Snowfall

Snowfall on weathernerds.org refers to the accumulated snowfall over the past HH hours (3, 6, 12, 24, 36, 48, or 72 h) in inches. This snowfall is computed dynamically from the model fields at Weathernerds data ingest time. The algorithm uses model forecast snowfall liquid equivalent, along with temperature, relative humidity, and vertical velocity at 50 mb increments from 950 to 400 mb. The algorithm starts with the basic 10:1 ratio and then scales upward (or downward, see sections below on 2-meter temperature analysis and sleet/freezing rain) based on the number of 50 mb intervals in which saturated lift is detected within the dendritic growth zone (DGZ: defined in the code as -18° C ≤ T ≤ -12° C). If no saturated lift is detected in the DGZ, the 10:1 ratio is used. If 5 or more 50 mb intervals contain saturated lift within the DGZ, a 25:1 ratio is used. When between 0 and 5 intervals are detected, a quadratic function is applied such that the snow ratio approximately matches:

Number of 50 mb intervals	Snowfall Ratio
0	10:1
1	11.5:1
2	14:1
3	17:1
4	21:1
5	25:1
> 5	25:1

After scaling based on the DGZ analysis above, a 2-meter temperature analysis and a sleet/freezing rain analysis are performed. The first process applies a “compaction factor” when the 2-meter temperature exceeds 30° F (-1.1° C). The compaction formula produces a downward linear adjustment of the snowfall ratio as the

temperature increases above the freezing mark. When the 2-meter temperature exceeds 40° F (4.4° C), the compaction factor is held at 0.5.Between 30° and 40° F (-1.1° and 4.4° C) compaction follows:

$$c = 1.0 - (0.05*(T - 30.0))$$

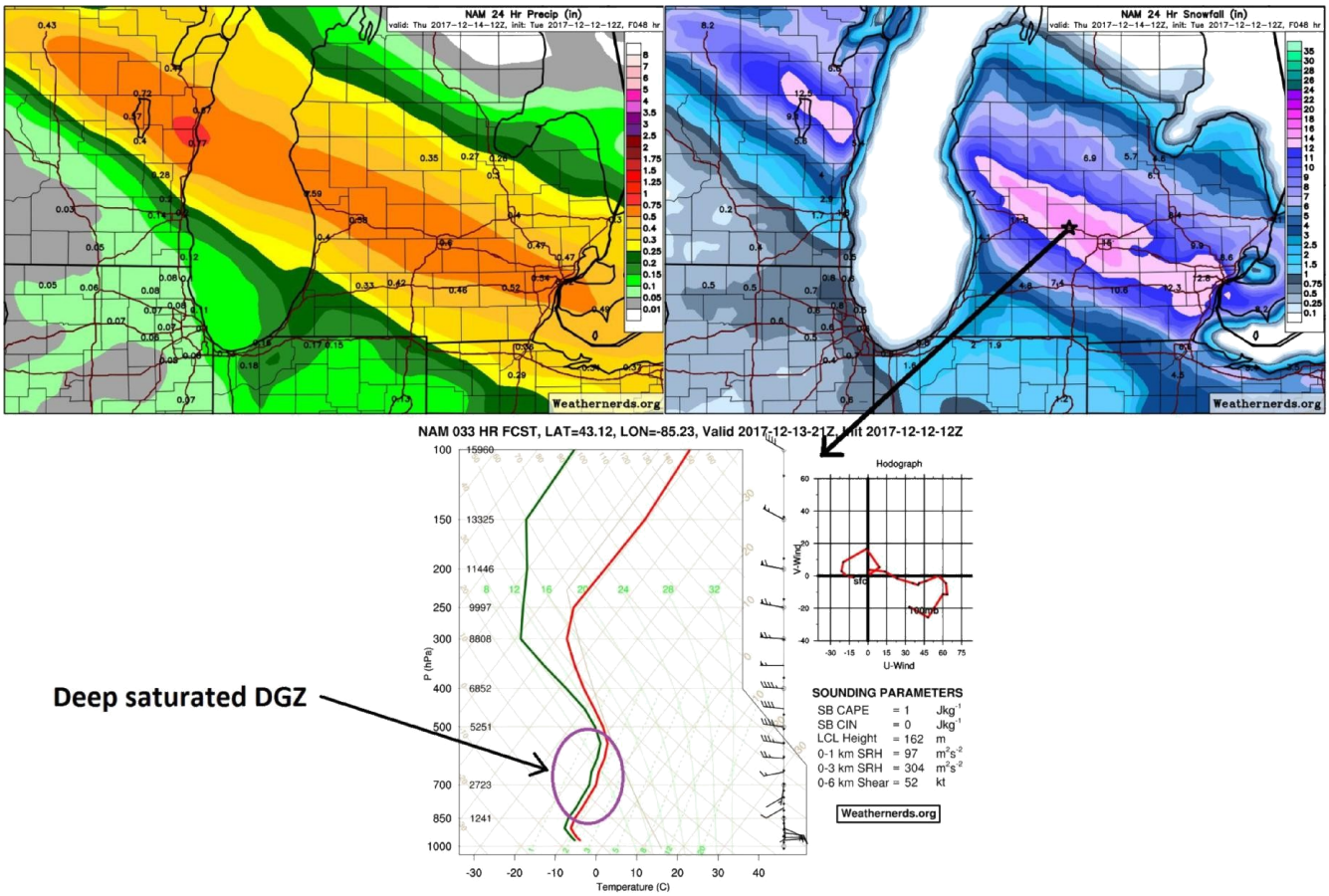
where T is 2-meter temperature in degrees Fahrenheit. The resulting compaction factor is multiplied with the originally computed snowfall ratio (after DGZ analysis) to produce an intermediate snowfall ratio. This intermediate ratio then is multiplied with the sleet/freezing rain ratio (see below) and model output liquid equivalent snowfall accumulation to produce the graphics.

The final adjustment involves a sleet/freezing rain analysis. Since instantaneous precipitation type also is computed at Weathernerds ingest time, this information can be used to adjust snowfall downward in regions where the type is not purely snow. Because snow accumulation is computed over an interval (6 h for example), the precipitation type is considered at the beginning and end points of the interval. The shortest possible interval is always used. If sleet or freezing rain is detected for one of these end points, a 0.5 reduction is applied to the snowfall for the total interval. If sleet or freezing rain is detected at both end points, a 0.9 reduction is applied (final snowfall is multiplied by 0.1). If only snow is detected, no reduction is applied. This essentially treats sleet accumulation as one to one (one inch of sleet for one inch of liquid equivalent).

The last step when computing snowfall is to multiply the original snowfall ratio (after DGZ analysis) by the compaction factor, the sleet/freezing rain reduction

factor, and the model output liquid equivalent snowfall accumulation. This process will generally provide a nice improvement on the basic 10:1 ratio.

The image below shows how the snowfall ratio is increased in an Alberta Clipper in which there is an exceptionally deep saturated DGZ.



Notice model accumulated precipitation peaks at only around 0.6 inches but the snowfall exceeds 12 inches due to the deep saturated DGZ.