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Changes in dissolved organic matter during stream drying and rewetting

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Dissolved organic matter (DOM) is a complex mixture of organic compounds, which represents an essential source of carbon (C) and nutrients in aquatic ecosystems. In addition, DOM can play a key ecological role by modifying the optical properties of waters, mediating the availability of metals and influencing trophic food web structure. While the effects of drying and rewetting on DOM dynamics in terrestrial soils is a well studied subject, less is known about its effects in aquatic ecosystems, especially in streams. This is an important gap of knowledge since temporary streams that naturally cease to flow are found worldwide. Moreover, many streams with perennial flow are currently facing flow intermittency due to the effects of water extraction or changes in land-use and climate. The aim of this study was to evaluate the effects of stream flow intermittency on the spatial and temporal variability of DOM. The study was performed in a 300-m long reach of the Fuirosos stream (Catalonia, NE Spain) during the drying (June to July) and rewetting (October to November) phases. We sampled at several points along the study reach every 3 to 4 days. We assessed DOM amount by measuring the concentration of dissolved organic C and nitrogen (N). We characterized DOM composition using spectroscopic measurements, size-exclusion chromatography and C:N stoichiometry. Results showed two markedly distinct biogeochemical shifts between the drying and the rewetting phases. During the transition from continuous to fragmented flow we observed an increase in the magnitude and spatial variability of DOM concentrations and DOM was dominated by compounds from aquatic origin. After flow recovery, we also observed a pronounced increase in DOM concentration, but during this hydrologic phase DOM was dominated by compounds of terrestrial origin. Taken together, these results emphasize the relevance of flow intermittency in regulating stream DOM dynamics not only in terms of its availability but also in terms of its quality, which may affect metabolic and biogeochemical responses of the communities of these ecosystems. Finally, these results can help predict biogeochemical shifts associated to DOM in more temperate regions under future water scarcity scenarios.