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Hydrological impact of forest fires and climate change in a Mediterranean basin

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Mediterranean basins affected by flash floods usually respond rapidly to intense rainfall because of steep slopes, impermeable surfaces, and/or saturated soils. This fast response can be amplified by forest fires affecting the basin: during the years right after a fire, the effects induced by a forest fire in the hydrological response may be similar to those produced by the growth of impervious areas. Moreover, climate change and global warming in Mediterranean areas can imply consequences on both flash flood and fire hazards, by amplifying these phenomena.

Based on post-fire experience, the consequences on the hydrological behaviour for a burnt basin have been established: (i) a 70% increase of the runoff ratio, (ii) a 60% decrease of characteristic time of the hydrograph, (iii) a 100% increase of the peak discharge. Interpreted in terms of rainfall-runoff model parameters, the impacts of forest fire have been studied in order to assess their consequences on flood occurrence. In a second time, the combined effect of forest fire and climate change has been analysed by using future climate scenarios.

This study has been conducted in the Llobregat river basin (Spain), a catchment of about 5000 km2 frequently affected by flash flood and forest fires. The results show that flood frequency can be significantly altered by forest fires. Also, it has been analysed how climate change may increase the occurrence of both hazards and make more frequent severe flash floods.