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The fluvial nitrogen budget of the United Kingdom – sources, in-stream losses and total N budgets

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Long term records of the concentration of nitrogen species from British rivers were compiled in order to assess temporal change in the total fluvial nitrogen flux compared to the other inputs to, and outputs from, the UK terrestrial biosphere. The following nitrogen species are considered: ammoniacal-N, nitrate, nitrite, dissolved organic nitrogen and particulate organic nitrogen. Concentration and flow records were reconstructed from 1974 to 2005 for ammoniacal-N, nitrate, nitrate and dissolved organic nitrogen (DON) and from 1992 for particulate organic nitrogen (PON). The reconstructed fluvial nitrogen time series was compared to records for inorganic fertiliser, atmospheric emissions, industrial and sewage effluent, and imports. The results show that:
i) The total dissolved nitrogen flux over the study period, after flow correction, varied from 470 to 980 ktonnes N yr-1, which, on average, comprised: 69% nitrate-N; 26% dissolved organic-N; 4% ammoniacal-N; and 1% nitrite-N.
ii) The total nitrogen flux including PON varied from 504 to 1004 ktonnes N yr-1.
iii) The flux of ammoniacal-N shows a significant decline over the study period, but significant increases in both nitrate-N and dissolved organic-N mean that the total dissolved nitrogen flux still shows a significant increase at a rate of 6.3 ktonnes N yr-1.
iv) The dissolved nitrogen flux record shows both a steady increase over the period 1974 to 2005 and sharp discrete rises in response to severe droughts. Flux increases (upto 69% increase compared to the 4 years prior to the drought) in response to severe droughts are not consistent with a storage effect caused by reduced flows but, instead, appear to represent enhanced production in the year of the drought.
The long-term rise of fluvial nitrogen flux from British rivers is in contrast to declines in inputs and other N outputs. The fluvial flux records for individual catchments was then compared to individual catchment characteristics in order to understand the what controls the sources of the nitrogen and the extent of in-stream losses of nitrogen at the national scale.