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Understanding the interaction of carbon and water budgets in the Eurasian Arctic

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Recent observed changes in the climate of high latitude regions, as well as projections for future changes, are among the largest globally. There are concerns that pervasive warming will lead to biochemical changes that may exacerbate greenhouse gas emissions, and could have the potential to negate land carbon sinks that might otherwise be associated with enhanced forest growth in a warmer climate. We review recent efforts to quantify interactions between the water and carbon balances of the Eurasian Arctic, and trends therein, from a variety of sources including in situ and remote sensing data, and model simulations. These changes, where present, could be primary drivers for changes in the land carbon balance, especially in wetland areas. Wetland inundation, which represents a balance between runoff (mostly during spring snowmelt) and evaporative losses (mostly during summer) exert strong controls on the transition between aerobic and anaerobic decomposition, and hence between CO2 and CH4 emissions, as well as the strengths of the fluxes. The potential magnitudes of these emissions are large due both to the amount of carbon stored in high-latitude soils and the high greenhouse warming potential of methane. We review recent progress in estimating fluxes of CH4 and CO2 over northern Eurasia, and their sensitivity to a generally warmer climate, and ongoing efforts to upscale current understanding of these interactions over the Eurasian Arctic domain. In particular, we summarize recent predictions of the interannual variability of model-derived wetland inundation and greenhouse gas emission data set across W. Siberia for the period 1948-2007.