IAHS2017-362-1
IAHS Scientific Assembly 2017

GCM-related uncertainty in future environmental flows and flooding in the Upper Niger and Inner Niger Delta

Julian Thompson (1), Cedric Laize (2), Acreman Mike (2), Andrew Crawley (1), and Daniel Kingson (3)

(1) UCL Geography, London, UK, (2) Centre for Ecology and Hydrology, Wallingford, UK, (3) Department of Geography, University of Otago, New Zealand

The implications of the RCP 4.5 scenario as simulated by 41 CMIP5 GCMs for the 2050s and 2080s are investigated using a semi-distributed hydrological model of the Niger River above and including the Inner Delta. Uncertainty in future river flows is driven by projections of precipitation rather than potential evapotranspiration (PET). Whilst PET increases for most GCMs over most sub-catchments, an almost equal number of sub-catchment–GCM combinations experience positive and negative precipitation change. On average the range of change in precipitation is, in percentage terms, four (2050s) and five (2080s) times as large as PET. Projections for changes in river discharge are as uncertain as those for precipitation. The inter-GCM range of change in mean discharge exceeds that of precipitation by three times in percentage terms. Declines in seasonal inundation of the Inner Niger Delta dominate with 32 and 28 of the 41 GCMs projecting declines in October and November for the 2050s and 2080s, respectively. Changes in mean annual peak flood extent range between -8,648 km^2 (-61%) and +9,735 km^2 (+68%) for the 2050s and between -11,060 km^2 (-78%) and +15,202 km^2 (+107%) for the 2080s. Projected changes in river flow and flood extent are assessed through an environmental flow method based on the range of variability approach. Ecologically relevant hydrological indicators are evaluated for baseline and climate change scenarios. Baseline-to-scenario change is assessed against thresholds that define likely risk of ecological impact. These are aggregated into single scores for high and low flows / flood extent. Results demonstrate considerable inter-GCM variability in future environmental flow conditions through the Upper Niger and the extensive floodplains of the Inner Delta.