Chapter 7
Summary and Outlook

After talking a lot about how to numerically model the heat transport process induced by a GSHP system, a few advices can be given to the end users, which were obtained by the authors through various modelling studies.

- Before designing a GSHP system, it is recommended to obtain the subsurface characteristics as accurately as possible. For example, the identification of aquifer and groundwater can greatly enhance the efficiency of the borehole heat exchangers, leading to a much shorter BHE and lower drilling cost. On the other side, if the thermal conductivity of the soil is over-estimated, a under-designed system can quickly run into trouble after a few years of operation.
- Make sure to conduct proper grouting inside the BHE. This is not only required by the regulation to prevent groundwater contamination. Actually, a poorly grouted BHE with air pocket in it is eventually a BHE with smaller surface area for heat exchange. When possible, a thermally enhanced grout should be applied, as simulation based result suggests that the additional investment will quickly be paid off after couple of years' operation (cf. Hein et al. 2016).
- Try to avoid multiple BHEs located in a close vicinity. The distance between BHEs is recommended to be larger than 10 m. Simulation results has suggested that the thermal plume from adjacent BHEs is very likely to interfere with each other. There are cases where the BHEs are drilled very close to each other and the system performance starts to drop after a few years of operation.

As mentioned above, more and more commercial buildings are now equipped with BHE coupled GSHP systems. In such cases, often dozens or even hundreds of BHEs are connected to each other and drilled in a small piece of land. These big systems can not be simulated yet by the OpenGeoSys software in its current stage. Currently, research has already been started on this front, and readers could expect an updated tutorial focusing on this topic in the near future.

H. Shao et al., *Geoenergy Modeling II*, SpringerBriefs in Energy,
DOI 10.1007/978-3-319-45057-5_7