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Numerical modeling evapotranspiration flux components in shrub-encroached grassland in Inner Mongolia, China

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Shrub encroachment into arid grasslands occurs around the world. However, few works on shrub encroachment has been conducted in China. Moreover, its hydrological implications remain poorly investigated in arid and semiarid regions. This study combined a two-source energy balanced model and Newton–Raphson iteration scheme to simulate the evapotranspiration (*ET*) and their components of shrub-encroached(with 15.4% shrub coverage) grassland in Inner Mongolia. Good agreements of *ET* flux between modelled and measured by Bowen ratio method with relatively insensitive to uncertainties/errors in the assigned models parameters or in measured input variables for its components illustrated that our model was feasible for simulating evapotranspiration flux components in shrub-encroached grassland. The transpiration fraction(T/*ET*)account for 58$\pm$17%during the growing season. With the designed shrub encroachment extreme scenarios (maximum and minimum coverage),the contribution of shrub to local plant transpiration (T_{shrub}/T) was 20.06$\pm$7%during the growing season. Canopy conductance was the main controlling factor of T/*ET*. In diurnal scale short wave solar radiation was the direct influential factor while in seasonal scale leaf area index (*LAI*) and soil water content were the direct influential factors. We find that the seasonal variation of T_{shrub}/T has a good relationship with ratio of LAI_{shrub}/*LAI*, and rainfall characteristics widened the difference of contribution of shrub and herbs to ecosystem evapotranspiration.