EAS270, "The Atmosphere" <u>Quiz 3</u> 22 Nov., 2010

<u>Professor</u>: J.D. Wilson <u>Time available</u>: 15 mins <u>Potential Value</u>: 10%

Instructions: For all 12 questions, please choose what you consider to be the best (or most logical) option, and use a pencil to mark that choice on the answer form. **Eqns/data given at back**. You may keep this quiz.

For the first six questions, please refer to Fig. (1). Assume you are situated at the point marked A and observe a sequence of events in time (first → last) as the storm moves from the WSW towards the ENE parallel to the indicated straight line.

1. During the passing of the storm you will observe this sequence of conditions:

   (a) stratiform cloud; fog; cumuliform cloud; clearing
   (b) cumuliform cloud; clearing; stratiform cloud; fog
   (c) cumuliform cloud; fog; stratiform cloud; fog
   (d) stratiform cloud; clearing; cumuliform cloud; clearing ✓✓[65% answered correctly]
   (e) stratiform cloud; clearing

2. The sequence of wind directions is likely to be ____

   (a) E; calm; E
   (b) E; SSW; SE
   (c) E; SSW; NW ✓✓[57% answered correctly]
   (d) W; NNE; SE
   (e) calm; NNE; NW

3. Your barometer will indicate the following trends in sequence:

   (a) rapidly falling pressure; slowly falling pressure; rising pressure ✓✓[41% answered correctly]
   (b) rapidly falling pressure; slowly rising pressure; rapidly rising pressure
   (c) rapidly rising pressure; slowly rising pressure; falling pressure
   (d) rapidly rising pressure; slowly falling pressure; rapidly rising pressure
   (e) unchanging pressure

4. When your position at **A** relative to the storm is as shown by Fig. (1), the air column over **A** most likely would be ____

   (a) absolutely unstable
   (b) stable ✓✓[39% answered correctly]
   (c) calm
   (d) saturated
   (e) sinking

5. When your position at **A** relative to the storm is as shown by Fig. (1), the two lowest layers of the air column above **A** would represent ____

   (a) the cold conveyor belt riding over the warm conveyor belt
   (b) the warm conveyor belt riding over the cold conveyor belt ✓✓[70% answered correctly]
   (c) the dry conveyor belt riding over the cold conveyor belt
   (d) the warm conveyor belt riding over the dry conveyor belt

6. The thermometer at **A** will show these phases ____

   (a) cold-to-warm transition followed by warm-to-cold transition ✓✓[69% answered correctly]
   (b) cold-to-warm transition followed by warm-to-warmer transition
   (c) warm-to-cold transition followed by cold-to-warm transition
   (d) warm-to-cold transition followed by cold-to-colder transition

7. With a mean temperature of −17.8°C, Winnipeg's January is climatologically colder than Edmonton's (−13.5°C). In reference to Figs. (2, 3), both cities are dominated by cP airmasses. One may explain Edmonton's (statistically) milder January as due to Alberta experiencing ____

   (a) occasional influence of mT airmass off Gulf of Mexico
   (b) occasional influence of mT airmass off subtropical Atlantic
   (c) regular influence of mP airmass off polar Atlantic
   (d) regular influence of mP airmass off polar Pacific ✓✓[77% answered correctly]
   (e) occasional influence of cT airmass off south-central U.S.

8. A parcel moving around a northern hemisphere trough axis has ____ relative vorticity; the decay of that vorticity as the parcel moves out of the trough results in ____ aloft

   (a) anticyclonic; convergence (area shrinkage)
   (b) anticyclonic; divergence (area expansion)
   (c) earth; saturation
   (d) cyclonic; convergence
   (e) cyclonic; divergence ✓✓[57% answered correctly]

9. Pick the incorrect association

   (a) temperature advection — baroclinicity
   (b) barotropic — isotherms parallel with height contours
   (c) shortwave — barotropic atmosphere ✓✓[33% answered correctly; p313; 1st question of 2009 exam]
   (d) longwave — vorticity maxima and minima
   (e) temperature advection — isotherms not parallel with height contours

