Soil erosion and subsequent delivery to river systems are increasingly studied as a consequence of both on-site and off-site impacts such as net soil and nutrient losses (Pimentel, 2006), turbidity increase in rivers and reservoir filling (Owens et al., 2005). Several physically based formulations representing the processes involved in soil erosion and sediment transport have been proposed at small scales in the last decades and implemented in distributed soil erosion models. All these formulations require a detailed definition of parameters that are difficult to measure. At the same time, the calibration of distributed soil erosion models with field data is complex for several reasons as the large number of parameters that need to be estimated, the high non-linearity of the equations, the interaction between input parameters, the scarcity of comprehensive field data available for calibration and the uncertainty in the experimental measurements. In order to make affordable the use of physically based models in meso-scale watershed studies it is often necessary to reduce the number of parameters or adapt the calibration method to the available data sets. The objective of this study was to analyze how the performance and calibration of a distributed event-based soil erosion model at the hillslope scale are affected by different simplifications on the parameterizations used to compute the production of suspended sediment by rainfall and runoff (Cea et al., 2016).

**CONTEX AND OBJECTIVES**

Data from the Hydrometeorologic Cévennes Vivarais observatory (Nord et al., 2015).

- Hillslope plots : 60m * 2m.
- Brown calcareous clayey soil.

Continuous measurements:
- rainfall: intensity (R) + drop sizes,
- water heights.
- Measurement on water samples:
  - concentrations,
  - effective and absolute particle sizes.

5 rainfall runoff events:

**FIELD DATA**

- 2D shallow water equations including rainfall and infiltration terms (Cea et al., 2014).
- Infiltration is modeled by an initial loss (I) followed by constant infiltration (K).
- Coefficients I, K, and n (Manning) were visually calibrated.

**MODELING**

Hydraulics

- Adopted from: Nord et al. (2005).

- 5 five model structure scenarios were compared:
  - with the standard GLUE methodology (Beven and Binley, 1992),
  - on measured sediment fluxes,
  - with the following prior parameter distribution for calibration:
    - \(0 < a < 50 \text{ kg m}^{-3}\)
    - \(0 < F < 1.1 \times 10^{-3}\)
    - \(1 < J < 10\) kg^{-1}
    - \(0 < M_s < 2.8 \text{ kg m}^{-2}\)

Erosion

- Model structure with the best predictive capabilities is M3S:
  - The scenarios MS1 and M5S also produce satisfactory predictions.

- A model structure considering a single soil layer with just two erodibility parameters accounting for the production of suspended sediment due to rainfall impacts and runoff:
  - Offers a good compromise between calibration efforts and model performance.

- Two-layer soil structure makes the calibration process more complex without improving significantly model performance, while it might be a constraint in the application of these types of models at meso-scales.

**REFERENCES**


**RESULTS**

Hydraulics

- Measured hydrographs are well captured by the model.
- \(I_p\) values show a high influence of the antecedent soil moisture conditions.

Erosion

- Calibration on event R1: results for various modeling scenarios

- Scenarios considering rainfall and runoff production (M5S and M5S6) are able to reproduce the measured sediment fluxes.
- Scenarios considering only rainfall production (M5S and M5S4) also give good results.
- The two scenarios with the worst performance are those that only consider detachment by runoff (M5S2 and M5S5).

**IMAGES**

- Image 1: Model structure diagrams.
- Image 2: Calibration results for different scenarios.

**TABLES**

- Table 1: Model parameters and their posterior distributions.
- Table 2: Calibration metrics for different scenarios.

**FIGURES**

- Figure 1: Schematic diagram of the model structure.
- Figure 2: Comparison of observed and simulated sediment fluxes.

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