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Hydrology and Earth System Sciences Discussions

Interactive comment on "The dynamics of cultivation and floods in arable lands of central Argentina" *by* E. F. Viglizzo et al.

E. F. Viglizzo et al.

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Comment of D. Le Maitre

The first problem I have with the analysis is this: although the patterns in the data seem to suggest that there are clear lags in the groundwater responses to the rainfall (see Fig 3), the authors barely mention them. For example, in the highland data there seems to be a lag of about a year between groundwater responses and rainfall (e.g. 1986, 1997). The groundwater responses also are smoothed relative to rainfall (which I would expect) but more so than I would expect (e.g. the smooth rise in groundwater levels from 1997-2001 despite marked rainfall cycles). The same is true of the lowland datasets. These lags need to be considered in deciding how to analyse the data. At the very least the authors should test correlations in the data using different lag periods

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to see if this resolves some of the strange patterns, especially in the lowlands.

Reply from L. Carreño

We re-analized our datasets in order to detect rainfall-groundwater relations. Significant lags between precipitation and water table behaviour during the study period both, in highlands and lowlands, occurred in the Quinto river area. By means of correlation analysis various options were analysed: i) no time lag, and ii) time-lags of 1, 2, 3, 4, 5 and 6 years, respectively. Highly significant ($P<0,01$) correlations ($R = 0.56$ and $R = 0.49$) were found only in highlands for a time lag of 1 and 2 years, respectively. Correlations were not significant for remaining options, suggesting that precipitation needs at least 1 year to impact on groundwater behaviour. Paradoxically, no correlation was detected in lowlands, and this could be interpreted as follows: i) in relation to highlands, water tables in lowlands were consistently higher and closer to surface; so they inevitably were less sensitive to respond to precipitation changes; ii) because of their lower topographic position, lowlands received large amounts of runoff water from highlands (probably exceeding that from rainfall water), which accumulated in a system of interconnected lagoons. Given that lagoons are a major source of water, they could explain high water tables in lowlands, decoupling groundwater from local rainfall supply; iii) subsurface water movements from highlands could make an additional contribution to water table rising in lowlands. An interesting 1-year lag between highlands and lowlands regarding the maximum flooded area can be appreciated in Figure 4. While the peak of flood-affected areas occurred in 2001 in highlands, the corresponding peak in lowlands ocurred in 2002. This suggests a water movement from highlands to lowlands that could plausibly explain the lack of response of groundwater level to precipitation in lowlands.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 2319, 2008.