10. Referring to Fig. (4), the dark shading encodes large values of ____

    (a) 500 hPa height
    (b) 1000-500 hPa thickness
    (c) cyclonic absolute vorticity ✓✓[53% answered correctly]
    (d) anticyclonic absolute vorticity
    (e) cloud top height

11. Referring to Fig. (4), the straight lines labelled A,B,C respectively denote ____

    (a) shortwave trough; shortwave trough; shortwave trough
    (b) longwave ridge; shortwave ridge; shortwave ridge
    (c) longwave trough; shortwave trough; shortwave ridge
    (d) longwave trough; shortwave trough; shortwave trough ✓✓[86% answered correctly]
    (e) Rossby wave ridge; shortwave ridge; shortwave ridge

12. A midlatitude storm situated at **D** on Fig. (4) would be being ____ by ____ in the mid troposphere

    (a) advected; subsidence
    (b) supported; divergence ✓✓[57% answered correctly]
    (c) weakened; convergence
    (d) supported; convergence
    (e) weakened; divergence

Equations and Data.

- N=0 or 360, NNE=22.5, NE=45, ENE=67.5, E=90, ESE=112.5, SE=135, SSE=157.5, S=180, SSW=202.5, SW=225, WSW=247.5, W=270, WNW=292.5, NW=315, NNW=337.5

  The sixteen so-called "cardinal points" of the compass, given alphanumerically and as an angle measured clockwise around the circle. A coarser eight-point subdivision is N, NE, E, SE, S, SW, W, NW; and the four cardinal points are of course N, E, S, W

- $\frac{\Delta\zeta}{\Delta t} = -\,\zeta \text{ div}$

  The Vorticity Theorem. $\Delta\zeta$ [s^{-1}], the change in the absolute vorticity ($\zeta = f + \omega$, sum of earth vorticity and the relative vorticity) of a parcel over time interval Δt; div [s^{-1}] the divergence.

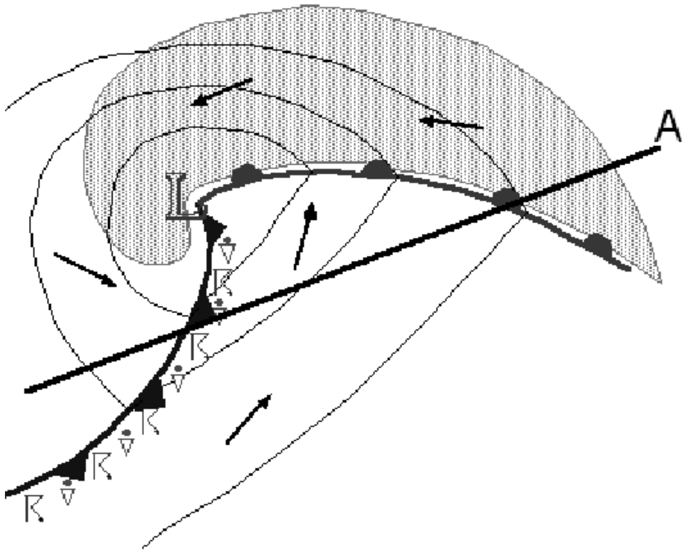

Figure 1: Midlatitude storm (from Doswell & Maddox, 1986). Arrows show direction of wind in the friction layer. The "R-like" symbols designate thunderstorms; the "dot over triangle" symbols designate rain showers. Questions concern the sequence of events or conditions at **A** as the storm moves to the ENE parallel to the indicated line through **A**.

