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# Downstream changes in DOC: Inferring contributions in the face of model uncertainties

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Dissolved organic carbon (DOC) is a central constituent of surface waters which control its characteristic color and chemistry. While the sources and controls of headwater stream DOC can be mechanistically linked to the dominant landscape types being drained, much remains unknown about the downstream controls at larger spatial scales. As DOC is transported from the headwaters to catchment outlets, the fate of stream DOC is largely dependent on the interaction of varying catchment processes. In this study, we investigated the main mechanisms regulating stream DOC in a meso-scale catchment. A landscape-mixing model was used to test the role of landscapes in determining stream concentrations. The quantity of DOC lost to in-stream processes was calculated using bacterial respiration and photo-oxidation rates. We investigated whether there was a change in water pathways using a mass balance model and comparison of hydrology between a headwater catchment and the entire catchment. A Monte Carlo approach was used to test robustness of the model assumptions and results to uncertainty in the process parameterizations. The results indicated that during high- and intermediate-flow conditions, DOC concentrations were regulated by the contributing upstream landscape types. During base flow, the connectivity between the meso-scale river and the upstream landscape reduced resulting in large residuals in the landscape model which could not be explained by the in-stream processes. Both the mass balance model and a specific runoff comparison between upstream/downstream sites independently indicated large input of deep groundwater during base flow. Deep groundwater was important for diluting stream DOC concentrations during base flow.