

IC6.2: Optional Job Sheet Answer Key

Strengths and Weaknesses of P-Type Algorithms

Question 1. What major issues do you see that could lead to error with the Baldwin technique for precipitation type based on this 03 UTC forecast sounding? Explain your reasoning. *Note that the precip type icons indicate frozen precipitation.

The post-processed precipitation type product in the NAM 40 used the Baldwin Technique. The cloud top would be the first level, coming down, where $T - T_d < 6$ degrees C and that is near 500mb, plenty cold enough for the algorithm to initiate ice. But if the actual cloud top is lower, where $T - T_d < 2$ degrees C then there may be a problem with the initial precip type. Another potential issue could arise if there is a deep, layer of wetbulb temperatures between -4 and 0 C such that there is an area above -4 degrees > 3000 deg. m. The technique would erroneously melt frozen precipitation. However, this warm layer wet bulb temperature maximum reaches 6 degrees C and likely exceeds 3000 deg m. The main error is more likely in determining whether or not the algorithm refreezes the precipitation in the cold layer. If it freezes, then ice pellets are diagnosed. The surface temperature is barely above freezing, and thus there is < 50 deg. m of warmth required to remelt ice pellets. If the algorithm doesn't find -3000 deg. m of subfreezing air in the lowest 150 m, rain would be the result.

Question 2. Explain Partial thickness method indicates freezing rain.

There is a very shallow layer of cold air just above the surface and below 850 mb, and a very warm (+6 C) warm layer perfectly positioned in the 850-700 m b layer. Thus, thickness values from 1000-850 mb will be very low while thickness values 850-700 mb will be quite high, leading to a classification of FRZ on the nomogram shown in the training module. The table below is derived from BUFKIT.

Model Run	Site	Forecast Hour	Post Processor (Baldwin)	Bourgouin	Eta Microphysics	Thickness
2/24/03 18z	DFW	F09	Sleet	Sleet	19%	not defined
2/24/03 18z	ADM	F09	Snow	Snow	100%	Snow
2/24/03 18z	ABI	F09	No type	Sleet	100%	Sleet
2/24/03 18z	AUS	F09	Sleet	Rain	11%	ZR/IP

Question 3. In the DFW and ABI soundings, explain the characteristics of the profiles that resulted in all techniques indicating sleet during the ~0-14 hr forecast period.

In the DFW sounding, there is a very persistent warm layer (+1 to +4C) at around 2 km MSL, and the entire warm layer is saturated. The lowest 1.5 km is always below freezing, with the coldest temps in this layer around -10C at 750 m MSL. In the ABI sounding, it too had a persistent although slightly colder warm layer around 2 km, but it was unsaturated. The near surface cold layer was coldest at 750 m MSL and around -12 C.

Question 4. In the AUS sounding, explain why Bourgouin indicated rain/freezing rain at the 9 hr forecast, versus the sleet indicated by the Baldwin and Partial thickness methods.

All methods easily melt the ice in the warm layer above the strong cold air near the surface because the warm layer was +6 C and saturated. The coldest temp in the cold layer near the surface is -5.3 C. For the Bourgouin method to create ice pellets, you would need another 100 j/kg of negative area to refreeze the precipitation. Looking at the nomogram in BUFKIT for the Partial Thickness method, the values calculated from the static levels place the P-type in the sleet category but close to the freezing rain category.

The Baldwin method was apparently found at least -3000 deg. m below freezing to generate ice pellets.

Question 5. In the ADM sounding and from what you learned in IC 6 Lesson 1 about the strength/depth of the warm layer, do you agree with the techniques that indicate sleet in the 0-6 hr forecast timeframe? Explain why.

No, it is hard to trust the methods that pick sleet because the max temperature in the warm layer is almost always colder than +1 C throughout this time frame. The wet bulb temperatures are below freezing throughout, thus we would expect snow rather than sleet.

Question 6. Based on the information you processed using both D2D and BUFKIT, use the attached map below to draw P-type contours valid at 03 UTC on 25 February, 2003.

Our contours are subjective so interpret them as you wish.

Warning Decision Training Branch

