

Division of Environmental Studies

Department of Environment Systems

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Energy and Environment Laboratory	Lecturer Masaatsu AICHI	<p>Current approaches to energy supply and consumption face problems such as climate changes and dwindling resources. The development of key technologies for saving energy, switching to renewable energy resources, and appropriate waste disposal is required. Our goal is to perform research that will contribute to the development of these technologies, especially by taking advantages of the characteristics of subsurface formations. For example, we study ways of developing a sustainable energy system, especially through hydrogeological and thermo-poro-mechanical modeling of geothermal heat pumps, geothermal power plants, and the geological sequestration of carbon dioxide.</p> <p>On the other hand, we also start to study how to adapt to global warming. Combining mitigation and adaptation is an attractive choice but it is not simple because one countermeasure possibly causes another environmental effects. For example, though the groundwater becomes more important water resource under changing climate, the overexploitation of groundwater possibly causes another environmental problem such as land subsidence, sea water intrusion in coastal area, so on. We try to predict and prepare for this kind of domino-like propagation to other environmental problems in advance.</p>	<p>water resource; groundwater; land subsidence; modeling; emergency situation</p>	<p>Land subsidence caused by groundwater abstraction has been one of the severe environmental problems in Asian coastal megacities. By strictly regulating the groundwater abstraction, the land subsidence in several cities in Japan ceased today. On the other hand, the groundwater becomes more important water resource under changing climate. In addition, the groundwater is considered to be an important water resource after an earthquake or flood disaster.</p> <p>Furthermore, the high groundwater pressure is harmful for the subsurface infrastructures. Then, the possibility to restart groundwater abstraction is becoming a matter of debate. However, it is essential to avoid the restart of land subsidence problem.</p> <p>Theoretically, it can be achieved by controlling the groundwater level so that the effective stress does not exceed the preconsolidation stress of subsurface formations. However, it is very difficult to find practically because of the heterogeneity in subsurface formations and the complex history of hydraulic head change in clayey layer. In this program, we try to numerically simulate the evolution of the preconsolidation stress under the historical groundwater abstraction and find a critical groundwater level in the future groundwater usage.</p> <p>The schedule is roughly planned as follows:</p> <p>1st-2nd week: Introduction to land subsidence simulation and excursion to the land subsidence monitoring system in Tokyo.</p> <p>3rd -4th week: Simulation of the past land subsidence and proposal for the future.</p>