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River methane hot-spots: Continuous methane ebullition measurements over an annual cycle linked to river sediment production

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Hot spot methane ebullition from impounded river reaches matches high rates observed around the globe. Ebullition dominates total methane flux in the Saar River (Germany) and is largely determined by sediment deposition rate. Using automated bubble traps developed in-house, and deployed over a year at four sites, we collected high resolution data showing that hydrodynamic disturbances from shipping, lock operations and hydrograph events trigger ebullition episodes. Reverse smoothing was used to integrate the observed ebullition back in time, and helped in visualizing the data, and provides a time-series closer to methane accumulation in the sediments, whereas ebullition shows the triggering and release of the accumulated gas. One major hydrological disturbance of shallow-water sediment released around 13% of the total annual ebullition at that site, and ebullition generally followed the seasonal sediment temperature variations. The same event damped ebullition from deeper water sites. Total annual ebullition values ranged from 200 to 500 gCH4 m-2 yr-1. Ebullition from shallow water sediments in winter ceased for extended periods, but continued un-broken from deeper sites. With on-going measurements we believe these findings will help to improve estimates and the modelling of methane emissions from impounded river systems.