Abstract

Persistent drought events over several years have been documented over the last centuries, eg. in the central US and Sahel region. Such multi-year droughts have been attributed to a small number of climate modes such as El Nino/Southern Oscillation (ENSO) and the Atlantic Multidecadal Oscillation (AMO). Particular AMO has been found relevant for the decadal variations in persistent pluvial and drought occurrence in the central US and Sahel region.

Moreover, strong efforts are made to develop and establish decadal climate predictions. Today for the first time decadal climate prediction is part of the CMIP5/IPCC AR5 data streams, and climate centres investigate whether decadal predictions can be added to their operational suite. Combined hindcast-forecast experiments of these systems have shown enhanced skill from initialisation at global scale and over the North Atlantic. Here of particular interest the AMO and the Atlantic Meridional Overturning Circulation (AMOC) have been shown potentially predictable at least 5 years in advance.

The principal aim of this proposal is to establish whether the state-of-the-art decadal climate prediction systems (e.g. MPI ECHAM/MPIOM and MetOffice Decadal Prediction System) are capable to predict multi-year persistent drought events and how such systems need to be improved. Based on existing methods we provide an extended backward estimation of decadal climate hindcast not been applied yet for a coupled system. With these experiments we are thus in the position to estimate historical droughts such as the Dust Bowl in the central US during the 1930s. For this various indices are considered to estimate the hindcast skill. Special emphasis is given on the improvement of the prediction system by including dynamical-vegetation components into ECHAM/MPIOM. An improvement of drought forecast is expected since the role of vegetation and/or river run off has been found essential for the development of droughts. Finally the scientific findings are transferred to the central prediction system of MiKlip and forecasts are performed.