PEAK FLOW MODELLING RELATED
TO A SMALL RIVER DATA IN MOUNTAIN REGION

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Presentation

Since 1982 rainfall-runoff data were recorded in a small catchment (Valle della Gallina) located in North Western Italy in an area were precipitation events are recurrent in springtime and in the fall of the year, while storms are likely in summer.

The recording activity gave the opportunity of investigations since the beginning (Maraga *et al.* 2006):

a) evaluation of the rainfall pattern at regional scale (Anselmo *et al.*, 1982);
b) streamflow response to storm rainfalls by means of water tracers in old and new watere (Arattano & Lazzari, 1995);
c) Nash model approach to investigate rainfall-runoff in terms of geomorphology and average streamflow velocity (Caroni *et al.*, 1986; Rosso, Caroni, 1986);
d) water-balance investigations by means of the Sacramento model coupled with the phisically based model Brook90 (Buchtele *et al.*, 1998);
e) SCS-CN method applied to discharge evaluation (Anselmo *et al.*, 2004)
The last topic is again a subject of investigation.

The Valle della Gallina as a representative catchment

The catchment can be considered undisturbed with the exception of seasonal works in the wooded areas. The forest cover is uniform and the extent of small bare soil areas are reducing in time.

Peculiar hydrogeological conditions characterize the catchment. Subsurface flow is confined in a layer whose thickness may attain no more than 2 m. It is due to the weathering of the impervious bedrock of riolithic rocks which generated the regolithic soil. That is the reason why runoff flows in a dense network of minor streams.

The gauging station was located at the outlet of the catchment at the elevation of 330 m above sea level, while one raingauge is operating on a crest at 360 m above sea level.

The catchment streamflow is characterized by frequent events (Di Nunzio, 1982-2006) so that 93 events with peak higher than 1 m^3/s were observed: 9 cases in 2002 (in the range $1.03 \div 4.40$ $m^3 \cdot s^{-1}$), 7 cases in 1987 (in the range $1.03 \div 5.26$ $m^3 \cdot s^{-1}$), 6 cases in 1982, 1988, 1991 and 1994 (in the range $1.09 \div 4.71$ $m^3 \cdot s^{-1}$); 5 cases in 1984, il 1989, il 2006 (in the range $1.01 \div 4.40$ $m^3 \cdot s^{-1}$); 4 cases in 1993 and 1995 (in the range $1.01 \div 6.44$ $m^3 \cdot s^{-1}$);

Table 1. Valle della Gallina catchment characteristics

Area	1.08 km^2	Temperature (mean 1982÷2006)	10 °C
Lithology	rhyolites	Precipitation depth (mean 1982÷2006)	1283 mm·year^{-1}
Altitude (mean a.s.l)	417 m	Runoff depth (mean 1982÷2006)	735 mm·year^{-1}
Inclination (mean)	49 %	Runoff coefficient (mean 1982÷2006)	0,57
Main channel length	1,57 km	Discharge (mean 1982÷2006)	0,02 m^3·s^{-1}
Soil cover (regolith)	0÷2 m	Peak flow max (19 Sept. 1995)	6,44 m^3·s^{-1}

3 cases in 1990, 1996, 1998, 2003, 2004 and 2005 (in the range 1.06÷5.78 m^3·s^{-1}); 2 cases in 1985, 1992, 2000 and 2001 (in the range 1.03÷3.53 m^3·s^{-1}).

Just one event with peak higher than 1 m^3·s was observed in 1983, 1986, 1997, 1999 (in the range 1.13÷1.97 m^3·s^{-1}).

The modeling exercise

The SCS approach needs the classification of soils according to their hydrological behaviour with reference to hydraulic conductivity. The choice is crucial in North Western Italy where no official maps of the hydrological behaviour of the soils are available in the mountain areas. A ten minutes time step was chosen because of the small area of the watershed and the Hec-1 calibration procedure was performed to derive information about the soil type. The aim is deriving suggestions to be used for hydrological computations in comparable catchments.

References

Anselmo V., Guiot E., Tesar M., 2004: *SCS-Curve Number derivation from rainfall-runoff data collected in forested experimental catchments of ERB network (Rio della Gallina, Italy: Liz, Czech Republic)*. Proceedings of ERB2004 10th International Conference "*Progress in surface and subsurface water studies at the plot and small basin scale*", 13-17 October, 2004 Turin (Italy): 131-134.

Anselmo V., Di Nunzio F. Godone F., 1982: *Hydrological investigations in a small catchment*. Proceeding of the International Symposium "*Hydrological research basin and their use in water resources planning*". Landeshydrologie, Bern (Switzerland), 21-23 September 1982, 2: 259-268.

Arattano M., Lazzari S., 1995: *Separazione delle componenti di un idrogramma di piena in un piccolo bacino tramite misure di traccianti naturali*. Atti II Incontro Internazionale dei Giovani Ricercatori in Geologia Applicata, Peveragno, Cuneo (Italy), 11-13 ottobre 1995, Politecnico di Torino, Dipartimento di Georisorse e Territorio: 230-235.

Buchtele J., Herrmann A., Maraga F., Bajracharya O.R., 1998: *Simulation of effect of land-use changes on runoff and evapotranspiration*. Hydrology, water resources and ecology in headwaters: Proceedings of the head water'98 conference, Merano (Italy), 20-23 April 1998, IAHS publication, 248: 99-106.

Caroni E., Rosso R. Siccardi F., 1986: *Nonlinearity and time-variance of the hydrologic response of a small mountain creek*. In: Gupta V.K. *et al.* (eds): *Scale Problems in Hydrology*. D. Reidel Publishing Company: 19-37.

Di Nunzio F., 1982-2006: *Bacino sperimentale Valle della Gallina. Deflussi. Idrogrammi mensili delle altezze*. CNR-IRPI, Torino, Internal Reports.

Maraga F., Di Nunzio F. Pelissero C., 2006: *Hydrological monitoring since 1982 in the Valle della Gallina small mountain basin (Italy)*. Proceedings of ERB2006 11th International Conference "*Uncertainties in the "Monitoring-Conceptualisation-modelling*". Sequence of catchment research, Luxembourg (Luxembourg), 20-22 September 2006, Poster.

Rosso R.; Caroni E., 1986: *Analysis, estimation and prediction of the hydrologic response from catchment geomorphology*. Excerpta, 1: 91-106.