EGU2020-12658
https://doi.org/10.5194/egusphere-egu2020-12658
EGU General Assembly 2020

Dry season water availability changes attributed to human-induced climate change

Ryan S. Padrón[1], Lukas Gudmundsson[1], Agnès Ducharne[2], David M. Lawrence[3], Jiafu Mao[4], Daniele Peano[5], Bertrand Decharme[6], Gerhard Krinner[7], Hyungjun Kim[8], and Sonia I. Seneviratne[1]

[1]ETH Zurich, Institute for Atmospheric and Climate Science, Department of Environmental Systems Science, Zurich, Switzerland (ryan.padron@env.ethz.ch)

[2]Sorbonne Université, CNRS, EPHE, Milieux environnementaux, transferts et interaction dans les hydrosystèmes et les sols, Metis, 75005 Paris, France

[3]Climate and Global Dynamics Laboratory, National Center for Atmospheric Research, Boulder, CO, USA

[4]Environmental Sciences Division and Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN, USA

[5]Fondazione Centro euro-Mediterraneo sui Cambiamenti Climatici, CMCC, Bologna, Italy

[6]CNRM, Centre National de Recherches Météorologiques, Université de Toulouse, Météo-France, CNRS, Toulouse, France

[7]LGGE, CNRS, Grenoble, France

[8]Institute of Industrial Science, The University of Tokyo, Tokyo, Japan

Human-induced climate change poses potential impacts on the availability of water resources. Previous assessments of warming-induced changes in dryness, however, are influenced by short observational records and show conflicting results due to uncertainties in the response of evapotranspiration. In this study we use novel observation-based water availability reconstructions from data-driven and land surface models from 1902 to 2014; a period during which the Earth has warmed approximately 1°C relative to pre-industrial conditions. These reconstructions reveal consistent changes in average water availability of the driest month of the year during the last 30 years compared to the first half of the 20th century. We conduct a simple attribution approach based on a spatial correlation analysis between the reconstructions and different climate model simulations. Results indicate that the spatial pattern of changes is *extremely likely* influenced by human-induced greenhouse gas emissions as it is consistent with climate model estimates that include historical radiative forcing, whereas the pattern is not expected from natural climate variability given by climate simulations with greenhouse gas levels set to pre-industrial conditions. Changes in water availability are characterized by drier dry seasons predominantly in extratropical latitudes and including Europe, Western North America, Northern Asia, Southern South America, Australia, and Eastern Africa. Finally, we find that the intensification of the dry season is generally a consequence of increasing evapotranspiration rather than decreasing precipitation.