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Antecedent soil moisture conditions in the estimation of the SCS-CN values

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The Curve Number (CN) method, developed by the US Soil Conservation Service (SCS) to estimate direct runoff from storm rainfall, has been widely used in engineering practice, including in real time flood forecasting. Its popularity is justified by its convenience, simplicity and responsiveness to four readily grasped watershed properties: soil type, land use, surface condition and antecedent soil moisture condition (AMC).

However the observed values of CN exhibit a significant storm to storm variation which can not be explained following the SCS method, based the total rainfall depth observed in 5 days before the storm and to the seasonal growth stages of the crops. As a consequence, as shown by other Authors, CN values vary from storm to storm on any one watershed for events which can be included in the same AMC class.

The objective of this study is to relate the variability of the values of CN to some indicators of the soil moisture content in the watershed before each storm: rainfall depths, discharge, temperature before the storm.

To perform this analysis we used observed values of CN estimated from recordings of rainfalls and runoff total volumes collected for 10 watersheds in the Tiber river basin; for each of them 10 floods are available on average.

The observed values of CN for each watershed were estimated separating baseflow and direct runoff and computing the volume of surface runoff. The average rainfall hyetographs were evaluated according to the Thiessen method and finally the CN value has been estimated. The observed values of CN were normalised (by dividing for the mean value) and included in a unique, regional sample. The mean values of CN for

each watershed agree satisfactorily with the values computed from soil type and land use maps (class II values of CN). The values of CN were correlated to the above indicators. It is confirmed that, for Tiber river basin, the 5 days antecedent precipitation depths do not explain the storm to storm variations of the values of CN; on other hand CN values resulted quite correlated to temperature and to discharge. Finally regional correlation formulas to estimate the values of CN according to the above mentioned indicators are provided.