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pCO_2 and enzymatic activity in a river floodplain system of the Danube under different hydrological settings.

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Surface waters may serve as either sinks or sources of CO_2. In contrast to rivers, which are typically sources of CO_2 to the atmosphere, the role of fringing floodplains in CO_2 flux is largely understudied.
This study was conducted in a river-floodplain system near Vienna (Austria). The sampling focused on changing hydrological situations, particularly on two distinct flood events: a typical 1-year flood in 2012 and an extraordinary 100-year flood in 2013. One objective was to determine partial pressure of CO_2 (pCO_2) in floodplain lakes with different degree of connectivity to the main channel, and compare the impact of these two types of floods. Another aim was to decipher which fraction of the dissolved organic matter (DOM) pool contributed to pCO_2 by linking pCO_2 with optical properties of DOM and extracellular enzymatic activity (EEA) of microbes. The EEA is a valuable tool, especially for assessing the non-chromophoric but rapidly utilized DOM-fraction during floods. In 2012 and 2013, the floodplain lakes were dominated by supersaturated pCO_2 conditions, which indicates that they served as CO_2 sources. Surprisingly, there were no significant differences in pCO_2 between the two types of flood. Our findings imply that the extent of the flood had minor impact on pCO_2, but the general occurrence of a flood appears to be important.
During the flood in 2013 significantly more dissolved organic carbon (DOC) ($p<0.05$) was introduced into the floodplain. The optical measurements pointed towards more refractory DOM, with higher molecular weight and humic content during the flood in 2013 compared to 2012. However there were no significant differences in EEA between the two floods. Few days after beginning of the floods in 2012 and 2013, an increase in activity of carbon-acquiring enzymes (EEA-C) was observed. We also found positive correlations of $pCO_2$with EEA-C both in 2012 ($r=0.86$, $p<0.01$) and in 2013 ($r=0.73$, $p<0.05$). The above findings imply that some fraction of DOM, which was introduced during the floods, was reactive and could be utilized by prokaryotes. This also indicates that pCO_2 during floods was driven by degradation of e.g. carbohydrates.