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How do land use, precipitation and temperature affect DOC concentration and DOM composition in an arid and a semi-arid region?

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Dissolved organic carbon (DOC) is the active portion of organic carbon in soils. The content of DOC and the composition of dissolved organic matter (DOM) have a close relationship with nutrient cycling, pollutant transport and bacterial growth in soils. It is well-accepted that DOC is affected by land use type and climatic factors. Due to the sensitive changes in DOC concentration over time and the complexity of DOM composition, it is hard to understand clearly the process of how land-use type and climate affect the quantity and composition of DOM in topsoils. Excitation-emission matrix (EEM) fluorescence combined with parallel factor analysis (PARAFAC) is a increasingly new technique which can provide accurate information on DOM fraction and its spectral characteristics. In this study, soil samples were collected across the Loess Plateau, from north to south, and covered regions with different temperatures and precipitation patterns; sample sites included 19 cropland samples (CL), 14 abandoned samples (AL), 10 grassland samples (GL), 5 forest samples (FR) and 4 orchard samples (Orch). The effects of land-use type and climate (i.e. temperature and precipitation) on DOC concentration, DOM composition and DOM spectral characteristics were investigated. We identified four components in topsoils by the EEM-PARAFAC method: two humic acid-like components, one fulvic acid-like component and one protein-like component. The two humic acid-like components (C1 and C3) were the dominant fractions of DOM in topsoils in the Loess Plateau area accounting for approximately 80% of the total DOM examined, irrespective of land-use type. There was no significant effect of land-use type on DOC concentration ($P \leq 0.05$). In contrast to land-use type, DOC concentration significantly increased in the south of the Loess Plateau as temperature and precipitation increased. The concentration of DOC also increased as precipitation increased in the topsoils of GL. We concluded that the effects of precipitation on DOC concentration were greater than the effects of land-use type in the Loess Plateau area. However, precipitation had no effect on DOM fractions (in CL and GL) or DOM spectral characteristics (GL). Temperature had no effect on DOC concentration (in CL and GL) or DOM spectral characteristics (in GL), but was sensitive to DOM fraction changes in CL. Neither precipitation nor temperature had a significant influence on the spectral characteristics of DOM in the Loess Plateau area, representative of a typical arid and a semi-arid region.