2020 International Conference on the Nile and Grand Ethiopian Renaissance Dam: Science, Conflict Resolution and Cooperation, August 20-21, 2020, Florida International University, Miami, FL USA (Virtual)

Bias-Corrected and Spatially Disaggregated Seasonal Forecasts: A Long-Term Reference Forecast Product for the Tekeze-Atbara and Blue Nile Basins

Christof Lorenz[1], Tanja C. Portele[1], Harald Kunstmann[1,2]

Abstract

Seasonal forecasts have the potential to substantially improve water management particularly in water scarce regions. Especially when sustainable and well-coordinated longer-term planning is crucial, seasonal forecasts can provide an important decision support. A recent example for such an application is the development of filling strategies for the Grand Ethiopian Renaissance Dam (GERD), as short-sighted decisions, particularly during extreme climatic conditions like droughts, can have significant societal implications on all Eastern Nile riparian countries. However, global seasonal forecast products are usually not directly applicable as they are provided at coarse spatial resolutions of at best 36 km and suffer from model biases and drifts. In this study, we therefore apply a bias-correction and spatial-disaggregation (BCSD) approach to seasonal precipitation, temperature and radiation forecasts of the latest long-range seasonal forecasting system SEAS5 of the European Centre for Medium Range Weather Forecasts (ECMWF) over a transboundary domain across Sudan, Ethiopia and Eritrea including the Tekeze-Atbara and Blue Nile river basins. As reference we use data from the ERA5-Land offline land surface re-run of the latest ECMWF reanalysis ERA5. By that, we correct for model biases and drifts and improve the spatial resolution from 36 km to 0.1° (approx. 10 km). Compared against ERA5-Land, the bias-corrected and spatially disaggregated forecasts have a higher spatial resolution and show reduced biases and better agreement of spatial patterns than the raw forecasts. Furthermore, the lead-dependent drift effects are remarkably reduced in our BCSD-forecasts, which hence provide a spatially and temporally consistent decision support for the regional water management. Our product covers the whole (re)forecast period from 1981 to the present and is operationally updated one day after a new seasonal forecast from the ECMWF is released, which usually happens on the 5th of each month. For the whole period, we provide bias-corrected and spatially disaggregated daily and monthly ensemble forecasts for precipitation, average, minimum and maximum temperature as well as for shortwave radiation from the initial date to the next 215 days and 7 months, respectively. This sums up to more than 100,000 forecasted days for each of the 25 (until the year 2016) and 51 (from the year 2017) ensemble members and each of the 5 analyzed variables. Our full repository is

1 Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Kreuzeckbahnstr. 19, 82467 Garmisch-Partenkirchen, Germany, Email: christof.lorenz@kit.edu

2 Augsburg University, Institute of Geography, Alter Postweg 118, 86159 Augsburg, Germany

made freely available to the public via the World Data Centre for Climate and (after registration) via our own KIT Campus Alpin THREDDS-Server. It is currently the first publicly available daily high-resolution seasonal forecast product for such a long period for this particular region. It hence provides a unique test-bed for evaluating the performance of seasonal forecasts and as driving data for hydrological, ecosystem or climate impact models. Furthermore, as it allows for the approximation of the incoming freshwater resources during the coming months, it can be a highly valuable decision support e.g. for developing careful and sustainable seasonal filling strategies for the GERD. Our forecast product hence provides an important contribution for an improved longer-term planning, disaster preparedness and, finally, climate proofing in this climatically sensitive region.

Keywords: Tekeze-Atbara Basin, Blue Nile Basin, GERD filling, Bias-correction, Spatial disaggregation, Seasonal forecasting system, precipitation forecasting, World Data Centre for Climate