GRD week 9
Due by December 11th

Direct use of geothermal resources part

1a) For a direct-use fish pond application, what are the two most significant sources of heat loss?

1b) What methods or strategies could be employed to reduce the heat losses in problem 1a?

1c) Plot the convective heat loss, as a function of wind velocity from 0 to 10 m/s, for a 5 m by 5 m pool. Assume that the air temperature is 5°C and the pool temperature is 35°C. Do the same calculation for an air temperature of 10°C.

1d) Plot how long it would take for the pool in problem 1c to drop by 5 degrees, as a function of wind speed, if its depth was 1 m? Assume heat loss from radiation, conduction, convection, and evaporation.

1e) Assume a geothermal water resource of 40°C was available. Plot the flow rate necessary to prevent the pool temperature from dropping more than 5°C.

EGS part

2a) How is an EGS project different from a conventional hydrothermal geothermal system?

2b) What are the benefits of an EGS system?

3) Describe the physical processes that distinguish hydro-shearing from hydro-fracturing. What is the benefit of using hydro-shearing over hydro-fracturing?

4) What are the factors that control seismic activity?

5) The potential EGS resource is very large. If you were an investor, what criteria would you use to determine where to first deploy this technology? Why?

6) Of the principal challenges faced by EGS, what, in your opinion, is the easiest to overcome? What is the hardest? Why?

7) What reservoir management strategies can be followed to reduce the amount of time needed to replenish the heat removed from a reservoir. Use Equation 13.6 to quantify your discussion:

$$T_{\mathrm{b}} = \frac{(\pi \times \gamma_{\mathrm{t}} \times d^2 \times t)}{(3 \times \gamma_{\mathrm{t}} \times v)}$$

where:

T_b is the time (h)

γ_t is the heat capacity (J/m^{3}K) of the reservoir

γ_f is the heat capacity of the fluid (J/m^{3}K)

d is the distance between wells (m)

t is the reservoir thickness (m)

v is the flow rate (m^3/h)