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Hydrological model parameters identification in a coastal nested catchment in Mersin province (SE Turkey)

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It is known that the coastal Mediterranean region is facing a serious problem of water resources exploitation due to the rapid demographic, socio-economic, land use and climate changes. The hydrological modeling has proven to be an efficient tool for better water resources prediction and management. In this study, the HYdrological Predictions for the Environment (HYPE) model was setup on the nested coastal Sorgun catchment in Turkey (449 km2). This catchment is located in the east part of the Mersin province and is characterized by extremely varied topography, land use, and population density in semi-arid Mediterranean climate conditions. First, the model was calibrated at the catchment outlet (Sarilar) for the period 2003-2006. Second, the model was validated temporally for the period 2009-2013 at daily and monthly time intervals. In addition, the model performance was tested spatially using an internal station (B. Sorgun, 269 km2) located in the headwater region.
Results showed that the HYPE model could reproduce the measured daily discharge significantly well (Nash Sutcliffe Efficiency (NSE) were 0.78 and 0.68 for calibration and validation periods, respectively). For monthly time step, the model performs better compared with daily time interval (NSE were 0.92 and 0.83 for calibration and validation periods, respectively). The model could represent the water balance relatively good at daily and monthly time steps, where the lowest PBIAS (percentage bias) were - 4.19% and - 3.53% for daily and monthly time intervals, respectively (considering the whole period). Results revealed, however, the agreement between the predicted and measured discharge was reduced, when the same best optimized model-parameters at Sarilar gauging station (catchment outlet) were used at B. Sorgun station (internal station). This model transferability less performance at internal station can be explained by the clear changes in terms of land use, soil type and precipitation rate in the headwater sub-catchment compared with the whole Sorgun catchment. The HYPE model could represent the measured discharge at the internal station (B. Sorgun), only when the most sensitive model parameters were slightly re-calibrated considering the climate, soil type and land use variabilities (NSE values were 0.73 and 0.86 for daily and monthly intervals, respectively).