Answer Key Final Exam Part I / II 2009 GEOB 300

Part A: Multiple choice questions

Solve all multiple choice questions. Check only one box per question. If you check none or multiple boxes, your answer will be invalid. Total: 24 marks (24% of exam).

1. Which term is part of the surface energy balance? [2]

   ○ Ri ● Q_H ○ NEE ○ u_*

2. What is the most dominant heat transfer mechanism in the planetary boundary layer? [2]

   ○ Conduction ○ Coalescence ● Convection ○ Convergence

3. What is the derived SI unit for a stress? [2]

   ● Pa ○ $\mathrm{N\,m^{-2}\,s^{-1}}$ ○ $\mathrm{W\,m^{-2}\,s^{-1}}$ ○ $\mathrm{J\,m^{-2}}$

4. What Bowen ratio β do you expect for a surface that experiences the 'Oasis-effect'? [2]

   ○ $\beta = 0$ ○ $0 > \beta > 1$ ○ $\beta > 1$ ● $\beta < 0$

5. Without performing a calculation, identify the most reasonable number that describes solar declination δ for today, noon (December 11, 2009, 12:00 PST)? [2]

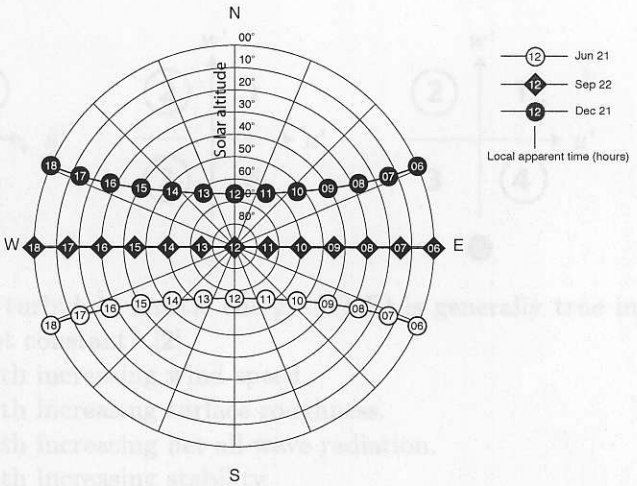
   ● $\delta = -22.9°$ ○ $\delta = +23.5°$ ○ $\delta = +56.4°$ ○ $\delta = 0°$

6. Which term describes the standard deviation of the wind component u? [2]

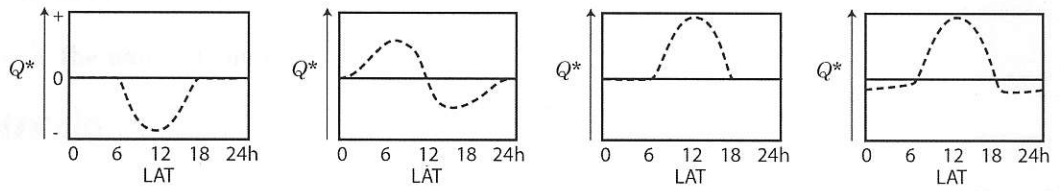
   ○ $\overline{\left(\sqrt{u'}\right)}$ ● $\sqrt{\overline{u'^2}}$ ○ $\sqrt{\overline{u'}^2}$ ○ $\sqrt{\overline{u}^2}$

7. Determine the latitude where the sun-path diagram shown below is valid for. [2]

   ○ 90°N ○ 23.5°S ● 0°N/S ○ 66.5°S

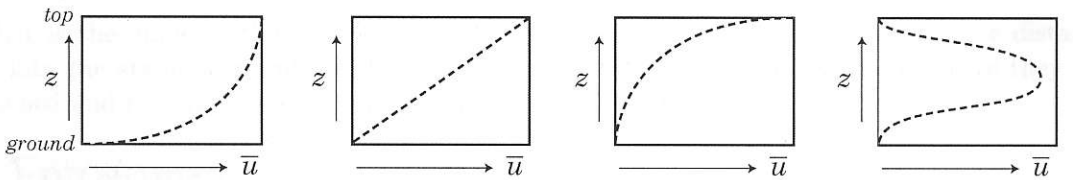


8. How does net all-wave radiation Q^* change with time over a 24h period? Assume clear skies and a grass surface on UBC Totem Field during our first field visit. [2]



