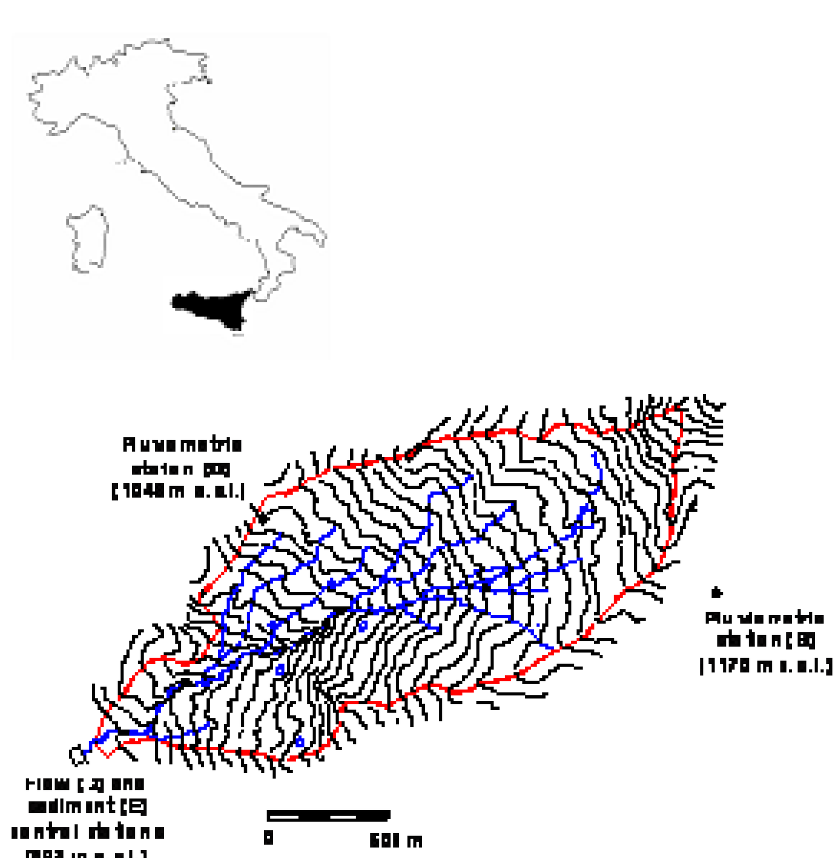
Cannata, Eastern Sicily, Italy

Basin characteristics

River Basin / River Basin (according EU-WFD)	Cannata
Operation (from… to…)	1996 -> today
Gauge coordinates / Gauge datum	37° 53' N, 14° 46' E
Catchment area	1.3 km^2
Elevation range	903 – 1270 m a.s.l.
Basin type (alpine, mountainous, lowland)	Mountainous
Climatic parameters (mean precipitation, temperature and others)	Annual precipitation between 541 and 846 mm
Land use	Pasture, cropland
Soils	Clay-loam
Hydrogeology (Type of aquifers, hydraulic conductivity)	K_{sat} in the range 0.2 to 17.6 mm h^{-1}
Characteristic water discharges: (Q_{min}, Q_{max}, Q_{mean})	Q_{max} = 3.4 m^3/s^{-1}; Q_{med} = 0.02 m^3 s^{-1}

