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Assessing water resources in Azerbaijan using a local distributed model forced and constrained with global data

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In many countries, data is scarce, incomplete and often not easily shared. In these cases, global satellite and reanalysis data provide an alternative to assess water resources. To assess water resources in Azerbaijan, a completely distributed and physically based hydrological wflow-sbm model was set-up for the entire Kura basin. We used SRTM elevation data, a locally available river map and one from OpenStreetMap to derive the drainage direction network at the model resolution of approximately 1x1 km. OpenStreetMap data was also used to derive the fraction of paved area per cell to account for the reduced infiltration capacity (c.f. Schellekens et al. 2014). We used the results of a global study to derive root zone capacity based on climate data (Wang-Erlandsson et al., 2016). To account for the variation in vegetation cover over the year, monthly averages of Leaf Area Index, based on MODIS data, were used. For the soil-related parameters, we used global estimates as provided by Dai et al. (2013). This enabled the rapid derivation of a first estimate of parameter values for our hydrological model.
Digitized local meteorological observations were scarce and available only for limited time period. Therefore several sources of global meteorological data were evaluated: (1) EU-WATCH global precipitation, temperature and derived potential evaporation for the period 1958-2001 (Harding et al., 2011), (2) WFDEI precipitation, temperature and derived potential evaporation for the period 1979-2014 (by Weedon et al., 2014), (3) MSWEP precipitation (Beck et al., 2016) and (4) local precipitation data from more than 200 stations in the Kura basin were available from the NOAA website for a period up to 1991. The latter, together with data archives from Azerbaijan, were used as a benchmark to evaluate the global precipitation datasets for the overlapping period 1958-1991.
By comparing the datasets, we found that monthly mean precipitation of EU-WATCH and WFDEI coincided well with NOAA stations and that MSWEP slightly overestimated precipitation amounts. On a daily basis, there were discrepancies in the peak timing and magnitude between measured precipitation and the global products. A bias between EU-WATCH and WFDEI temperature and potential evaporation was observed and to model the water balance correctly, it was needed to correct EU-WATCH to WFDEI mean monthly values.
Overall, the available sources enabled rapid set-up of a hydrological model including the forcing of the model with a relatively good performance to assess water resources in Azerbaijan with a limited calibration effort and allow for a similar set-up anywhere in the world. Timing and quantification of peak volume remains a weakness in global data, making it difficult to be used for some applications (flooding) and for detailed calibration. Selecting and comparing different sources of global meteorological data is important to have a reliable set which improves model performance.

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