



Evaluation of the AnnAGNPS model for predicting runoff in large agricultural watershed in Navarre (Spain)

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The intensification of conventional agriculture in the last decades by increasing mechanisation and soil tillage has had an important environmental impact. Conventional agricultural practices leave the soil surface uncovered during long periods of time making soils more vulnerable to erosion. Besides, excessive amount of sediments and chemicals in runoff cause degradation of drinking water quality, contamination of aquatic ecosystems and siltation of hydraulic structures. Thus, there is a need for assessing the magnitude of these impacts to ensure a sustainable agricultural activity and an appropriate management of resources. For this, the Government of Navarre (Spain) created in 1996 a network of hydrologic and metheorological stations comprised of four watersheds with contrasting land uses and locations. This allows collecting a large number of hydrological, metheorological, territorial, soil erosion and water quality data of great utility for evaluating modelling tools.

The Annualized Agricultural Non Point Source Pollution Model (AnnAGNPS) Model is a well known and widely used model developed by the USDA-ARS and the USDA-NRCS, to assess the hydrologic and water quality responses of watersheds. More precisely, it is a distributed parameter, physically based, continuous simulation, and daily time step model.

After evaluating AnnAGNPS Model in two small (~ 200 ha) watersheds belonging to the Government of Navarre Agricultural Watersheds Network (GNAWN), the need to know the hydrological, erosive and water quality response of larger watersheds arises.

The aim of this study is then to evaluate the AnnAGNPS model capability to simulate runoff from a large agricultural watershed of Navarre, named Cemborain.

Cemborain watershed (5,000 ha) is located in the central part of Navarre. Its climate is Sub-Mediterranean, with an average annual precipitation ranging from 400 to 800 mm, and an average annual temperature of 12.4°C. The soils in general are clayey loamy. Regarding land use, about 40% of area is covered by natural forest, 24% by agricultural fields, 31% by shrubs, 4% by rangeland and 1% by urban areas. The watershed outlet is equipped with a hydrological station, which provides runoff data in a daily basis since 1955. However, from May 2005 onwards runoff is also recorded in a fifteen minutes basis. Climatic data required by AnnAGNPS were derived from four meteorological stations within the watershed.

AnnAGNPS model was applied to Cemborain watershed during the period from September 1992 to August 2003 to predict runoff. Simulated and observed runoff was compared at seasonal and annual scales. At seasonal scale, predicted runoff in summer and autumn times was overestimated whereas during winter and spring times it was underestimated; this probably due to the fact the model does not take into consideration baseflow which is particularly significant in these periods.

At annual scale, runoff was underestimated 10-18% in height. However, in very dry years, the model greatly overestimated the observed runoff. In fact, some runoff was predicted even though none was recorded. This suggests that during dry seasons the hydrologic component of the model was not able to satisfactorily assess the effect of drier soils (high water holding capacity) on infiltration rate.

There is a need to calibrate the model and separate the base flow from the total runoff. This will be possible by using the last five years where detailed runoff records are available. In December 2010, the collection of sediment yield was started, then model assessment on predicting sediment yield will be possible in the near future.