Map of the research basin

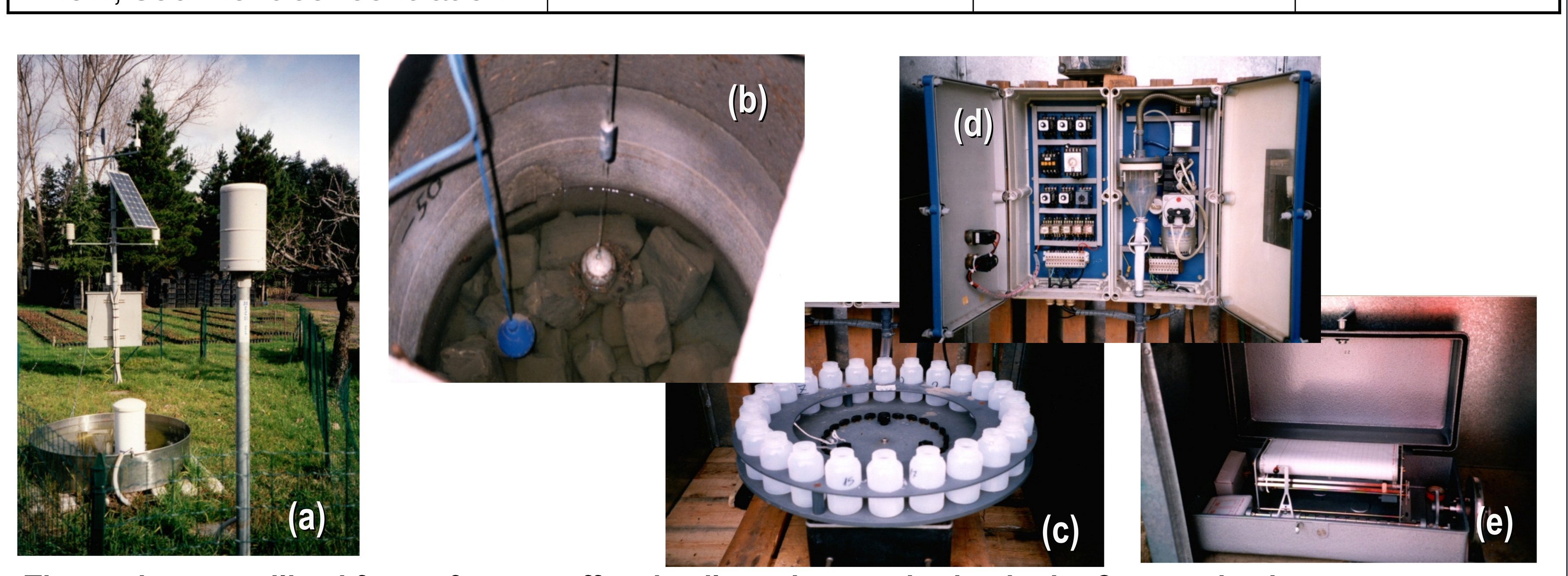


Special basin characteristics (hydrogeology, lakes, reservoirs etc.)

The Cannata watershed is a mountainous tributary, ephemeral in flow, of the Flascio River in eastern Sicily (37° 53' N, 14° 46' E). The watershed covers about 1.3 km^2 between 903 m and 1270 m above mean sea level with an average land slope of 21%. The longest channel pathway is about 2.4 km, with an average slope of about 12%. The Kirpich concentration time (the time required for runoff to flow to the outlet from the point of a drainage basin having the longest travel time) is 0.29 h.
Five different soil textures (clay, loam, loam-clay, loam-sand, and loam-sand-clay) were recognized; clay-loam (USDA classification) resulted as the dominant texture. The soil saturated hydraulic conductivity, measured by a Guelph permeameter, resulted in the range 0.2 to 17.6 mm h^{-1}.
Continuous monitoring of land use has highlighted the prevalence of pasture areas (ranging between 87% and 92% of the watershed area) with different vegetation complexes (up to 15 species) and ground covers. Four soil cover situations can be distinguished: a high-density herbaceous vegetation (eventually subjected to tillage operations), a medium-density herbaceous vegetation, sparse shrubs, and cultivated winter wheat with a wheat-fallow rotation.

Instrumentation and data

Measured hydrological parameters	Measuring period	Temporal resolution	Number of stations
Rainfall, surface runoff, peak flow, sediment concentration	1996 -> today	Continuous	3



The equipment utilised for surface runoff and soil erosion monitoring in the Cannata basin:
(a) meteorological station; (b) and (c) hydrometrograph; (d) and (e) runoff/sediment automatic sampler

Applied models

AGNPS, AnnAGNPS, RUSLE, WEPP, SWAT

Main scientific results

In order to assess and improve the possibility to predict runoff and soil erosion in different environmental situations, four hydrological models (AGNPS and its continuous release AnnAGNPS, WEPP and SWAT) were implemented in the Cannata watershed and its performance were evaluated at different time scales, by utilising a geomorphological and hydrological database collected at this goal.
The results of the AGNPS implementation showed a good correlation between the simulated and observed runoff volume, confirming, however, a significant underestimation tendency already detected in other tests. The runoff volume appeared closer to measurements (and this tendency significantly smoothed), after a first attempt of calibration reducing significantly in the CN algorithm the coefficient which sets the initial loss occurring before the beginning of the runoff. Model performance in terms of sediment yield estimation, assessed also after the calibration on runoff volume, is not discouraging.
The AnnAGNPS model showed satisfactory capability in simulating surface runoff at event, monthly, and annual scales after calibration. Peak flow predictions were generally good for low flow events and poorer for higher flow rates. A high model efficiency was achieved for the 24 suspended sediment yield events recorded during the entire period of observation after reducing the roughness coefficients for both rangeland and cropland areas. The overall results confirmed the applicability of the AnnAGNPS model to the experimental conditions.
Storm runoff depth was generally underestimated by WEPP for both large and small rainfall events; the same model behaviour was observed for annual runoff and sediment yield prediction. Nonetheless, in spite of the difficulties encountered and the limitations of the model, and given the relatively low rates of erosion, the results were reasonable with discrepancies within the order of magnitude found in other works.
The evaluation of SWAT performance showed a good capability in simulating cumulated in the whole period of observation and yearly stream flows when the FAO Penman-Monteith equation was used to simulate the potential evapotranspiration. A high coefficient of determination and model efficiency were found in surface runoff estimation at monthly and daily scale. The model does not estimate well the different time scale base flows. A reasonable simulation of 25 event suspended sediment yields was found after a calibration/validation process carried out by modifying the USLE-C factor.
Moreover, a sensitivity analysis determined that the SWAT model was more sensitive to this potential evapotranspiration (PET) parameter than to the other six parameters impacting surface runoff in this small Mediterranean watershed.

Key references for the basin

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