IC6.5: Optional Job Sheet Answer Key

Snowfall Forecasting

Question 1. What type of snow ratio might you expect from this sounding: Average
Explain your reasoning, being sure to discuss the effects from surface temperature, low-level winds, RH profile, and omega fields.

From 500 m up to 3 km there is a nearly isothermal and completely saturated layer around -2C, at least unfavorable for light snow ratios. The upper part of the sounding is somewhat supportive of dendritic growth, and those crystals should heavily rime in the 500 m to 3 km layer. Surface winds are 15 knots with a low sun angle, both supportive for at least average to heavy snow ratios. There is a low cloud base and nearly saturated boundary layer. This should be a low snow ratio event (<10:1) but we chose average simply because there will be some dendritic growth as a result of this sounding.

Question 2. When will the heaviest snow fall based on the Dendritic Growth Zone (DGZ) and upward velocities method discussed in the lesson?

Between 6 UTC on Monday through 18 UTC on Monday.

Question 3. What are the maximum the vertical velocities in the DGZ during that time (adjust contour interval accordingly to find maximum)?

-10 μb/sec

Question 4. Where is the core of the strongest vertical velocities located relative to the DGZ?

below

Question 5. Based on this technique, what is the range of the expected snow ratio throughout the event?

~ 4:1 first batch of snow, up to ~ 30:1 near the end

Question 6. Did this agree with your reasoning question (#1)? If not, why not?

Yes and no. The low end of the “average” spectrum is 10:1. These ratios are in the heavy range. This is because acccording to the Caribou method dendritic growth is even less of a factor that the sounding may indicate, and thus the riming in the lowest layer will be extremely dominant compared to the dendritic growth potential.

Question 7. How much snow is expected from this event based on this technique? (to integrate totals, hold down the right click button and drag left to right across snowfall bar graph)

8.2 Inches. If you discounted the precpitation that’s expected to fall as ice pellets by the Ptype algorithm, you may find only 6” of snow. If the student comes up with a different answer, then he/she should have discounted the accumulations due to sleet.

Question 8. Based on what you see, explain why the snow ratio (and thus snow fall amount) from this technique is so low.

The maximum vertical velocities occured in a saturated, nearly isothermal layer at about -2C, thus plenty of riming and aggregation.

Question 9. How much snow is expected from this event based on this technique?

10.5 Inches

Question 10. Why is the snow ratio so much higher with this technique compared to the Zone Omega Method?

Because of the deep warm layer 500m to 3 km above the surface collocated with maximum vertical velocities.

Question 11. How much snow is expected from this event based on this technique?

16.6 Inches. Again, if the student discounted the sleet, his/her snow accumulations may be less.

Question 12. How much snow is expected from this event based on this technique?

7.6 Inches

VERIFICATION: PIA received a total of 8 inches

Question 13. What type of snow ratio might you expect from this sounding: Heavy, Average, or Light (circle one)? Explain your reasoning, and be sure to discuss the effects from surface temperature, low-level winds, RH profile, and omega fields.

The maximum vertical velocities are within the dendritic growth zone. Surface winds are around 12 knots. Steep lapse rates and near saturated conditions from the surface to the tropopause all support high snow ratios (>15:1).

Question 14. When will the heaviest snow fall based on the Dendritic Growth Zone (DGZ) and upward velocities method discussed in the lesson?

Between 16 UTC on Monday through 3 UTC on Tuesday.

Question 15. What are the maximum the vertical velocities in the DGZ during that time (adjust contour interval accordingly to find maximum)?

-40 μb/sec. Don't worry if the student's answer is a little off.

Question 16. Where is the core of the strongest vertical velocities located relative to the DGZ--

within

Question 17. Based on this technique, what is the range of the expected snow ratio throughout the event?

~ 7:1 - 30:1

Question 18. Did this agree with your reasoning in question #13? If not, why not?

Yes

Question 19. How much snow is expected from this event based on this technique? (to integrate totals, hold right click and drag left to right across snowfall bar graph)

30.4 Inches

Question 20. Based on what you see, explain why the snow ratio (and thus snow fall amounts) from this technique is so high.

This is a perfect example of having the maximum vertical velocities colocated in the dendritic growth zone. Steep lapse rates in a saturated atmosphere with the entire sounding below freezing all point towards significant dendritic growth and very light snow ratios. This is typical for lake enhanced events like this one.

Question 21. How much snow is expected from this event based on this technique?

19 Inches

Question 22. Why is the snow ratio so much lower with this technique compared to the Zone Omega Method?

There are several valid answers to this question.
The max temp in profile technique is based on a climatological average and this event is not typical. Another answer is that the Zone Omega technique is highly biased by the omega when there's a huge ratio of positive omega in the zone compared to outside. This ratio may not be well calibrated in a convective event such as this.

Question 23. How much snow is expected from this event based on this technique?

17.1 Inches

Question 24. How much snow is expected from this event based on this technique?

15.5 Inches

VERIFICATION: BUF received from 16-25 inches from this storm depending on what part of the city was measured.