

# Snow accumulation methods by computing system

Current as of: 15 December 2022

NCEP Models - Information provided by the [Model Evaluation Group \(MEG\) Presentation](#)

EC Models - Information provided by the ECMWF [Forecasters User Guide](#)

CMC Models - Information provided by [The COMET Program](#)

NOHRSC - Information provided by [NOHRSC](#)

NBM - Information provided by [NBM v4.1 Winter Training](#) (Andy Just, CRH)

## Global Models/Ensemble Systems

<b>GFS</b>	How: <a href="#">Dominant Precip Type (4 wet bulb profile methods)</a> How much: Uses model-output Snow Water Equivalent (SWE) Field AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Website plots: Vary <b>Note: Current GFS v16.3 snow depth field can overestimate accumulation in the presence of precipitating cloud ice due to its density assumption. The previous GFS v16 density assumption error causing overestimation in the presence of sleet, freezing rain, and graupel was corrected with GFS v16.3 on 30 November 2022 [15 DEC 2022 MEG]</b>
<b>GEFS</b>	How: <a href="#">Dominant Precip Type (4 wet bulb profile methods)</a> How much: Uses model-output SWE Field AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Website plots: Vary
<b>ECMWF</b>	How: <a href="#">Temperature/Moisture profiles for each grid point</a> → deterministic precipitation type. Only mixed precipitation type categorized is rain/snow. How much: Total precipitation in kg/m <sup>2</sup> (1 kg/m <sup>2</sup> /s= .1 cm) AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Website plots: Vary
<b>EPS</b>	Same as deterministic, calculated for each individual ensemble member Website plots: Vary
<b>CMC</b>	How: Bourgouin scheme for each grid point, includes wind effects How much: QPF at beginning/end of 3 hr, Bourgouin applied and summed every 3h AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Snow: <a href="#">Dube's scheme</a> Website plots: Vary

<b>CMC-Ens</b>	Same as CMC Website plots: Vary
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## Mesoscale Models

<b><u>NAM</u></b>	How: <a href="#">Dominant Precip Type (4 wet bulb profile methods plus 5th “explicit” method)</a> How Much: QPF/Snow Water Equivalent Field AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Website plots: Vary
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## Convection-Allowing Models/Ensemble

<b>NAM Nest</b>	How: <a href="#">Dominant Precip Type (4 wet bulb profile methods plus 5th “explicit” method)</a> How Much: Both QPF and SWE are available AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Website plots: Vary
<b><u>HRRR/RAP</u></b>	How: Explicit prediction from <a href="#">Thompson Bulk Microphysics</a> How Much: <a href="#">Snow Fraction Calculation</a> AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Products: RapidRefresh site uses SWE which does not include graupel or sleet: <ul style="list-style-type: none"> <li>• Variable snow density with SLR less than 5:1 up to 17:1 (best for environments producing dendrites but marginally warm or very cold)</li> <li>• Constant 10:1 SLR</li> <li>• Snow depth</li> </ul> Website plots: Vary
<b>HRW ARW</b>	How: <a href="#">Dominant Precip Type (4 wet bulb profile methods)</a> How Much: Both QPF and SWE are available AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Products: No snow accumulation products, users must apply their own methods Website plots: Vary
<b>HRW NSSL</b>	How: <a href="#">Dominant Precip Type (4 wet bulb profile methods)</a> How Much: QPF/Snow Water Equivalent AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and surface topography model (recommend not using) Products: No snow accumulation products, users must apply their own methods Website plots: Vary
<b>HRW FV3</b>	How: <a href="#">Dominant Precip type (4 wet bulb profile methods)</a> How Much: QPF/Snow Water Equivalent Field AWIPS: Applies 5:1, 10:1, or 15:1 SLR to QPF using partial thicknesses and

	<p>surface topography model (recommend not using)</p> <p>Products: No snow accumulation products, users must apply their own methods</p> <p>Website plots: Vary</p>
<b>HREF</b>	<p>How: Dominant Precip Type (Explicit Precipitation Type for HRRR)</p> <p>How much: Snow Water Equivalent Field</p> <p>AWIPS: Does not have method to display snow amount; Water Equivalent Snow Depth (and probability of exceedance values) are available in mm</p> <p>Snow: HREF does not produce any hourly snowfall amounts. Users must apply their own method to estimate snowfall. From Brett Roberts at NSSL: <i>"For each member, each hour, any precipitation in the member is counted as snowfall if the diagnostic variable CSNOW=1 at a grid point. In other words, if the grib2 data indicate that some snowfall fell at the grid point, all precipitation that hour is counted as snow. For snow ratios, we use WPC's SLR forecast grids when seasonally available, and just fall back to 10:1 otherwise."</i></p>
<b>RRFS</b>	Under evaluation winter 2022-23, coming soon

## Model Blends and ForecastBuilder

<b><u>NBM v4.0</u></b>	<p>How: <a href="#">Revised Bourguin method for each ensemble member</a> (Slide 18)</p> <p>How Much: Blended members w/ weighting, then bias correction from URMA data</p> <p>Hourly totals 1-35 hours, 3-hourly totals 36-84+ hours</p> <p><b>0.75 coefficient applied to remove overall high bias</b></p> <p>Products: 1- and 6-hourly, run total snow amounts</p> <p>1- and 6-hourly, run total ice amounts</p> <p>24/48/72 hour Accumulation Percentiles and Probability Specific Amounts</p> <p>Conditional Probability types, Probability Freezing Rain, Cloud Ice, Freezing Spray, Snow Ratio, Snow Level</p> <p><i>NOTE: NBM v4.0 is expected to be decommissioned and v4.1 become the operational version in January 2023.</i></p>
<b><u>NBM v4.1</u></b>	<p>F001-F036 (100 members)</p> <p>F039-F240 (81 members)</p> <p>How: <a href="#">Individual member weighting</a> (Slides 21-22)</p> <p>How Much: NBM QMD downscaled QPF for each ensemble member (90 out of 100)</p> <p>Raw QPF for the remaining 10</p> <p>Ice accumulation, uses FRAM and is blended with Snow</p> <p><b>0.75 coefficient applied to remove overall high bias</b></p> <p>Products: 1- and 6-hourly, run total snow amounts</p> <p>1- and 6-hourly, run total ice amounts</p> <p>24/48/72 hour Accumulation Percentiles and Probability Specific Amounts</p> <p>Conditional Probability types, Probability Freezing Rain, Cloud Ice, Freezing Spray, Snow Ratio, Snow Level,</p> <p>NEW: 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles for:</p> <p>One Hour Snow accumulation (through 36 hours)</p>

	<p>Six Hour Snow accumulation</p> <p>Six Hour Ice Accumulation</p>
<b>Forecast Builder</b>	<a href="#">See Documentation</a>

## Verification

<b>NOHRSC</b>	<p>How: Combination of Ground (NWS, SNOTEL, USACE, QC'd CoCoRAHS international, etc.), Airborne, Satellite. All goes into model to grid w/ bias correction. Output online &amp; in AWIPS</p> <p>How Much: Snowfall, SWE, Snow Depth, Snow Melt</p> <p>Also Provided: Snow Temperature</p>
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