Geophysical Research Abstracts
Vol. 18, EGU2016-16735, 2016
EGU General Assembly 2016
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Adjustments in channel morphology due to land-use changes and check dam installation in mountain torrents of Calabria (Southern Italy)

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In Mediterranean semi-arid conditions the geomorphic effects of land-use changes and check dam installation on active channel headwater morphology are not completely understood. In such environments, the availability of specific studies, which monitor channel adjustments as a response to reforestation and check dams over representative observation periods, could help develop new management strategies and erosion control measures. This investigation is an integrated approach assessing the adjustments of channel morphology in a typical torrent (Sant'Agata, Calabria, Southern Italy) after land-use changes (e.g. fire, reforestation, land abandonment) and check dam construction across a period of about 60 years (1955-2012). A statistical analysis of historical rainfall records, an analysis of land-use change in the catchment area and a geomorphological mapping of channel adjustments were carried out and combined with field surveys of bed surface grain-size over a 5-km reach including 14 check dams. The analysis of the historical rainfall records showed a slight decrease in the amount and erosivity of precipitation. Mapping of land-use changes highlighted a general increase of vegetal coverage on the slopes adjacent to the monitored reaches. Together with the check dam network installation, this increase could have induced a reduction in water and sediment supply. The different erosional and depositional forms and adjustments showed a general narrowing between consecutive check dams together with local modifications detected upstream (bed aggradation and cross section expansion together with low-flow realignments) and downstream (local incision) of the installed check dams. Changes in the torrent bends were also detected as a response to erosional and depositional processes with different intensities.
The study highlighted: (i) the efficiency of check dams against the disrupting power of the most intense floods by stabilising the active channel; and (ii) the influence of reforestation in increasing hillslope protection from erosion and disconnectivity of water and sediment flows towards the active channel. The residual sediment deficit circulating in the watershed suggests the need of slight management interventions, as, for instance, the conversion of the existing check dams into open structures, allowing a definite channel and coast stability.