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Towards improved disaster preparedness and climate proofing in semi-arid regions: development of an operational seasonal forecasting system

Christof Lorenz[1], Tanja Portele[1], Patrick Laux[1], and Harald Kunstmann[1,2]
[1]Institute of Meteorology and Climate Research Atmospheric Environmental Research (IMK-IFU), Karlsruhe Institute of Technology (KIT), Garmisch-Partenkirchen, Germany
[2]Institute of Geography, Regional Climate and Hydrology, University of Augsburg, Augsburg, Germany

Seasonal hydrometeorological forecasts have the potential to significantly improve the regional water management, particularly in water-scarce regions. This includes a better disaster preparedness by developing e.g. forecast-based action plans for extreme climatic events like droughts and anomalous wet conditions. However, raw global products from data providers like the European Centre for Medium Range Weather Forecasts (ECMWF) cannot be directly used for regional applications due to model biases and drifts as well as a coarse spatial resolutions of 35km and more. In this study, we present a comprehensive dataset of operationally available seasonal hydrometeorological forecasts based on ECMWF's newest seasonal forecast system SEAS5 that is a) corrected for biases against ECMWF ERA5 reanalysis data and b) spatially disaggregated to a higher spatial resolution of 0.1° (approx. 10km). We adopt a modified version of the Bias-Correction and Spatial Disaggregation (BCSD) technique, which is a highly robust method for regionalizing e.g. global climate data. The final repository contains daily ensemble forecasts for precipitation, temperature and radiation from 1981 to the present for 7 different semi-arid river basins in Iran (Karun), Sudan and Ethiopia (Tekeze-Atbara and Blue Nile), West-Africa (Niger and Volta), Brazil (Rio São Francisco) and Ecuador (Catamayo-Chira). In total, forecasts for more than 2.5 Million days for each variable and study region are corrected and disaggregated. An evaluation against reference data from ERA5 shows significantly reduced biases for the monthly averages as well as consistent and lead-independent forecast characteristics like wet/dry-day frequencies. As the entire repository is freely available, it provides an optimal test-bed for evaluating the forecast skill in different study regions; it allows to develop and implement e.g. hydrological forecasting systems and to train and educate local stakeholders and water experts. Our operational output of the forecasting system is already used by several authorities and weather services in Iran and Sudan; it thereby constitutes a large step towards an improved disaster preparedness and, hence, the climate proofing of the water sector particularly in these semi-arid regions.