients

• shallow aquatic systems (lagoons) suffers especially from nutrient inputs

• need for better monitoring of bigger run off events
future addressing of water crisis

- hydrological variability
- desertification / land use practices
- erosion and mass inputs
- first flush dynamics
- nutrients
- salinity
- toxic pollutants
- pollution reduction and increased availability of safe water resources
- adequate modelling tools
- adapted river and reservoir operation

Directions in Watershed modelling