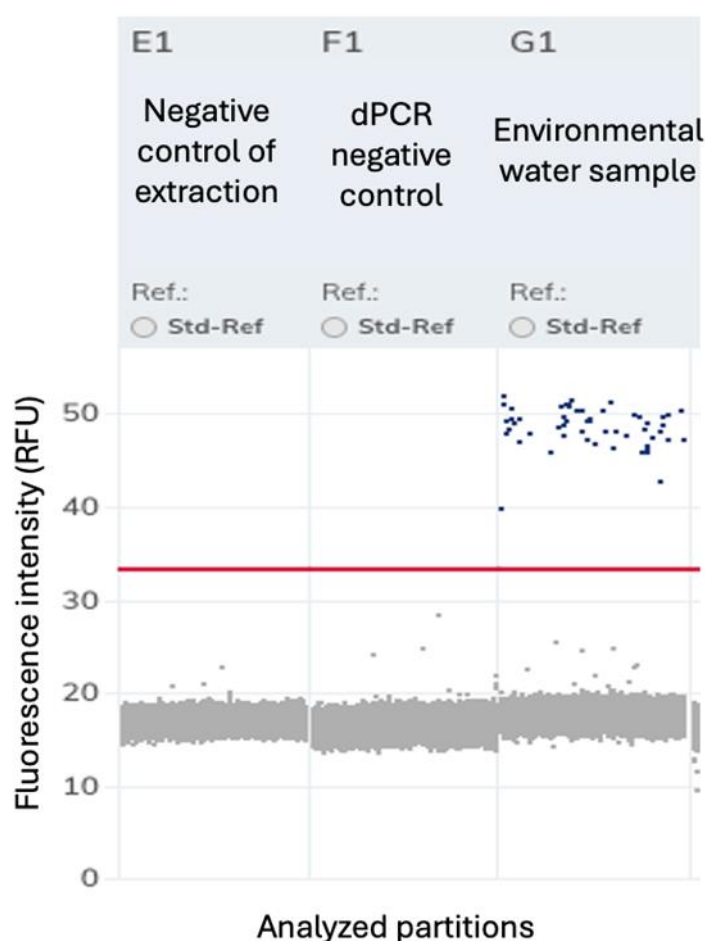


Supplementary Materials

- *Figure S1*
- *Form of the analytical solution of equation (1)*
- *Figure S2*

Figure S1: Scatterplot (raw results) from PMMoV dPCR analysis on the Qiacuity® platform. Blue dots represent positive partitions, where amplification occurred (the fluorescence intensity is high), while grey dots represent negative partitions. The red line indicates the threshold used to discriminate between positive and negative partitions. Final results are calculated based on the number of positive partitions detected by applying Poisson statistics. As no positive partitions could be detected either in the negative control of extraction or in the dPCR negative control, the space between positive and negative partitions of the environmental water sample was extremely clear (with no rain), showing the successful amplification of PMMoV target in the environmental water sample.



Form of the analytical solution of equation (1)

The analytical solution of equation (1) for x in $[a,b]$, supplemented by the initial condition

$$c(0,x) = h(x) \text{ for } x \text{ in } [a,b]$$

and the boundary condition

$$c(t,a) = g(t) \text{ for } t \text{ in } [0,T] \text{ is}$$

$$c(t,x) = g(t - (x-a)/v(t)) \exp(- \alpha (x-a)/v(t)).$$

This form holds if there are no tributaries in the interval $]a,b[$. Then it is applied to each of the four sections (represented with different colors in Figure 1): $[0, x_M]$, $[x_M, x_C]$, $[x_C, x_O]$ and $[x_O, x_T]$ with $x_M=5.86$ (Marne), $x_C=28.87$ (Clichy), $x_O=82.83$ (Oise) and $x_T=93.44$ km (Triel). For the first segment, $g(t)$ is obtained by interpolating the measurements at Choisy. For the following segments, $g(t)$ is the result of mixing the water from the preceding segment (with flow rate d_p and concentration c_p) with that from the new tributary (with flow rate d_n and concentration c_n) considered at the beginning of the segment

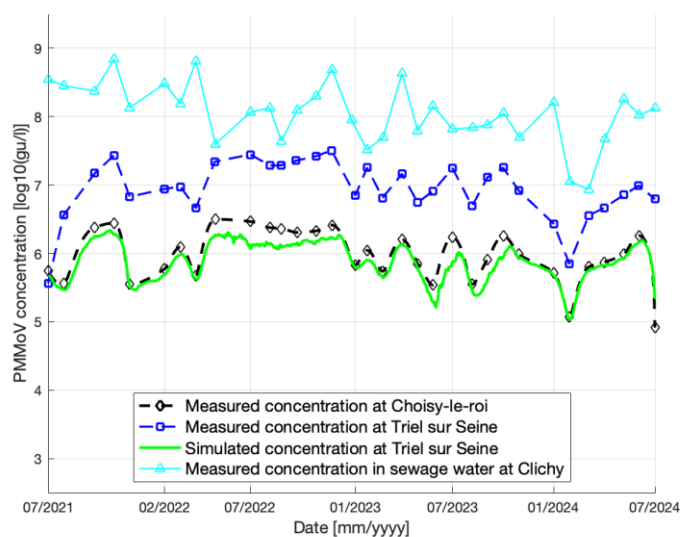
$$g(t) = [c_p(t) d_p(t) + c_n(t) d_n(t)] / (d_p(t) + d_n(t)).$$

Figure S2: Temporal variations of PMMoV concentrations, measured upstream of Paris (Choisy-le-Roi, black diamonds), downstream of Paris (Triel-sur Seine, dark blue squares), in sewage water at Clichy (light blue triangles) and different simulated concentrations (green curves) at Triel-sur-Seine: (A) Hypothesis 1, Tributary concentration assumed to be equal to the one of Choisy, (B) Hypothesis 2, with Marne River, (C) Hypothesis 2, with Oise River. Pink curves in (B), (C) corresponded to the simulated concentrations in the tributaries in case of an input of this tributary allowing to fit with the observed measurements at Triel. The pink dashed line represented the mean estimated concentrations in the tributary.

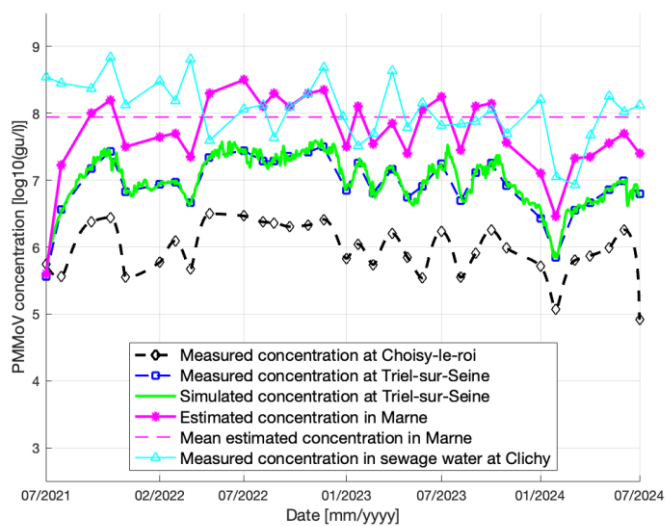
Hypothesis 1: the decay rate of the virus explains the observed concentrations

Hypothesis 2: a tributary is the main contributor in addition to decay rate of the virus.

A



B



C

