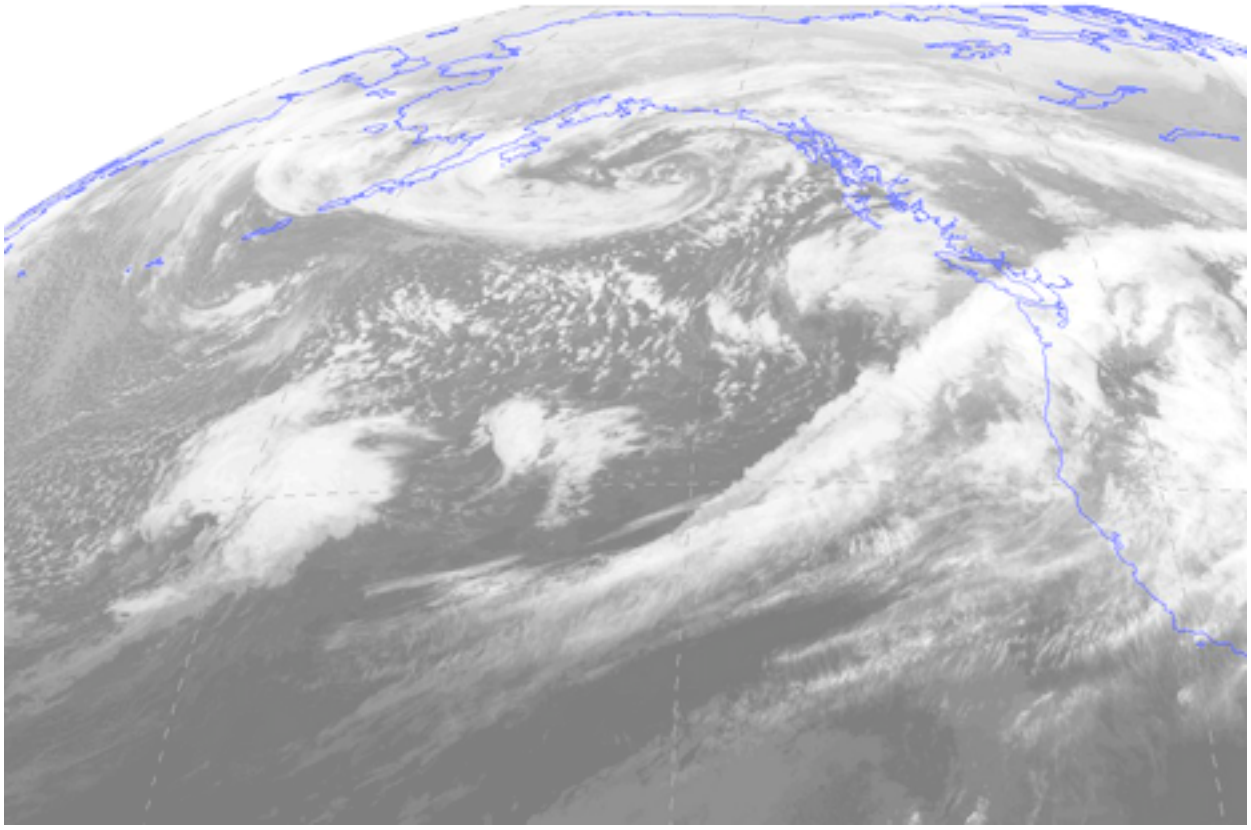
ATSC 201 **Final Exam** Name: _____
Prof. Stull (open books, notes, calculator)
Fall 2015 (90 points ≈ 1 minute/point) Student Number: _____

1) (3 points)

a) What type of cloud was over UBC at the start of this exam? _____
b) What features or characteristics of the cloud lead you to this determination?

c) Based on this cloud and other weather characteristics you observed outside, what is your forecast for 6 hours after the start of the exam?

2) (3 points) **On** the IR satellite image below, do the following:
a) Write "L-old" at the low-pressure center of a dying cyclone (cyclolysis).
b) Write "L" at the low-pressure center of an intensifying cyclone (cyclogenesis).
c) For the old low, draw the occluded front that corresponds to the satellite image.
d) For the old low, draw the cold front that has become detached from the low.
e) Draw an arrow on the atmospheric river showing the wind vector of the pre-frontal jet.
f) Circle an isolated thunderstorm.



