Geophysical Research Abstracts
Vol. 16, EGU2014-4042, 2014
EGU General Assembly 2014

Impact of erosion and transfer processes in Polycyclic Aromatic Hydrocarbon contamination of water bodies in the Seine River basin (France)

David Gateuille (1), Olivier Evrard (2), Elodie Moreau-Guigon (1), Marc Chevreuil (1), and Jean-Marie Mouchel (1)

(1) UPMC, Paris, France (david.gateuille@upmc.fr), (2) CEA, Gif/Yvette, France

Polycyclic Aromatic Hydrocarbons (PAHs) reach problematic concentrations in water and sediment of numerous streams of the world. In the Seine River (France), they prevent to achieve the good chemical status enforced by European law. However, the provenance and the fate of PAHs found in rivers are still poorly understood. Here, we combined chemical and fallout radionuclide measurements conducted on a large number of suspended sediment (SS) (n = 231) and soil (n = 37) samples collected at 62 sites during an entire hydrological year. A model was developed to estimate mean PAH concentration in sediment from the population density in the drainage area and good relationships were found during both low stage and flood periods. Influence of human population also appeared to be stronger during the latter period. However, some discrepancies between measured and modeled PAH concentrations were observed and the role of the origin of SS was investigated. During the low flow period, the observed differences were explained by the provenance of river sediment (agricultural topsoil vs. eroded channel banks). Time-averaged PAH concentrations measured in suspended sediment collected in the catchments where erosion of agricultural topsoil dominated were systematically higher than the predicted values. On the contrary, in the catchments where erosion mainly occurred in deep soil or river embankment, the supply of particles protected from atmospheric fallout contamination led to measure concentrations below the predicted values.

As this relationship between population density and SS contamination was no longer valid during the flood period, the role of transfer times was also investigated. The percentages of freshly eroded sediment in samples were determined by comparing the 7Be/210Pb ratio in rainfall and SS. An annual turn-over cycle of sediment was observed but no relationship was found between PAH contamination and residence times of particles within rivers. This result suggested that the impact of PAH exchanges between aqueous and particulate phases was negligible. Finally, results derived from PAH diagnostic ratios showed that the contamination signature vary between rural soil and urban signatures therefore suggesting that the temporal changes in riverine pollution mainly depend on the variations of contribution of both pools. More specifically, the low flow period is characterized by background signal provided by erosion and mainly driven by the origin of SS and the stocks accumulated in the vicinity of anthropogenic activities. During the flood period, an additional signal of contamination is provided by direct urban releases due to the increase in PAH emissions (household heating) and impervious surface leaching.