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Discussions

Interactive comment on "Time-series analysis of the long-term hydrologic impacts of afforestation in the Águeda watershed of North-Central Portugal" *by* D. Hawtree et al.

Anonymous Referee #2

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This paper examines the effect of land use change (from "uncultivared/wasteland" to Pinus pinaster and to Eucalyptus globulus) on runoff characteristics for a 404 km2 catchment in north-central Portugal. The analytical tools used for analysis were trend tests of precipitation, streamflow yield (ratio of streamflow to precipitation) and BFI.

Essentially, there are two approaches to investigating the impact of land use change: a single catchment experiment in which before and after streamflows are assessed, and paired-catchment experiments in which treated catchments are compared with a control or untreated catchment. For single catchments, two approaches have been adopted in the literature: trend tests or rainfall-runoff modelling. Because the authors

are dealing with land use change for only one catchment, they were restricted to a single-catchment analysis and opted for a trend test.

Although the trend analysis appears to be satisfactory, what stands out in this study is that the effect of precipitation on runoff is not seriously addressed. The authors adopted the ratio of annual runoff to annual precipitation to do this. However, this is a crude approach because any change in precipitation/runoff relationship will occur at a much shorter time-step and the effect will be largely masked at an annual level. Therefore, for the study to provide credible results, I would have expected the effect of precipitation on runoff to be removed in a more credible way.

The interpretation of the baseflow trends needs further consideration. A recent paper in HESS by Cartright et al. (2014) is pertinent. For the watershed analysed by Cartright et al., they showed that estimates of baseflow from the local minimum and recursive digital filters (including the Eckhardt filter adopted by the authors) are higher than those based on chemical mass balance using Cl calculated from continuous electrical conductivity measurements. This suggests that baseflow computed using a digital filter is made up of local riparian groundwater (including bank storage) that has a short storage delay time plus the more regionally based groundwater with a much longer storage delay time. The interplay between these two baseflow components may explain some of the features of the BFI trends observed in Figure 6. I would suggest the authors examine this aspect in relation to the Agueda watershed.

My other comments are as follows: P12224, L6: I think 7 should read 70. P12226, Ls28 - 29: After "20%" add 'of total rainfall'. Delete "of total rainfall" from the next line. P12226, L28 -12227, L6: These percentages are not useful unless the mean annual precipitation is provided for each case. P12228, Ls16-17: Delete "analyzes" and add after Value 'are analysed'. P12230, L26: "Corine Land Cover" requires an appropriate reference. P12233, L15: "streamflow/precipitation". Should this not be 'annual streamflow/annual precipitation". P12238, L5: Reword – replace "well below" with 'less than'. P12238, Ls15-23: It would be helpful if the authors had compared their results with those from similar catchments elsewhere. There are approximately 190 separate land use impact studies reported in Bosch & Hewlett (1982), Brown et al. (2005) and Farley et al. (2005). It is likely that some of these would be from catchments that have similar climate and physical features as in the Agueda watershed.

Reference Cartright, I., Gilfedder, B. and Hofmann, H.: Contrasts between estimates of baseflow help discern multiple sources of water contributing to rivers,. Hydrol. Earth Syst. Sci., 18, 15–30, 2014.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 12223, 2014.