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Factors controlling F-specific RNA bacteriophages fate and transport in the Orne River (France)

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The presence of F-specific RNA phages (FRNAPH) in stream waters indicate faecal pollution, and its occurrence and propagation constitute a major public health issue. FRNAPH are considered as water colloids, they can be transported in suspension, attached to suspended sediment particles and flocs, or be deposed in the channel bed. For instance, several studies have shown a higher persistence of viruses in sediment than in the water column. However, the exchanges between water and sediment are not well understood, and further studies are needed in catchment with varying physiographical characteristics and anthropogenic disturbances. Accordingly, whereas laboratory experiments have shown that temperature and sunlight are among the most important factors responsible for the virus inactivation, we still lack a general understanding on how the virus are transported, its dynamics and persistence under natural conditions. Here, we present a 2-years dataset (2015-2017) of weekly FRNAPH concentrations in the Orne River (northeastern France), which drains around 1,270 km^2 and flows into the Moselle River. Our underlying hypothesis is that the fate and transport of FRNAPH might be explained by catchment hydrologic processes, suspended sediment transport and meteorological variables. We hypothesize that if we are able to decipher the controlling factors, we might better predict concentration downstream of the faecal sources and better understand the relationship between FRNAPH and suspended sediment dynamics. We collected stream water samples weekly at two sampling sites, upstream and downstream a wastewater treatment plant, and quantified FRNAPH concentrations using infectivity assays. In parallel, we measured hydrological and meteorological parameters, including water temperature, conductivity, turbidity, flow rate, suspended sediment concentration, solar radiation, rainfall and air temperature. We also investigated the occurrence of FRNAPH on suspended sediment particles. Our results showed a higher concentration of FRNAPH at the upstream site (Haropré), what might be associated to faecal pollution point sources. A seasonal variability on phage concentrations was only observed at the downstream site (Beth), what could be associated with water temperature annual fluctuations. Correlations between FRNAPH and suspended solids were non-significant, indicating a low implication of suspended sediment transport on the phage transport and settling in our study site. A multivariate statistical analysis will be presented, together with an estimation of the FRNAPH fluxes at the two study sites.