

## **Coupling climate conditions, sediment sources and sediment transport in an alpine basin**

Riccardo Rainato (1), Lorenzo Picco (1), Marco Cavalli (2), Luca Mao (3), Andrew J. Neverman (4), and Paolo Tarolli (1)

(1) University of Padova, Department of Land, Environment, Agriculture and Forestry, Legnaro (PD), Italy, (2) CNR-IRPI, Corso Stati Uniti 4, 35127 Padova, Italy, (3) Department of Ecosystems and Environment, Pontificia Universidad Católica de Chile, Santiago, Chile, (4) Physical Geography Group, Institute of Agriculture & Environment, Massey University, Palmerston North, New Zealand

In a fluvial system, mountain basins control sediment export to the lowland rivers. Hence, the analysis of the erosion processes and sediment delivery patterns that act in mountain basins is important. Several studies have investigated the alterations triggered by recent climatic change on the hydrological regime, whilst only a few works have explored the consequences on the sediment dynamics. Here we combined and analyzed the quasi-unique dataset of climatic conditions, landscape response, and sediment export produced, since 1986 in the Rio Cordon basin (5 km<sup>2</sup>, Eastern Italian Alps) to examine the sediment delivery processes occurring in the last three decades. The temperature, precipitation, and fluvial sediment fluxes in the basin were analyzed using continuous measurement executed by a permanent monitoring station, while the landscape evolution was investigated by three sediment source inventories established in 1994, 2006, and 2016. Thus, the analysis focused on the trends exhibited during the periods 1986-1993, 1994-2006, and 2007-2015. In terms of climatic conditions, three distinct climate forcing stages can be observed in the periods analyzed: a relatively stable phase (1986-1993), a period characterized by temperature and rainfall fluctuations (1994-2006), and a more recent warmer and wetter phase (2007-2015). In the 1986-1993 period, the fluvial sediment fluxes reflected the stable trend exhibited by the climatic conditions. In the subsequent 1994-2006 period, the average temperature and precipitation were in line with that previously observed, although with higher interannual variability. Notwithstanding the climate forcing and the occurrence of high magnitude/low frequency floods that strongly influenced the source areas, between 1994 and 2006 the Rio Cordon basin showed relatively limited erosion activity. Hence, the climatic conditions and the landscape response can only partially explain the strong increase of sediment export recorded in the 1994-2006 period. In this sense, the sediment availability resulting from armour layer and bedform removal appears crucial to describing the sediment fluxes during this period, stressing the key role of the in-channel sediment supply. In the recent period 2007-2015 a marked climate warming accompanied by increased precipitation was observed. This climate forcing did not affect the landscape evolution, with sediment source extent remaining substantially in line between 2006 and 2016. The absence of a significant landscape response and the restoration of the channel armour layer can describe the limited sediment fluxes observed during the last decade. In particular, the increased temperature and precipitation were not accompanied by an increase in flood occurrence and magnitude, stressing the evident absence of hillslope-channel network coupling. This research was funded by the University of Padova Research Projects ‘Sediment transfer processes in an Alpine basin: sediment cascades from hillslopes to the channel network-BIRD167919’.