

Comportement des métaux particulaires (Al, Fe, Mn, Cd, Cu, Hg, Pb et Zn) dans la Seine à Poses en période de hautes eaux (1990-1995)

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Abstract Total suspended solids (TSS) and associated particulate Al, Fe, Mn, Cd, Cu, Hg, Pb and Zn have been studied from 1990 to 1995 ($n = 123$ samples) for the Seine at the river mouth station (65 000 km², $Q = 430 \text{ m}^3 \text{ s}^{-1}$, $Q_{max} = 2090 \text{ m}^3 \text{ s}^{-1}$). Special attention was given to major floods ($Q > 1000 \text{ m}^3 \text{ s}^{-1}$) very seldom sampled during regular surveys. Turbid events ($50 < \text{TSS} < 300 \text{ mg l}^{-1}$) are linked to the rising stage of floods which occur from 1.4% (dry year) to 10.4% (very humid year) of the time. The high water stages ($Q > 600 \text{ m}^3 \text{ s}^{-1}$) represent from 4.4% to 44% of the time, and from 11% to 73.5% of the yearly runoff. The TSS vs. Q pattern is a classical marked clockwise hysteresis which starts at $600 \text{ m}^3 \text{ s}^{-1}$ and is interpreted as a resuspension of river bed sediments. Seine particles are poor in Al (0.85 to 7.58%) and both Al and Fe contents increase during floods possibly due to the addition of detrital aluminosilicates to carbonates and autochthonous organic matter rich in diatoms that dominate at low flows. Fe is well correlated to Al but the Fe/Al ratio is slightly higher at low flow. This additional Fe, and a similar additional Mn, could result from in situ precipitation. Heavy metals contents, expressed in $\mu\text{g per g}$ of TSS are very high: 0.55 to 8.1 for Cd, 36 to 343 for Cu, 62 to 309 for Pb, 174 to 1023 for Zn and 0.43 to 2.67 for Hg. The average contamination factors (Seine content/average unpolluted river) are 10 for Cd and Hg, 4 for Pb and Zn, and 2.5 for Cu. Cd, Cu, Pb and Zn vs. Q present a bell-shaped curve with a maximum at $Q = 500$ to $600 \text{ m}^3 \text{ s}^{-1}$ and a minimum at $Q = 50 \text{ m}^3 \text{ s}^{-1}$ and $2000 \text{ m}^3 \text{ s}^{-1}$, although dispersion is noted. The pattern for mercury is different with regular dilution of particulate contents from $2 \mu\text{g g}^{-1}$ and more to $0.4 \mu\text{g g}^{-1}$ at high flows. All Me/Al ratios area at a maximum at low flow ($50 \text{ m}^3 \text{ s}^{-1}$) then decrease and reach a near constant value for high waters ($Q > 600 \text{ m}^3 \text{ s}^{-1}$) particularly during the three major floods studied in January 1991, January 1993 and January 1994 (peaks $\geq 1900 \text{ m}^3 \text{ s}^{-1}$). At peak discharges, the particles are still somewhat contaminated probably as a result of basinwide soil contamination.

INTRODUCTION

Durant les années 70 et 80, la station de qualité des eaux de Poses sur la Seine, juste