McGill University, Montreal
GEOG 321 - Climatic Environments
Knox
January 2, 2024

Study Questions - Topic 11

1. At 11:30 in the morning, we measure a soil heat flux density $Q_{G(5\text{cm})}$ of $25\,\text{W}\,\text{m}^{-2}$ using a heat flux plate installed at 5 cm depth. Calculate the soil heat flux density at the surface $Q_{G(0)}$, if the soil's heat capacity in the layer from 0 to 5 cm depth is $2\,\text{MJ}\,\text{m}^{-3}\,\text{K}^{-1}$ and the temperature in the same layer changed from 24.8°C at 11:00 to 25.3°C at 12:00.

2. For the same soil, at 20:30 in the evening, we measure a soil heat flux density $Q_{G(5\text{cm})}$ of $-12\,\text{W}\,\text{m}^{-2}$. Calculate the soil heat flux density at the surface $Q_{G(0)}$, if the temperature in the layer from 0 to 5 cm depth changed from 7.5 at 20:00 to 7.0°C at 21:00.

3. What is meant by "heat sharing"?

4. Calculate the sensible heat flux Q_H at 11:30 for the example in Question 1, if the soil's thermal conductivity is $k = 0.27\,\text{W}\,\text{m}^{-1}\,\text{K}^{-1}$ and the atmospheric thermal admittance μ_a is $\approx 5000\,\text{J}\,\text{m}^{-2}\,\text{K}^{-1}\,\text{s}^{-1/2}$.