Optical indicators of organic matter and mercury cycling in wetlands

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Wetlands are important habitats that serve many ecosystem functions in part because they exist on the biogeochemical transition between aerobic and anaerobic conditions. This transition creates a rich tapestry of biogeochemical transformations that can affect the fate of many contaminants. Mercury is a contaminant of great concern and its fate is intrinsically linked to wetland conditions. Optical characterization has proven useful in identifying dissolved organic matter (DOM) source and processing, provinding a tool for understanding biogeochemical cycling in wetlands. In this study, surface waters were collected from eight different managed wetlands from the Cosumnes River Preserve (CRP), California to characterize the DOM to infer biogeochemical conditions and processes affecting mercury methylation. Five of the wetlands were managed for rice (*Oryza sativa*) production whereas three of the wetlands were dominated with emergent or submergent wetland plants. All samples were analyzed for DOM concentration, optical characterization using fluorescence spectrometry, and methylmercury (MeHg) concentrations. The fluorescence signatures at the outlets of the fields were then compared to the inlets to characterize changes in the signature due to passage of water through the field. Results were compared to fluorescent signatures changes in plant leachates exposed to biodegradation and photodegradation in a laboratory experiment. Simple mixing models indicated unique signatures by wetland type. Rice fields were similar to each other within seasons but differed between seasons. Most importantly, the relationship between MeHg concentration and the fluorescence signature also differed between wetland types and appeared to be related to different mechanisms. Increases in MeHg were related to increases in fresh rice DOM in summer and more degraded rice DOM in the winter. In contrast, it appeared that the non-agricultural wetlands lost both MeHg and fluorescent signatures primarily due to photodegradation. These findings highlight the differences in biogeochemical cycling in rice fields and non-agricultural wetlands and potential effects on mercury cycling.