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A multi-hazard approach to flash flood in rocky coastal area: the case of the Dragone catchment, Atrani, Amalfi Coast (southern Italy)

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This study deals with flash flood affecting the small watersheds of the Amalfi Coast, a stretch of steep rocky coast that rises abruptly from the Tyrrhenian Sea in southern Italy. This area consists of Mesozoic carbonate rocks covered by unstable pyroclastic deposits, with a complex pattern of bedrock rivers characterized by small catchment areas that are very high relative to the base level. These rivers show a distinct seasonality and torrential behaviour, with main delivery areas into the adjacent marine shelf.

Natural disasters resulting from flash floods are an intimate part of the Amalfi Coast as testified by maritime Roman villas buried by alluvial deposits and coarse fan delta at mouth of the main streams. In the last five centuries, heavy damage was produced by a number of catastrophic floods documented both in the historical and environmental records. Sudden torrents of water (flash floods) are caused by high-intensity and very localized cloudbursts of short duration, inducing slope erosion and sediment delivery from slope to stream. The slides involve a water saturated mass of materials rapidly flowing down slopes, that incorporates vegetated covers and man-made structures.

In these settings the scarcity of suitable networks of instrument stations and the importance of erosional processes claim the use of different data sources for predictive water models that include geological and hydrological analyses. The advantages of an integrated approach is highlighted by the case of the Atrani flood in September 2010. Marine and on land geological investigations combined with meteorological and hydraulic/hydrological analyses proved to be critical for modelling the flooding event. The main results indicate a single storm cell with a very flat elliptical shape and of limited areal extent (from 50 to 70 km2) that produced a localized rainstorm event, lasting about 1 h with maximum rainfall intensity of nearly 120 mm h-1. On the other hand, historical researches along with marine geophysical investigations of the Dragone submerged delta allowed to reconstruct the main physical features of past events as well as the recurrence of flash floods in the study area. The collected data confirm the importance of the local orography and the thermic anomalies of the coastal waters.