Before the formal instruction of this quick start, it should be noticed that CCHE3D-GW has not been incorporated into CCHE GUI interface at this moment, i.e., it can only be run in an old-fashion manner which is similar to MODFLOW. Users only need to download the executable file ‘CCHE3D-GW-beta.exe’ and then copy that into the input file folder. After that, by clicking this executable file the simulation can be run. The following is the quick start which majorly addresses the meaning of each input file.

A numerical experiment about a single-well pump in an unconfined aquifer is used as an example to demonstrate how to set up a simulation with CCHE3D-GW. The followings are information about this simulation.

The confined aquifer is 2137 m × 2137 m × 31 m in which the pumping/injection well was located at the center (Figure 1). A non-uniform mesh (127 × 127 × 26) was adopted where the finest mesh size was 2.0 m in x (y) direction while Δz = 0.5 m was used from 18.25 m to 23.75 m, and Δz = 2.0 m was used for the other part. The initial water table was located at z = 21.0 m. The screen interval of the pumping well was from 0.0 m to 10.0 m. The simulation period was 12.0 days, and the time step was 1 hour. The corresponding input files are: (a) ‘basic_input.dat’ is the basic input file; (b) ‘head_initial.dat’ sets up the initial water table; (c) ‘head1.bound’, ‘head2.bound’, ‘head3.bound’ and ‘head4.bound’ are the boundary files; (d) ‘kb.dat’, ‘kl.dat’, ‘kn.dat’, ‘kr.dat’, ‘kt.dat’ and ‘nf.dat’ set up the type of mesh nodes; (e) ‘well1.bound’ sets up the pumping well. The meaning of each input can be found in Chapter 3.3 in the technical report.

The van Genuchten (VG) model was used to describe the soil characteristic curves which can be written as:

$$\theta(\psi) = \theta_r + \frac{(\theta_s - \theta_r)}{\left[1+(\alpha|\psi|)^{\beta}\right]^{1-1/\beta}}, \qquad \psi < 0 \tag{1}$$

$$\theta(\psi) = \theta_s, \qquad \psi \geq 0 \tag{2}$$

$$K(\psi) = K_s \frac{\left\{1-(\alpha|\psi|)^{\beta-1}\cdot\left[1+(\alpha|\psi|)^{\beta}\right]^{1/\beta-1}\right\}^2}{\left[1+(\alpha|\psi|)^{\beta}\right]^{\frac{(-1/\beta+1)}{2}}}, \qquad \psi < 0 \tag{3}$$

$$K(\psi) = K_s, \qquad \psi \geq 0 \tag{3}$$

where α is a scaling parameter inversely related to the air-entry pressure (input file 'alpha.dat'), and β is a slope parameter inversely related to the pore-size distribution (input file 'm2.dat'). θ_r is residual moisture content (input file 'thetar.dat') and θ_s is saturated moisture content (input file 'thetas.dat'). K_s is the saturated hydraulic conductivity.

The input file 'head_draw.dat' is used for setting up the observation points that users want to output groundwater hydraulic heads and the moisture content.

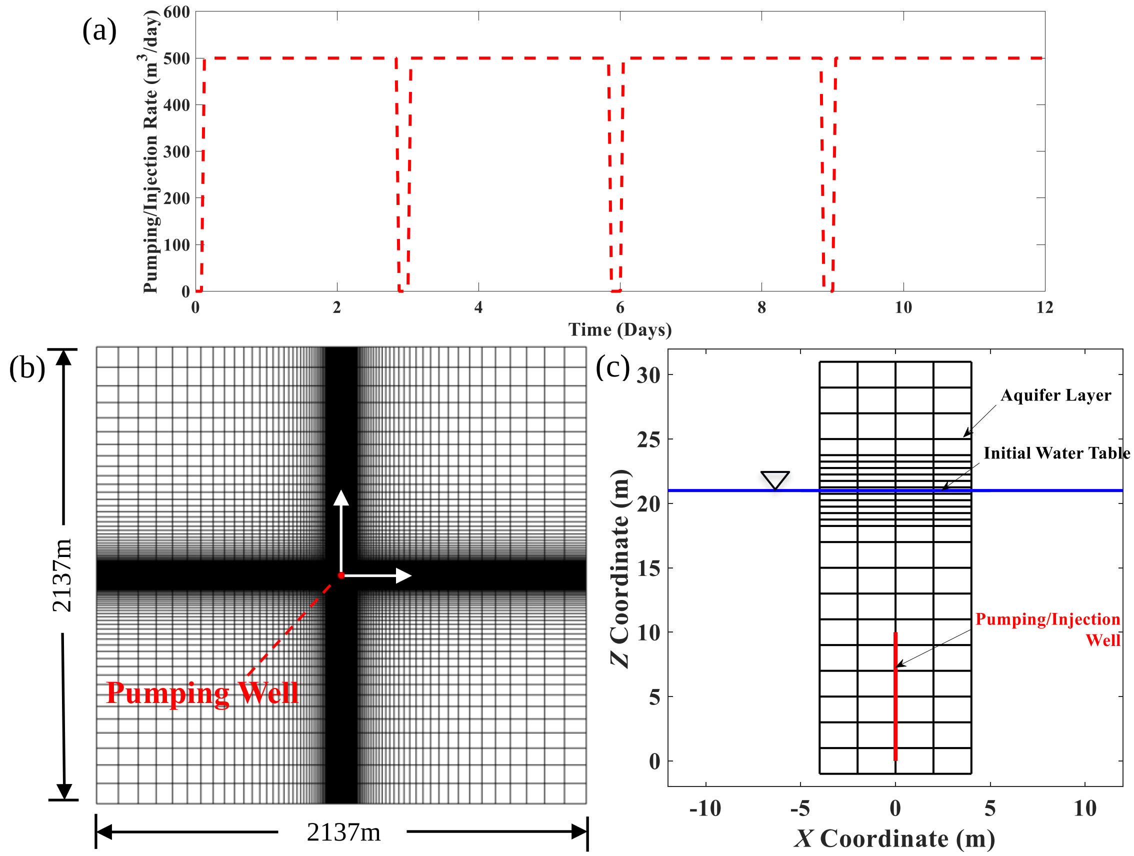

Figure 1. (a) The pumping curve of the simulation, (b) is the mesh of the simulation in the *x*-*y* plane and (c) is the mesh in the *z* direction.