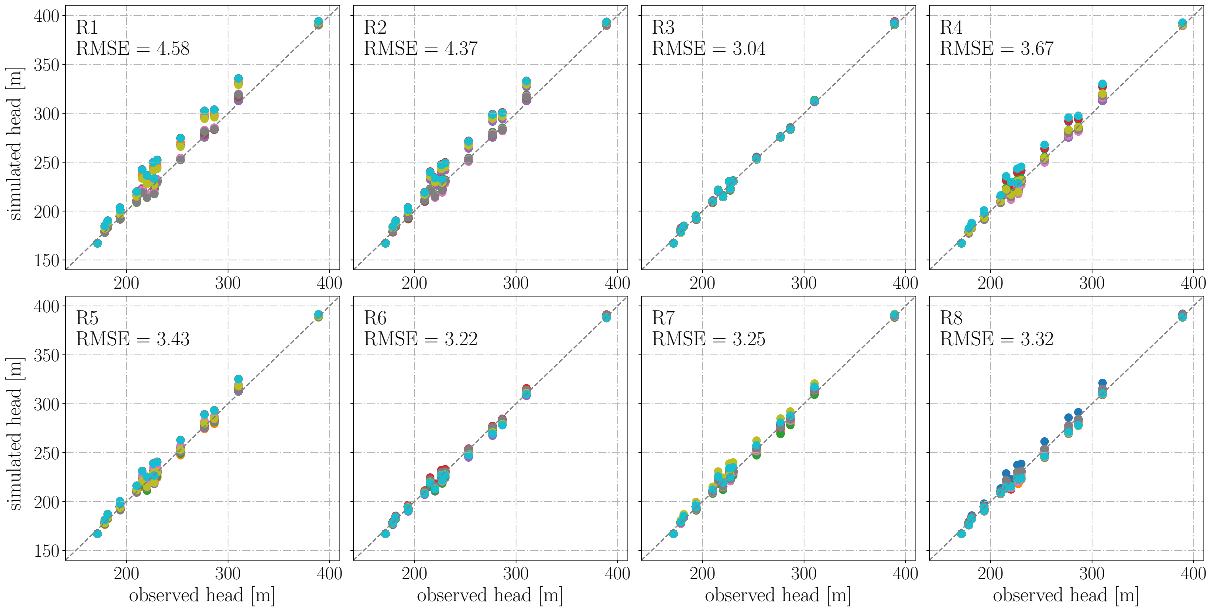

Figure 5. Observed and simulated groundwater heads for each parameter and recharge realization. The results of 400 realizations (R1K1 - R8K50) are categorized by recharge realization and shown in different panels.

layer (Table B1). The other parameters fluctuate moderately and are constrained within one order of magnitude in most of the recharge realizations. Hydraulic conductivities of several permeable layers (mo, mm, alluvium, and soil) increase from R1 to R8, which is not surprising because the hydraulic conductivity increases with increasing recharge and constant groundwater head. Moreover, the hydraulic conductivities of the above layers are roughly linearly correlated to the corresponding recharge in each recharge realization. Figure 5 shows the simulated and observed groundwater heads for all 400 realizations. All of the 400 realizations are well constrained to observations, with the root mean square error (RMSE) of groundwater level residuals being lower than 4.6 m in all of the considered recharge realizations.

3.3 Theory of analytical StorAge Selection function

The travel time is defined as the time spent by a moving element (either a water particle or a solute) in a control volume of a hydrologic system. In principle, the control volume can be defined at arbitrary spatial scales (i.e., from the molecular scale to the regional scale). Considering a hydrologic system in which the input flux (J) and the output fluxes ($Q_1, Q_2, ..., Q_n$) are known, each parcel of water within the system is tagged using its current age τ. The age-ranked storage $S_T = S_T(T,t)$ is defined as the mass of water in the system with age $\tau < T$. The backward form of the master equation (ME) for TTD in a control volume can be expressed as follows (Botter et al., 2011; Van Der Velde et al., 2012; Harman, 2015):

$$\frac{\partial S_T}{\partial t} = J(t) - \sum_{j=1}^{n} Q_j(t) \overleftarrow{P}_{Q_j}(T,t) - \frac{\partial S_T}{\partial T} \tag{3}$$