Geophysical Research Abstracts
Vol. 21, EGU2019-4348, 2019
EGU General Assembly 2019

GRUN – An observations-based global gridded runoff dataset from 1902 to 2014

Gionata Ghiggi (1,2), Vincent Humphrey (2), Sonia Seneviratne (2), and Lukas Gudmundsson (2)

(1) Environmental Sciences and Engineering Department, EPF Lausanne, 1015 Lausanne, Switzerland , (2) Institute for Atmospheric and Climate Science, ETH Zurich, 8092 Zurich, Switzerland

Freshwater is regarded as one of the most important natural resources for human development and understanding its past variability is vital to water management in the context of current and future climatic change. However, relevant in-situ observations are only available at a limited number of locations and often cover irregular time-periods, thereby limiting large-scale freshwater research. To overcome this challenge, we introduce here the first soon publicly available observations-based reconstruction of global monthly runoff covering the period from 1902 to 2014 at a 0.5-degree spatial resolution (GRUN). To this end, millions of in-situ streamflow observations from small catchments are used to train a machine learning algorithm which estimates monthly runoff rates based on antecedent precipitation and temperature from an atmospheric reanalysis. The accuracy of this reconstruction is assessed with cross-validation and compared to an independent set of discharge observations for large river basins. The presented dataset agrees on average better with streamflow observations than an ensemble of 13 state-of-the art global hydrological model runoff simulations from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2a), that are driven by the same atmospheric forcing. The temporal coverage of the reconstruction offers an unprecedented view on large-scale features of runoff variability also in regions with limited data coverage making it an ideal candidate for large-scale hydro-climatic process studies, water resources assessments and for evaluating existing hydrological models. We provide example applications fostering the understanding of global freshwater dynamics, in terms of interannual variability, drought propagation and the response to atmospheric teleconnections.