EGU2020-9138, updated on 30 Sep 2020
https://doi.org/10.5194/egusphere-egu2020-9138
EGU General Assembly 2020

A new estimation of water and nutrients (N & P) discharge to the Mediterranean Sea from the LPJmL model: modelling the dynamics of the land-sea nutrient transfer

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Runoff from rivers and coastal plains delivers significant amounts of nutrients to the Mediterranean Sea from the agricultural activities and urban waste waters. Several recent studies show that variations in rivers inputs may play a significant role on the marine biogeochemical cycles and planktonic food web in the entire basin. The aim of this study is to estimate the release of nutrients (N & P) to the Mediterranean Sea from basin-wide agriculture and urbanization through the implementation of the biogeochemical land-sea nutrient transfer processes within the agro-ecosystem model LPJmL. This is a contribution to the LaSeR-Med project (Towards an integrated prediction of Land & Sea Responses to global change in the Mediterranean Basin).

A compilation of a new input data set of fertilizer, manure and wastewater nutrients content [1961-2005] has been added to the LPJmL forcing data set, with a new land use patterns produced by an econometric model. The representation of the nutrient transfer from land to sea has been introduced into LPJmL by considering the following processes: mineralization, denitrification, adsorption, remineralization, nitrification, and phytoplankton dynamics.

First basin-wide LPJmL simulation at 1/12°, indicates that the model succeeds in simulating the temporal variations of water discharge for the main rivers flowing to the Mediterranean Sea, and shows a good consistency between the simulated nutrients concentration (NO3 and PO4) and available in-situ data. Preliminary results show that wastewater strongly contribute to the phosphorus fluxes (as PO4), while both agriculture and wastewater control the nitrogen fluxes (mainly as NO3). Alternative scenarios for land-use will allow to explore the future amounts of terrestrial nutrients that will reach the sea through rivers discharge and water runoffs and impact the marine ecosystems.

How to cite: Ayache, M., Bondeau, A., Pagès, R., and Baklouti, M.: A new estimation of water and nutrients (N & P) discharge to the Mediterranean Sea from the LPJmL model: modelling the dynamics of the land-sea nutrient transfer, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-9138, https://doi.org/10.5194/egusphere-egu2020-9138, 2020