2. Air properties

17. October 2024

Exercise 1.
A tourist is walking in the mountains with a barometer, measuring the pressure. In the valley, he got 1050 hPa, on the mountain, he got 950 hPa.

- Using the baric step near the ocean surface (i.e., with the highest air density), what is the estimated height of the mountain?
- The tourist had also a thermometer and he was measuring the average temperature during the hike, which was 0°C. Using the Babinet formula, what would be the height difference. Refine the solution using the Laplace formula.
- If the tourist measured the same pressures in summer with the average temperature 20°C, how high would the mountain be?

Exercise 2.
An eagle wants to eat a mouse. Before diving to the mouse, the eagle cries. Can the mouse be warned by the sound? Estimate, what time does the sound take until it reaches the mouse.

Near the ground, the temperature is $T_1 = 40$°C, the eagle flies in the height 50 m above the flat surface, where the temperature is $T_2 = 20$°C. Assume for simplicity, that the temperature changes between T_1 and T_2 at an interface at the height $z_1 = 10$ m. That is, there are two layers of air: the first layer with temperature T_1 starts at ground and goes to the height z_1, the second layer with temperature T_2 continues to the height of the eagle with the thickness $z_2 = 40$ m. The horizontal distance of the eagle to the mouse is $m = 5$ m.

Think further about the situation with linear vertical temperature profile instead of just two values. Would this improve the chances for the mouse?