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Daily variability of suspended particulate concentrations and yields and their effect on river particulates chemistry

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Abstract Daily total suspended solids concentrations (TSS, mg L^{-1}), yields (Y, kg day^{-1} km^{-2}) and runoff (q, L s^{-1} km^{-2}) in world rivers are described by the median (C_{50}), the upper percentile (C_{99}), the discharge-weighted average concentrations (C*), and by their corresponding yields (Y_{50}, Y_{99}, Y*) and runoff (q*, q_{50}, q_{99}). These intra-station descriptors range over two to six orders of magnitude at a given station. Inter-station variability is considered through three sets of dimensionless metrics: (i) q^*/q_{50}, C^*/C_{50} and Y^*/Y_{50}, defining the general temporal variability indicators, and q_{99}/q_{50}, C_{99}/C_{50} and Y_{99}/Y_{50}, defining the extreme variability indicators; (ii) river flow duration (W_2) and flux duration (M_2) in 2% of time; and (iii) the truncated rating curve exponent (b_{50sup}) of the C *vs* q relationship for the upper flows. The TSS and Y variability, measured on US, French and world rivers, are first explained by hydrological variability through the b_{50sup} metric, the variability amplifier, then by basin size, erodibility, relief and lake occurrence. Yield variability is the product of runoff variability × TSS variability. All metrics are considerably modified after river damming. The control of river particulate matter (RPM) composition by TSS or yields depends on the targeted component. For major elements (Al, Fe, Mn, Ti, Si, Ca, Mg, Na, K), the average RPM chemistry is not dependent on C* and Y* in most world hydroregions, except in the tropical hydrobelt where it is controlled by basin relief. By contrast, the particulate organic carbon content (POC, as a percentage of RPM) is inversely correlated to TSS concentrations for (i) intra-station measurements in any hydroregion, and (ii) inter-station average POC and TSS figures in world rivers. TSS controls heavy metal content (ppm) in highly contaminated basins (e.g. Cd in the Seine *vs* the Rhone), and total metal concentration (ng/L) in all cases. Relations between RPM composition and TSS should be taken into account when assessing riverine fluxes, as ignoring them could lead to overestimation.

Key words world rivers; daily sediment loads; temporal variability; flux duration; major particulate elements; particulate organic carbon; cadmium