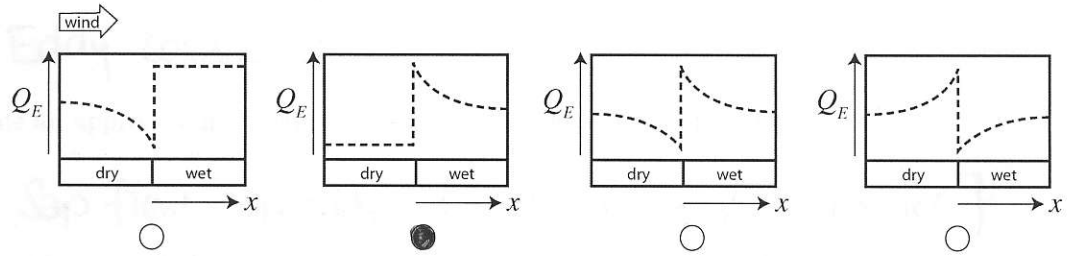
○ ○ ○ ●

9. How does mean wind speed $\overline{u}$ change with height z within an ideal, uniform crop canopy? *top* refers to the top of the crop canopy. [2]



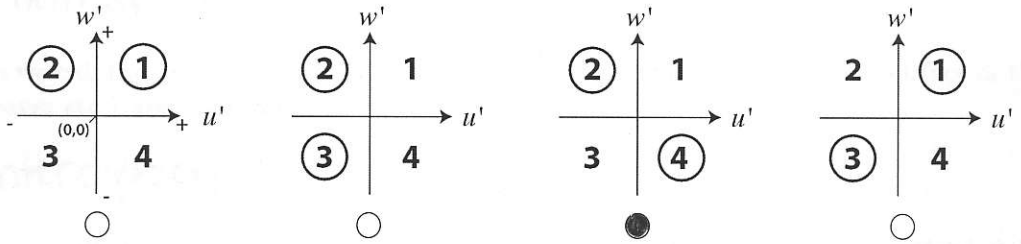
○ ○ ● ○

10. How does Q_E at a given height above the surface change as an air mass flows first over a dry patch then over a wet patch? Wind is blowing from left to right, and x is the 'fectch'. [2]



○ ● ○ ○

11. In the surface layer, which two quadrants (combinations) of the joint probability distribution between u' and w' are the two most likely ones to occur? [2]



○ ○ ● ○

12. Which statement on turbulent kinetic energy (TKE) is generally true in the surface layer, if everything else is kept constant? [2]

○ TKE decreases with increasing wind speed.
○ TKE decreases with increasing surface roughness.
○ TKE decreases with increasing net all-wave radiation.
● TKE decreases with increasing stability.

Part B: One-word questions

Answer all of the following short answer questions in one or a few words, or provide a formula. Total: 16 marks (16% of exam).

1. What is the name of the ratio $K_{\uparrow}/K_{\downarrow}$? [2]

   Albedo

2. List a parameter / number of your choice that can be used to describe dynamic stability of the atmopshere. [2]

   Richardson flux number [or Richardson gradient number]

3. What is the name of the process where large mixed-layer thermals penetrate some distance up into the stable atmosphere aloft the inversion that caps the mixed layer, where they are repelled and returned (which results in a downward flux of Q_H)? [2]

   Entrainment

4. Name the approach that we used to directly measure the sensible heat flux density Q_H by tracking vertical wind fluctuations w' and fluctuations of temperature T' on UBC Totem Field. [2]

   Eddy covariance

5. Name an approach or instrument to measure transpiration of a tree. [2]

   Sap flow approach [or Porometry / Porometer]

6. Name the region half-way up the slopes in a valley that show typically the highest temperatures during night? [2]

   Thermal belt

7. What do we call the precipitation in a forest or crop canopy that remains on the surface of the plant (leaves etc.) and that does not reach the ground? [2]

   Interception

8. What do we call the energy needed to warm up one kilogram of a material by one Kelvin? [2]

   Specific heat