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Distinguishing climate and land use change impacts on streamflow for 472 catchments in the United States and Australia

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Climate change and land use change are ongoing features which affect the hydrological regime by changing the rainfall partitioning into actual evapotranspiration and runoff. A data-based method has been previously developed to distinguish climate and land use change impacts on streamflow. Since this method has not been often applied, a large sample study by applying the method to catchments in different parts of the world will provide more insight in the water partitioning and will evaluate the method. Therefore, the objective of this study is to apply a data-based method to distinguish climate change and land use change impacts on streamflow to a large sample set of 472 catchments in the United States and Australia and to evaluate the used method. The method calculates the water and energy budget of a catchment which can be translated to climate and land use induced changes in streamflow between two periods: a pre- and post-change period. The method has been adapted, so that it is applicable to a large sample set of catchments. Several geographical characteristics (e.g. aridity index, average catchment slope, historical land use) were considered for the interpretation of the results. To evaluate the method, the results are compared with trends in potential evapotranspiration and precipitation and with documented land use changes. The results indicate that in general an increase of the annual discharge is caused by deforestation and a wetter climate, and a decrease of the annual discharge is caused by afforestation and a drier climate. A difference between American catchments and Australian catchments is present. The changes in streamflow of American catchments are caused by a wetter climate, while changes in streamflow of Australian catchments are caused by a wetter climate or a drier climate. Geographical characteristics which explain the results of the method are the aridity index and the historical land use. The average catchment slope seems to be less well explaining the results, however this could be the result of only including relatively flat catchments. The trends in potential evapotranspiration and precipitation confirm the results of the method. The documented land use changes are in line with the values of land use induced changes in streamflow for all except one of a sub-set of fifteen catchments examined. It can be concluded that the method performs reasonably well and that the results are best explained by the location of the catchment, the aridity index and historical land use.