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Increase of erosion processes induced by the evolution of anthropogenic agricultural pressure during the last decades

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French Brittany is an area of crystalline shield composed of granites and schists. Agriculture has been considerably developed in this area from 1960. There is currently a livestock of about 40 M chickens, 15 M pigs and 6 M cows for an area of 27 000 km2. Intensive agriculture has induced an extremely high environmental pressure. Manure and slurry as well as chemical fertilizers have induced extremely high nitrate concentration, often higher than 50 mg/L (French regulations).
The evolution of the nitrate concentration during the last 50 years has been constrained through the analyses of the major river of Brittany (Vilaine river) and the analyses of more than 100 groundwaters wells. The evolution of the river shows annual cycles with the highest concentrations during winter and the lowest concentrations during summer. The mean annual concentrations and the annual maximum have been increasing from 1970 to the early 1990's. Summer annual means are still increasing. The evolution of the nitration concentration in the recharge waters (infiltration through the soil) has been reconstructed using groundwater dating. It shows a very sharp increase during the 1980 decade. Comparison of recharge and river and groundwater data allows understanding the transfer time from surface to the hydrological system.
Organic and chemical fertilisers are a source of H+ through the transformation of NH4+ to NO3- (nitrification process). This process leads to the acidification of the catchment. Such acidification is source of an increase of the erosion processes. In cristalline rocks from Brittany, it leads to Na feldspar and biotite consumption. This evolution is observed when investigating the chemical evolution of several rivers in French Brittany. The Ca and Mg concentrations have been increasing during the last 3 decades, Ca concentrations being multiplied by a factor 3. Na concentrations have also been increasing, as well as the Na/Cl ratio. C/HCO3 and Na/HCO3 ratios indicate that this increase is not related to carbonate dissolution. A clear correlation between Ca and NO3 confirms the relationships between the intensification of agriculture and the erosion increase.
Since crystalline rock erosion induces the consumption of CO2, and as regards to the amount of fertilizers used worlwide, agriculture indirect effect on the carbon cycle should be evaluated.