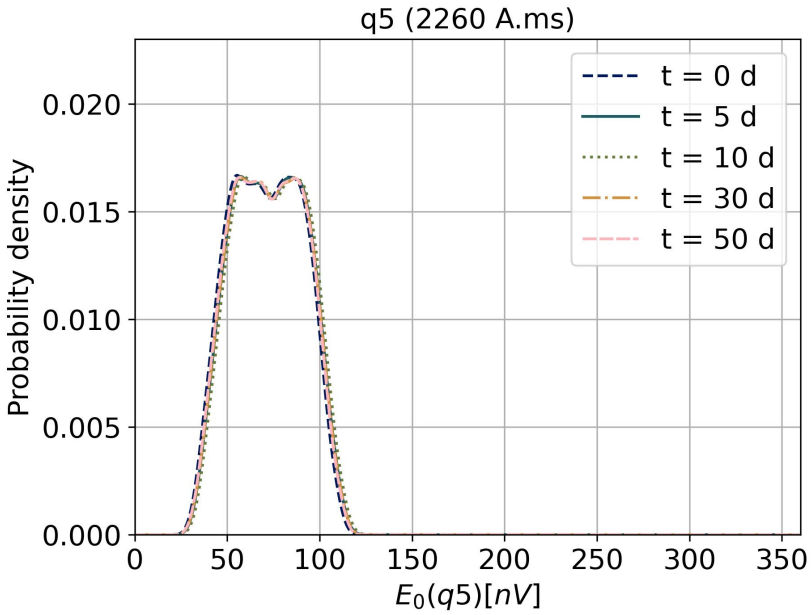

Figure S1. MRS signal probability density functions at times $t \in \{0, 5, 10, 30, 50\}$ days for pulse $q_5 = 2260$ A.ms.

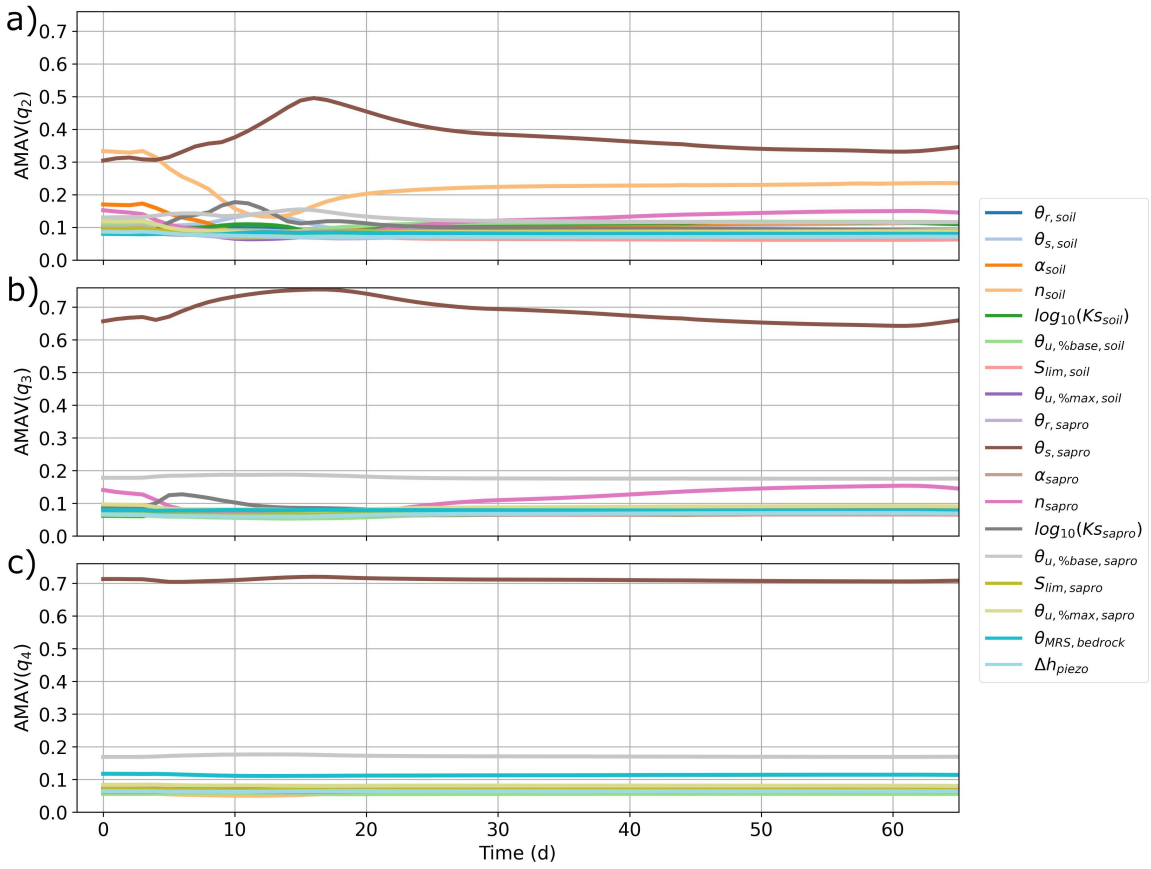

Figure S2. AMAV indices time series for pulses a) q_2, b) q_3, and c) q_4.