3) On this map of mean sea-level pressures (kPa) in the center of Canada in mid winter:

a) (8 points) Draw isobars every 1 kPa from 96 kPa to 101 kPa.

b) (1 point) Write "H" to label any high-pressure centers, and "L" for any low-pressure centers.

c) (2 points) Use a thick line to draw the front (there is only one)

d) (4 points) At every station on this map, draw a short vector showing the surface wind direction

e) (2 points) Based on your answer to (d), name that front: cold , warm , stationary (circle one).
Then draw the appropriate frontal symbols on the appropriate side(s) of that frontal line.

f) (1 point) Write the two-letter airmass abbreviation for the likely airmass at
- the upper left corner of the map, and - the lower right corner of the map.

g) (4 points) For the one station with the bold underlined pressure, write your forecast below:

- Pressure will _____ and then _____

- Temperature will _____ and then _____

- Wind direction will shift from _____ to _____
- This type of which shift is called: veering , backing (circle one)

- The clouds and precipitation are _____ and will later change to be _____

98.5	98	98	98.5	99	99.6	100.2
97.5	95	96	97	98.2	99.2	99.9
98	97	98	98.2	98	99	99.7
99	99	99.1	99.2	98.7	99	100
100	100.2	100	99.8	99	**99.5**	100.2
100.5	101.5	100.2	100	99.5	100	100.5
100.2	100.5	100.1	100	100	100.5	100.8

4) (6 points) Compare the location of peak wind (latitude and altitude) and driving mechanism (i.e., what causes them to exist) for the following jets:

Subtropical jet
Polar jet
African easterly jet

5) (10 points) Regarding the polar jet:

What is a Rossby wave?
Why do Rossby waves exist?
Relative to the ground, toward which direction (north, east, south, west) and how fast (fast, slow, near-zero) do Rossby waves move for : - short wavelength waves _____ - very long wavelength waves _____
Why are Rossby waves important for extratropical cyclogenesis, and where would the surface low form relative to the upper-level trough? (a sketch might be good)

6) (5 points)

Suppose the earth was shaped like a cylinder, with its column axis in the vertical. If this cylinder was rotating about its axis, could hurricanes exist in the atmosphere of this cylindrical earth? If they exist, would they be stronger or weaker than on the real earth? Why? (ignore the top and bottom ends of the cylinder). Hint, draw a sketch of this earth first, before answering.

7) (5 points)

When a cold front over the Pacific Ocean in winter approaches British Columbia, it often encounters colder air over the land. This results in a warm occlusion at the coastline. Draw a vertical cross section of a warm occluded front. Label the Warm, Cool, and Cold airmasses. What type of clouds and weather would you expect over land near the British Columbia coast in this situation (sketch it on your cross section)?

8) (3 points)

Suppose very cold ($\Delta\theta = 10°C$) shallow (300 m) air is flowing through a short gap in a mountain range. What maximum wind speed would you expect, given $|g| / T \approx 0.0333$ m s^{-2} K^{-1}. Assume dry air.

9) (3 points)

If sea-level pressure in the eye of a typhoon is 15 kPa lower than the surrounding air outside of the typhoon, then what max tangential wind speed would you expect, and what is the Saffir-Simpson category of that storm?

10) (30 points) The table below lists Stull's top 5 atmospheric relationships. It also lists some of the textbook chapters covered after the midterm exam. For each empty cell in the table, write the name of a phenomenon or application associated with that chapter and that atmospheric relationship. (Do NOT fill in any cell that is crossed out.) As an example, I have already filled in two cells.

Chapter -> Relationship	Chapter 10 **Forces & Winds**	Chapter 11 **General Circulation**	Chapter 12 **Fronts & Airmasses**	Chapter 13 **Extratropical Cyclones**	Chapter 16 **Tropical Cyclones**
1) Hypsometric eq.					
2) Geostrophy (steady winds blow parallel to isobars)	Geostrophic & Gradient Winds				
3) Conservation of potential vorticity					
4) Adiabatic cooling as air rises & **5) saturation** mixing ratio is less in cold air than in warm air		Cloud formation at ITCZ			

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