Geophysical Research Abstracts
Vol. 21, EGU2019-18790, 2019
EGU General Assembly 2019

Hydrological benchmarking improves local-scale streamflow estimates in a large-scale hydrological model

Alessandro Todaro (1), Bibi S. Naz (2), Stefan Kollet (2), Alberto Bellin (1), and Bruno Majone (1)

(1) Department of Civil, Environmental and Mechanical Engineering, University of Trento, via Mesiano 77, 38122, Trento, (2) Research Centre Jülich, Institute of Bio- and Geosciences: Agrosphere (IBG-3), Jülich 52425, Germany

Large-scale Hydrological Models (LHMs) are increasingly used in studies concerning the water cycle at synoptic, continent, and global scales. These models are not constrained to reproduce hydrological processes and streamflow at the local scale, i.e. the scale at which water resources are managed.
In the present study, we evaluated suitable modifications of the Community Land Model v3.5 (CLM3.5), which improve streamflow reproduction in a relatively large Alpine catchment: the Adige river basin, south-eastern Alps with a drainage area of about 10500 km2 at the Trento gauging station. In particular, we added to CLM3.5 a simple module dealing with deep infiltration to aquifers and return flow, and replaced the grid based routing scheme with the multi-scale grid independent scheme embedded in the HYPERstreamHS hydrological model. The performance of a calibrated run of HYPERstreamHS stand-alone model in reproducing observed streamflow at the Trento gauging station was also evaluated to provide a benchmark for assessing the effectiveness of the introduced parameterizations of deep infiltration, return flow and streamflow routing. Note, all simulation runs were informed by the same meteorological forcing.
Runoff computed by CLM3.5 with the HYPERstream routing scheme improved the performances of the Nash Sutcliffe Efficiency (NSE) from -0.05 (uncalibrated CLM3.5 run) to 0.15. Furthermore, results indicate that, at least in the case of the Alpine watershed considered in this study, low NSE values are due to an underestimation of the water recharging deep aquifers and not re-entering the river network in CLM3.5. In addition, simulations using HYPERstreamHS informed by actual evapotranspiration outputs as provided by CLM3.5 showed a good agreement with observations (NSE = 0.61), which is very close to the performance obtained with the stand-alone run of HYPERstreamHS (NSE=0.65), thus suggesting that the land surface energy and mass balance is correctly simulated in CLM3.5 model also at the local scale.
Results of this study suggest that a significant improvement of the performance of CLM3.5 in reproducing observed streamflow time series at the local scale may be achieved by replacing the grid based routing scheme with a more accurate scale-independent routing scheme and adding a simple parametrization of deep infiltration, with the latter producing the most significant improvement.