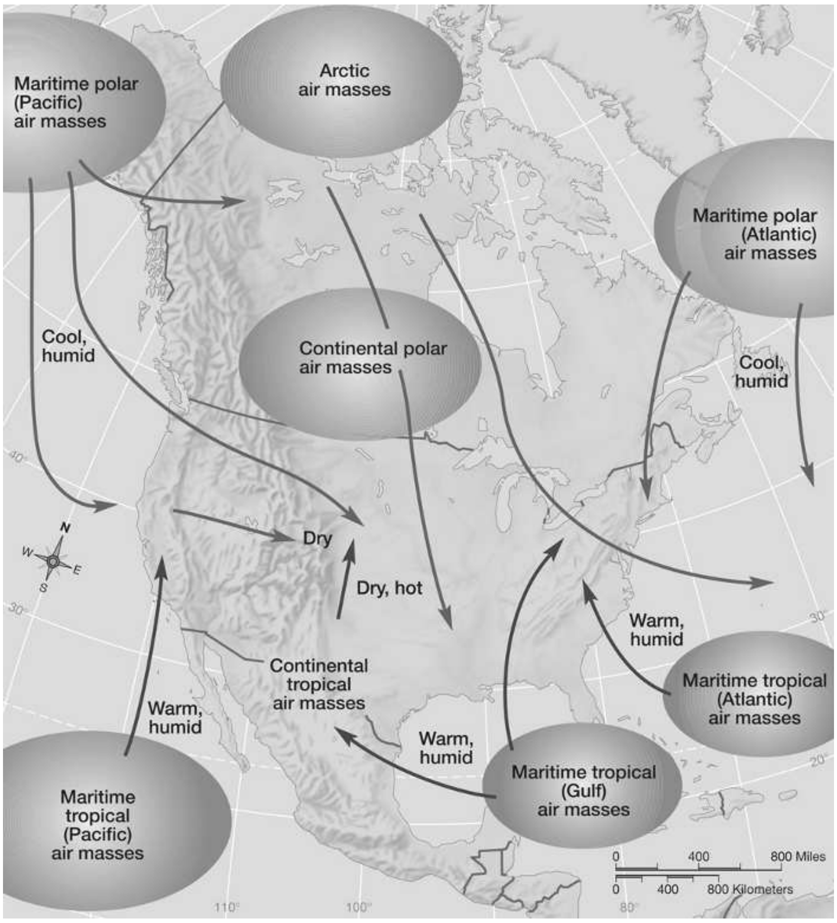

Figure 2: Air mass source regions (Aguado & Burt, Fig. 9-1).

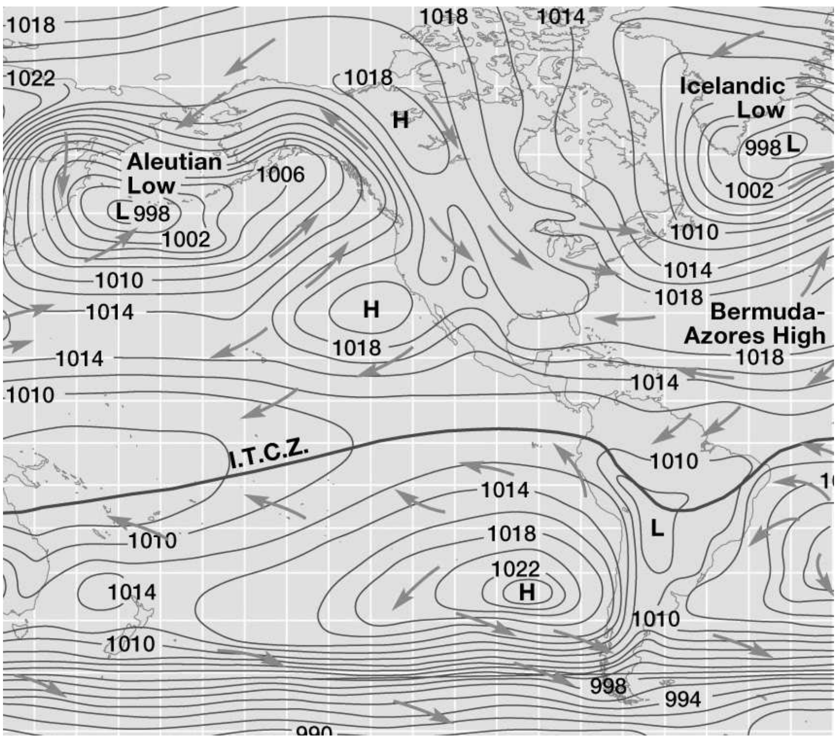

Figure 3: January mean sea-level pressure (Aguado & Burt, Fig. 8-5(a)).

