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Hydrology and Earth System Sciences Discussions

Interactive comment on "Local and regional impact of anthropogenic drainage on fen contiguity" *by* A. H. van Loon et al.

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Reply #2 We appreciate the clear comments on this discussion paper by Prof. Ab Grootjans. We can benefit from the provided suggestions to improve the paper by the following aspects.

General comments: The main comment of Prof. Grootjans on the paper is that he does not support the conclusion that local measures have priority above regional measures in order to restore degraded fens in intensively managed regions. Instead, he suggests that the conclusion should be that fen restoration requires the identification of both local and regional hydrological impacts in order to provide knowledge for discussion with different parties to find the best solution to the problem during the immediate future and

also on the long run. To stress his statement, Prof. Grootjans raises the question "what the authors would suggest if local measures would have priority and later it turned out that regional influences, which usually are very costly to remove, frustrate the fen regeneration?". We think that this comment is justified in that sense that the priorities of resource managers are not only related to the potentials in which they are thought to add to successful restoration, but also by the feasibility to implement measures at a certain moment. Chances to implement measures may depend on non-scientific factors such as financial resources and political support creating temporary opportunities. However, the results of the present paper provide convincing evidence that the implementation of regional measures, that indeed are often very costly and have a wide impact upon many land use functions, will not result in the desired restoration of nearby drained fens until the diffuse groundwater losses to drainage elements have been sufficiently reduced to allow for the supply of available groundwater to the fen surface. We advocate to first act local, and then regional measures, because we think that the implementation of measures in another order may not only reduce the political support to further invest in the hydrology of degraded fens, but it may also obscure the dimensions of regional measures needed to restore fens. As shown in this study, a rise in the water levels caused by the elimination of drainage ditches may cause a reduction of the total volume of regional groundwater recharged at the ice-pushed ridge that is supplied to fens, if groundwater is not only redistributed within fens, but if it is also redirected towards outside the fen area where the water levels are not altered. For this reason, the implementation of regional measures may at first seem to be effective to enhance groundwater flow towards drained fen areas, while as soon as drainage ditches are eliminated, part of the groundwater will be redirected towards surrounding regions other then fens, rendering the regional measures less effective than one may expect in the presence of drainage elements. For this reason, we think that it is not sufficient to analyze local and regional impacts on groundwater flow to fens independently from each other, but that it is required to analyze the effects of regional measures after local measures have been implemented first. Following this reasoning,

we have decided to leave the conclusion of the paper as it is, while including a note in the final paragraph of the paper that the planning of restoration measures can deviate from the listed priorities for practical reasons, but that policy makers and water managers should be aware that costly investments to improve the regional hydrology of fen reserves only have effect after measures have been implemented in the direct vicinity of the fens targeted at preventing diffuse loss of groundwater via drainage ditches.

Detailed comments: *(page 4383, line 25) We will reconsider citing Lamers instead of Boyer and Wheeler (1989) here.

*(page 4388, line 18) We will shortly explain that the high Tritium concentration in alien surface water originates from industrial (nuclear) activities in the River Rhine catchment.

* We don't see the mentioned inconsistency in Tritium-concentrations listed in Table 1 and Figure 2, i.e., 45 TU vs 7499 TU. Note that the Tritium time series in Figure 2 is generated by calculation of the Tritium concentration in groundwater at the date of sampling using time series of Tritium in precipitation derived from literature. Fig 2 is thus not applicable to dating the age of alien surface water.

* The Tritium concentration in alien surface water listed in Table 1 is an average concentration observed at Lobith (East Netherlands) and Maassluis (West Netherlands) in 2006. We will include this as a comment to Table 1. As we feel that the minimal value for Tritium can be more convincing to identify alien surface water in our transects, we will further review the databases to assess the range in Tritium values in alien surface water at the study site.

*We will improve the readability of Fig. 3 by increasing the size of letters, and by improving the correspondence between the caption and figure.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 4379, 2009.