



Compared impacts of direct anthropogenic pressures and climate change on the Seine River

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To explore the evolution of a human impacted river such as the Seine River (France) over the 21st century, we constructed future scenarios for three presumably important driving factors. Climate change is based on simulations by a GCM driven by the SRES-A2 scenario of radiative forcing. To explore a reduction in nitrate pollution from agricultural origin, we constructed a scenario of integrated farming, introducing catch crops and a 20% decrease in nitrogen fertilisation. We estimated future point source pollution under the assumptions of high demography and medium technological improvement, for consistency with scenario SRES-A2. This leads to reductions of 30 to 75% compared to 2000, depending on the pollutants. We coupled four models addressing separate components of the river system (agronomical, hydrogeological, land surface and water quality models) to analyse the relative impact of these scenarios on water quality (oxygen, nutrients, organic carbon, planktonic biomass), in the light of their impact on hydrology and crop production. The main driving factor of water quality over the 21st century is the projected reduction of point source pollution, inducing a noticeable decrease in eutrophication and oxygen deficits downstream from Paris. The impact of climate change is much smaller, except for nitrate concentration, which is dominated by diffuse sources from agricultural origin. Under climate change, both nitrate concentration and crop production increase, whereas they decrease with integrated farming. The combined impact of these two scenarios is positive, with reduced diffuse sources of nitrate and increased crop yields. These results suggest that the evolution of the Seine River during the 21st century should not be catastrophic.