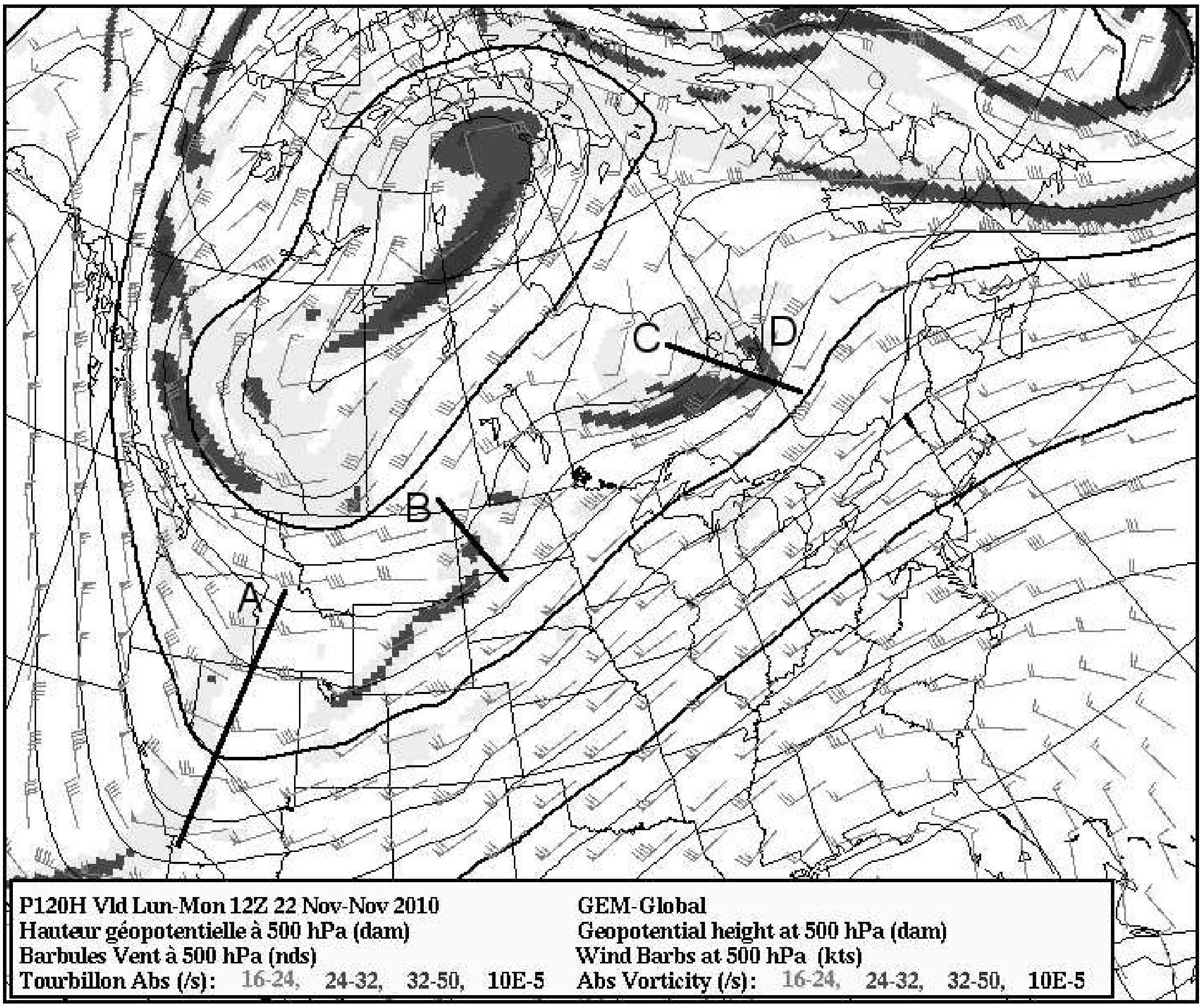

Figure 4: 120hr forecast valid 12Z today (Mon 22 Nov. 2010) from GEM Global run initialized 12Z on 17 Nov.