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First post-fire flush in a Mediterranean temporary stream: source ascription in bed sediments

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First flushes can be of great importance for suspended-sediment transport in fluvial systems of drylands, being temporary streams a characteristic feature of Mediterranean basins. After a wildfire, storm flows may enhance runoff delivery to channels and then increasing the first-flush effect. 137Cs and 210Pbex were used as tracers for recognizing the first post-fire flush effect in the source ascription of bed sediments temporarily stored in a Mediterranean temporary stream severely affected by a wildfire. Thirty potential sediment source samples were collected along the main stem of a catchment located in Mallorca (Spain) during a field campaign developed some weeks after the wildfire. The sample collection was designed considering the wildfire affection, and also distinguishing between soil surface and channel bank. To quantify the relative source contribution to the bed sediment temporarily stored, five sediment samples –deposited during the first storm occurred three months after the wildfire– were collected into the bed stream of the main channel. The 137Cs and 210Pbex concentrations were measured by gamma spectrometry. Then, a linear mixing model was used to establish the relative contribution of each source type to the bed sediments discerning between the most upstream and the downstream parts of the catchment. Post-fire first-flush effect was generated by a torrential event with a suspended-sediment concentration peak ca. 33,618 mg L-1, although transmission losses under a very low runoff coefficient (1%) promoted sediment deposition. Significant differences were observed in fallout radionuclide concentrations between burned surface soil and channel bank samples ($p < 0.05$), as well as between burned and unburned sources at the downstream part of the catchment ($p < 0.01$). The radioactivity concentrations in bed sediments samples were statistically similar ($p > 0.05$). Source ascription in bed sediments in the middle stream shows that 67% was generated in burned hillslopes, reaching 75% in the downstream part because downstream propagation of the sediment derived from the burned area. Bed sediments were mostly generated in burned hillslopes because of the fire effects on soils and sediment availability, high intensity rainfall and limited contribution of channel banks that are fixed by dry-stone walls. This hydro-sedimentary response indicates an association between driven sediment transport factors and sediment availability, generating an effective slope-to-channel sediment connectivity. Long-term sediment sources monitoring will elucidate if the most effective period of the window of disturbance at catchment scale is further extended (i.e. $\approx$5 years).