Geophysical Research Abstracts
Vol. 19, EGU2017-10325, 2017
EGU General Assembly 2017

Current and future groundwater recharge in West Africa as estimated from a range of coupled climate model outputs

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This research addresses the terrestrial water balance for West Africa. Emphasis is on the prediction of groundwater recharge and how this may change in the future, which has relevance to the management of surface and groundwater resources. The study was conducted as part of the BRAVE research project, "Building understanding of climate variability into planning of groundwater supplies from low storage aquifers in Africa – Second Phase", funded under the NERC/DFID/ESRC Programme, Unlocking the Potential of Groundwater for the Poor (UPGro).

We used model output data of water balance components (precipitation, surface and subsurface run-off, evapotranspiration and soil moisture content) from ERA-Interim/ERA-LAND reanalysis, CMIP5, and high resolution model runs with HadGEM3 (UPSCALE; Mizielinski et al., 2014), for current and future time-periods.

Water balance components varied widely between the different models; variation was particularly large for sub-surface runoff (defined as drainage from the bottom-most soil layer of each model). In-situ data for groundwater recharge obtained from the peer-reviewed literature were compared with the model outputs.

Separate off-line model sensitivity studies with key land surface models were performed to gain understanding of the reasons behind the model differences. These analyses were centered on vegetation, and soil hydraulic parameters. The modelled current and future recharge time series that had the greatest degree of confidence were used to examine the spatiotemporal variability in groundwater storage. Finally, the implications for water supply planning were assessed.

Mizielinski, M.S. et al., 2014. High-resolution global climate modelling: the UPSCALE project, a large-simulation campaign. Geoscientific Model Development, 7(4), pp.1629–1640.