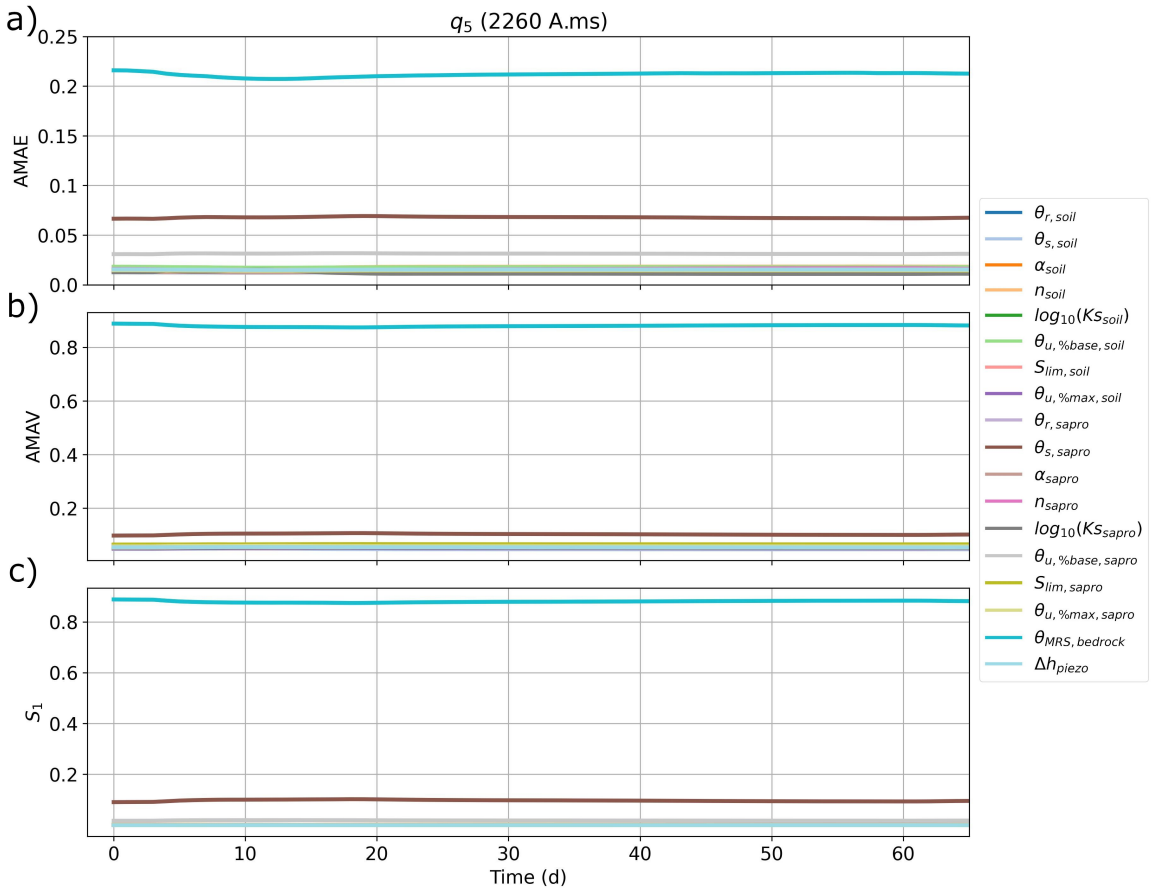

Figure S3. GSA indices a) AMAE, b) AMAV, c) S_1 time-series for pulse $q_5 = 2260$ A.ms.

