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Hydrology and Earth System Sciences Discussions

Interactive comment on "Impact of climate evolution and land use changes on water yield in the Ebro basin" *by* J. I. López-Moreno et al.

Anonymous Referee #2

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Title: IMPACT OF CLIMATE EVOLUTION AND LAND USE CHANGES ON WATER YIELD IN THE EBRO BASIN The paper uses a simple trend analysis of monthly time series across 88 subbasins over a 56 year period in a large Mediterranean river basin. Using Mann-Kendall (MK) test of trend in temperature, precipitation, and discharges, the authors assess time evolution of these climatic and hydrologic variables in Ebro River basin. Using climatic projection they identify locations with higher impacts on hydrology and potential impacts on water yield. In general, the paper highlights an important issue facing water resources managers – upland linkages to low land supplies and vulnerability to climate change. The introduction is well written that highlights the motivation and the problem that is being studied. The documentation of methods is well done and is nice to see application and analysis of a good dataset that is both

spatial and temporal in dimensions. The methods are sound with clear use of established methods and inclusion of tests for statistical significance. The use ofa simple analysis of trend like the MK method is reasonable to analyze general trends in the multivariate data. Major conclusion is that climate change, land use, and increase in water consumption affect water yield, in the watershed, calling for coordination among politicians and managers. General and specific comments are listed below. Hope it will be useful in improving the paper or can be useful in further extensions of this study. - The runoff calculations based on ratio of precipitation and discharge are fine under the assumption of precipitation - runoff response occurring at the same period (month here). In large watersheds like this, lag effects (time of concentration) can be substantial. Sometimes the lags can be several days, weeks, and months. While this paper studies interaction within a month it will be useful to specify this assumption. - The land use changes are assessed indirectly through a regression with climatic factors. This assumes that land use and climate are major factors. While such elimination method can provide general trends, it will be much useful to quantify land cover in the regression. Other factors like groundwater discharges, soils, landforms, and diversions are not explicitly modeled. This is a weakness given that land use change is highlighted in the title. - The analysis is done with climatic and discharge variables at different spatial locations. There exist cumulative and interactive effects that are difficult to assess using the approach of studying them individually. For example, upstream runoff accumulated over geographic space within a subbasin and having effect on downstream flows. Land use and climate change variables also interact to create combined effects on flow regimes. I recommend discussing these issues in the introduction. Specific comments: âĂć Page 2657, line 18 – How are the distances calculated? - Shortest linear distance? âĂć Page 2657, Line 21 – Why are the residuals interpolated? âĂć Page 2658, Line 3 – Is the ratio assuming no carry-over to next month? âĂć Page 2658, Line 20 – Need to add tau = 0? âĂć Page 2658, Line 25 – The elimination method used will work if major factors contribute to high variation in flows. There are other factors that can be influential. It will be useful to add the assumption behind this

method. âĂć Page 2659, Line 17 – Please add some discussion on why this GCM is chosen compared to others. âĂć Page 2659, Line 21 – The time span should be written 2015-2080 (typo). âĂć Page 2660, Line 12 – Here are elsewhere “stationary situation” is discussed. Please add some discussion on this based on reasons for such stationarity. âĂć Page 2662, Line 12 – Temperature only affecting on average 4% of variation (based on r2), and in majority it is not significant. Please relate this to climate change impacts with a focus on uncertainty in impacts. âĂć Page 2662, Line 17 – The decline in runoff coefficient can be from reduction in precipitation and increase in discharge (as per the ratio defined). Given precipitation is stationary, please add some more discussion here.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2651, 2010.