Erosion and Sediment Transport – Measurement and Modelling from Headwaters to large Catchments: A Research Project to reduce Reservoir Sedimentation in semi-arid Environments

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In dryland environments, the water supply depends strongly on the study areas.

Study Areas

Name: Esla/Isábena catchment
Catchment area: 1231 km²
Climate: Mediterranean-mountainous
Precipitation: 600 - 1200 mm

Name: Ribera Salada catchment
Catchment area: 225 km²
Climate: Mediterranean-mountainous
Precipitation: 700 - 800 mm

Name: Bengue catchment
Catchment area: 933 km²
Climate: Semiarid
Precipitation: 430 mm, highly variable and seasonal

Bedload Modelling in the Ribera Salada

3 bedload models

1. Riverbed gradiation at Ribera Salada

- Methods:
  - Water routing
  - Sediment transport

2. Middle-term sediment yield of badlands

- Motivation: Investigation of the sediment transfer and storage processes by quantifying the total amount and its spatial distribution of fine sediments in the Isabena riverbed.
- Methods:
  - Survey of colluvium
  - Monitoring of hillside erosion

3. Temporal estimation of sediment storage at specific cross-sections in the Isabena River

- Methods:
  - Complete WASA update
  - Analysis of temporary sediment storage (Esla/Isábena River)
  - Analysis of measured bedload data (Ribera Salada)
  - Testing / Scenario studies (Esla/Ribera Salada, Bengue)
  - Assesment of vertical distribution of suspended sediment concentration close to the dam (Barasona Reservoir)
  - Analysis of the effects of small reservoirs on water and sediment budget in semiarid areas (Bengue)

Bedload transport in reservoirs

- Motivation: The water level in reservoirs is the output of the hydrological system and the input of the sediment transport pathways.
- Methods:
  - Water routing
  - Sediment transport

- Water routing:
  - Reservoir routing: weighting factor calculated from the elevation of the cross section
  - River routing: based on the standard step method for a gradually varied flow

- Sediment transport:
  - Non-equilibrium sediment transport equation as proposed by Han (1980)
  - Sediment carrying capacity computed by four different equations

- Formulas:
  - 0.004 to 100
  - 0.001 to 100
  - 0.001 to 100
  - 0.040 to 100

- d) Bed elevation changes
  - Deposition: used of a weighting factor, computed as a ratio between the water depth represented by each point and the maximum water depth at the cross section
  - Erosion: symmetric distribution of bed thickness at the active layer is assumed adapted from the equilibrium channel width model proposed by Futter & Lane (1983)

Water and sediment transport in reservoirs

Bathymetric Surveys of Barasona Reservoir

- Motivation: Analysis of sediment deposition in Barasona reservoir
- Method:
  - Bathymetric survey

Bathymetric surveys of the Barasona reservoir (a) In 1996; (b) In 1993; (c) In 1998; and (d) In 2006

OUTLOOK

- Complete WASA update
- Analysis of temporary sediment storage (Esla/Isábena River)
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- Assessment of vertical distribution of suspended sediment concentration close to the dam (Barasona Reservoir)
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RELATED PUBLICATIONS


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