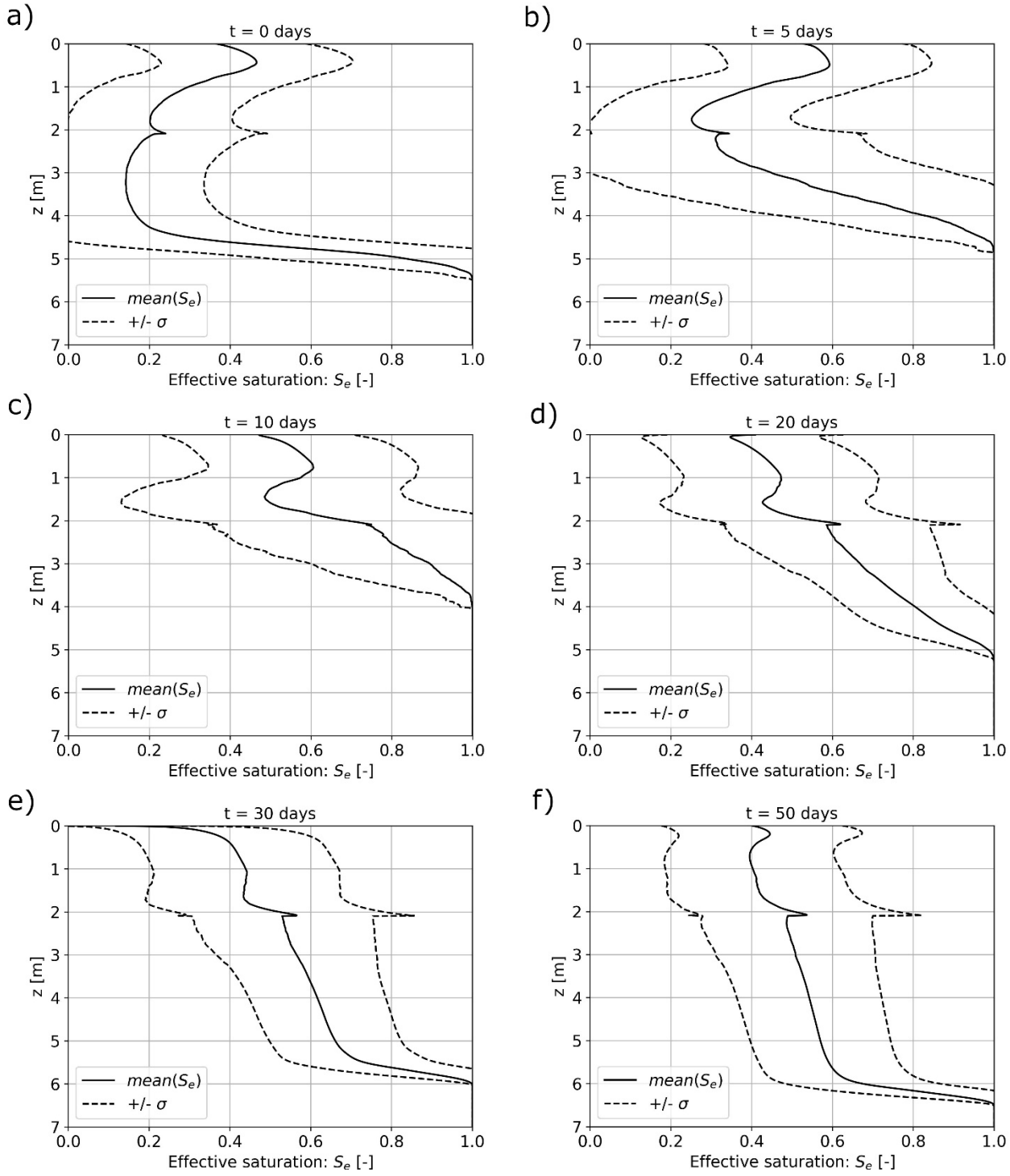

Figure S4. Mean effective saturation profiles $S_e(z)$ and standard deviation σ, at times $t \in \{0, 5, 10, 20, 30, 50\}$ days. The profiles are computed from 1000 parameter set samples.

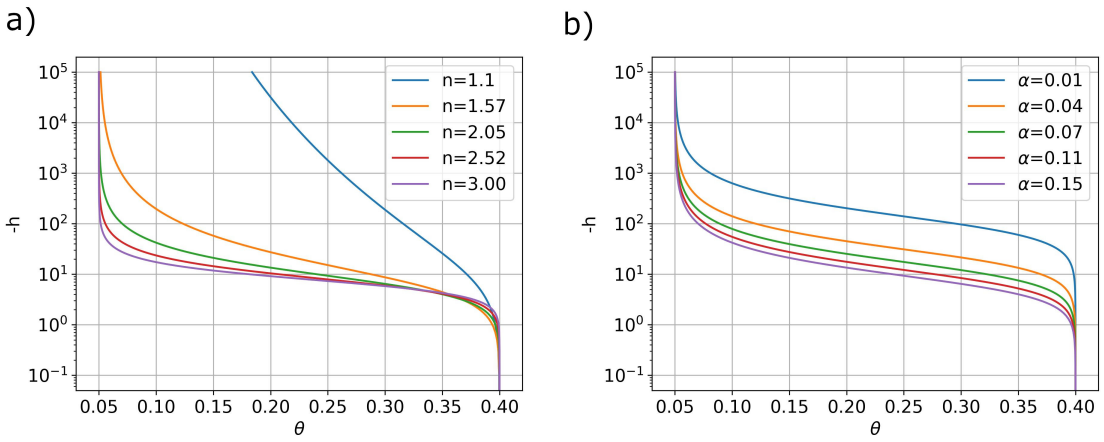

Figure S5. a) Retention curves examples for $n \in \{1.1, 1.57, 2.05, 2.52, 3.0\}$, with other hydrodynamic parameters fixed: $\theta_r = 0.05$, $\theta_s = 0.40$, $\alpha = 8\ \mathrm{m}^{-1}$. b) Retention curve examples for $\alpha \in \{1.0, 4.5, 8.0, 11.5, 15.0\}\ \mathrm{m}^{-1}$, with other hydrodynamic parameters fixed: $\theta_r = 0.05$, $\theta_s = 0.40$, $n = 2.05$.

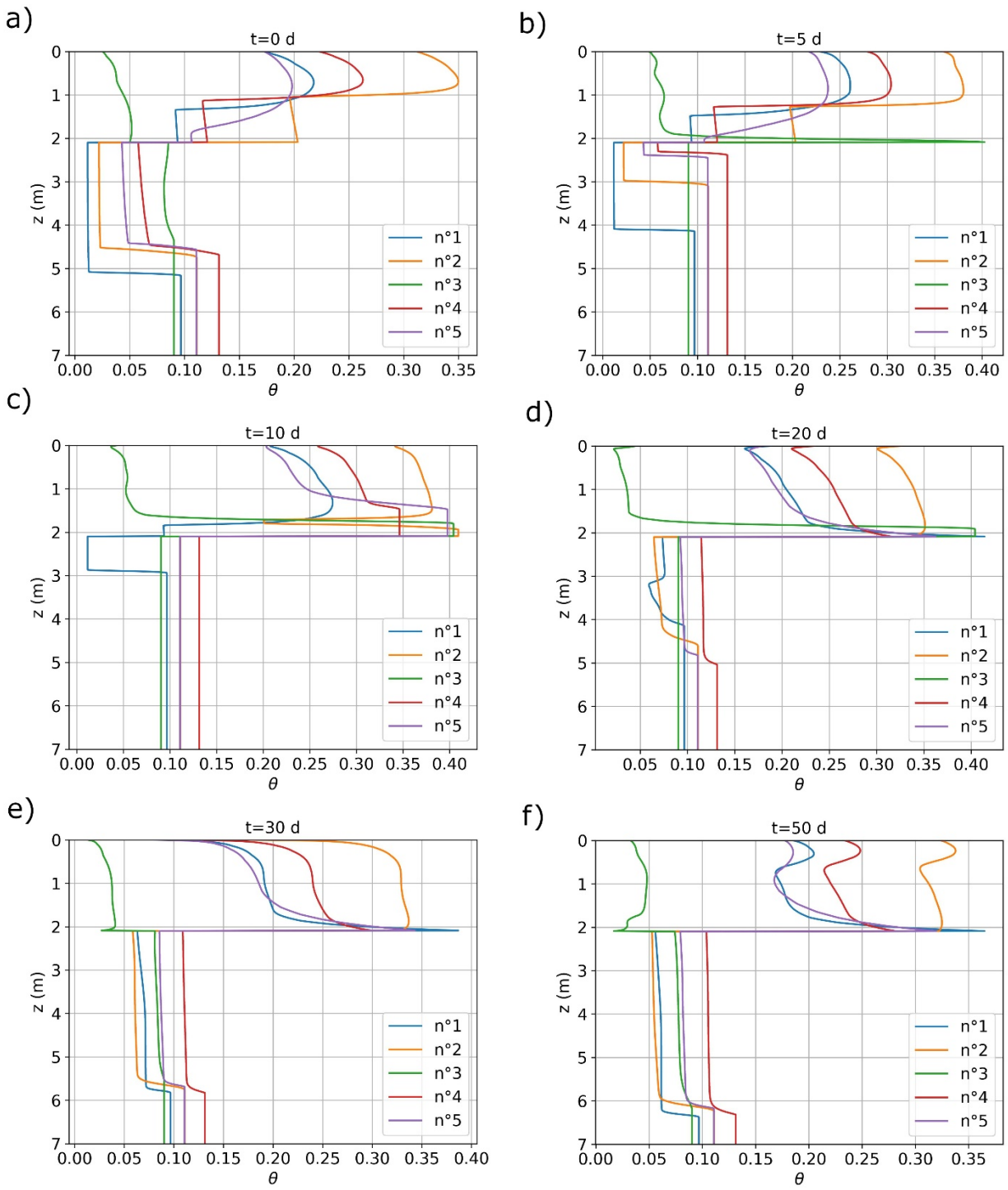

Figure S6. Water content profiles $\theta(z)$ examples for five parameter sets, at times $t \in \{0, 5, 10, 20, 30, 50\}$ days.