Northwest Flow Snow 2007-2008 Season Review and Forecast Methodology

GSP Winter Weather Seminar
Blair Holloway
11/18/08
Outline

• 2007-2008 winter season review
  – 1-2 January event
  – 26-28 February event

• Forecast methodology
  – Climatology based forecast aid
  – Using graduated snow-to-liquid ratio values for SnowAmt grids in GFE
2007-2008 Season Review

• Several low end, advisory type of events

• Highest impact events occurred 1-2 January and 26-28 February

• Both events were well anticipated with good POD, FAR, and LT
1-2 January 2008

Surface – 21 UTC 1 Jan.  
Surface – 06 UTC 2 Jan.
1-2 January 2008

Regional Radar: 19 UTC 1 Jan. – 18 UTC 2 Jan.
1-2 January 2008

MicroRainRadar (MRR)
Flat Springs, NC

18 UTC 1 Jan. – 18 UTC 2 Jan.
12 UTC 2 Jan. – 12 UTC 3 Jan.
1-2 January 2008

03-06 UTC
26-28 February 2008

Surface – 00 UTC 27 Feb.

Surface – 12 UTC 27 Feb.
26-28 February 2008

Regional Radar: 07 UTC 27 Feb. – 18 UTC 28 Feb.
26-28 February 2008

00 UTC 27 Feb. –
00 UTC 28 Feb.

00 UTC 28 Feb. –
00 UTC 29 Feb.

MicroRainRadar (MRR)
Flat Springs, NC
26-28 February 2008

500 hPa
00 UTC
27 Feb.

500 hPa
12 UTC
27 Feb.

06 UTC
27 Feb.

Flach Springs Soundings

09 UTC
27 Feb.
26-28 February 2008

Northwest Flow Snowfall Event
Event Total Accumulations

12” - Newfound Gap
16” - Cherohala Skyway

Data analysis and graphic by Blair Holloway
NWS Greenville-Spartanburg, SC
www.erh.noaa.gov/gsp
2007-2008 NWFS Events

• Both events well anticipated

• 1-2 January 2008
  – Watch stats; 1.0 POD, avg. lead time 61 hours
  – Warning stats; 1.0 POD, avg. lead time 48 hours

• 26-28 February 2008
  – Watch stats; 1.0 POD, avg. lead time 48 hours
  – Warning stats; 1.0 POD, avg. lead time 23 hours
Event Differences

- Duration – February event lasted about 12 hours longer

- Moisture – Flat Springs RH values
  - January event: 83.3%
  - February event: 91.4%

- Snow density – Flat Springs observations
  - January event: 33 kg/m³ (30.8 snow-to-liquid ratio)
  - February event: 47 kg/m³ (21.3 snow-to-liquid ratio)

- Wind – RNK sounding
  - January event: 35 kts at 850 hPa
  - February event: 21 kts at 850 hPa

- Low snow density, blowing and drifting of snow helped reduce measurable accumulations in the January event
Forecast Methodology

- We all have good conceptual models of NWFS events

- But what separates a warning event from an advisory event?

- What values of atmospheric parameters should we be looking for?
Forecast Methodology

- Synoptic climatology of NWFS events from 1950-2000 (Perry 2006)
- All values for snow region 8
- Total of 574 events

Perry (2006) fig. 2.5
Forecast Methodology

### Northwest Flow Snow Climatology - Forecast Aid

<table>
<thead>
<tr>
<th>Temporal Element/Synoptic Field</th>
<th>All Cases (574)</th>
<th>Ascent (159)</th>
<th>Subsidence (415)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Event Duration (hours)</strong></td>
<td>Light (431)</td>
<td>Heavy (143)</td>
<td>Light (120)</td>
</tr>
<tr>
<td></td>
<td>(Advisory)</td>
<td>(Warning)</td>
<td>(Advisory)</td>
</tr>
<tr>
<td>&lt;12</td>
<td>12-24</td>
<td>&lt;12</td>
<td>12-24</td>
</tr>
<tr>
<td><strong>Mean 1000-500 mb RH (%)</strong></td>
<td>59</td>
<td>68</td>
<td>69</td>
</tr>
<tr>
<td><strong>500 mb RH (%)</strong></td>
<td>35</td>
<td>44</td>
<td>47</td>
</tr>
<tr>
<td><strong>850 mb RH (%)</strong></td>
<td>76</td>
<td>82</td>
<td>79</td>
</tr>
<tr>
<td><strong>500 mb Height (m)</strong></td>
<td>5429</td>
<td>5385</td>
<td>5451</td>
</tr>
<tr>
<td><strong>850 mb Wind Direction (deg)</strong></td>
<td>302</td>
<td>297</td>
<td>299</td>
</tr>
<tr>
<td><strong>850 mb Wind Speed (m/s)</strong></td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td><strong>850 mb Temperature (°C)</strong></td>
<td>-7</td>
<td>-8</td>
<td>-5</td>
</tr>
<tr>
<td><strong>1000-500 mb Thickness (m)</strong></td>
<td>5300</td>
<td>5279</td>
<td>5339</td>
</tr>
<tr>
<td><strong>Precipitable Water (cm/in)</strong></td>
<td>0.79 / 0.31</td>
<td>0.84 / 0.33</td>
<td>1.07 / 0.42</td>
</tr>
<tr>
<td><strong>Mean Snowfall (inches)</strong></td>
<td>1.2</td>
<td>3.1</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Max Snowfall (inches)</strong></td>
<td>3.5</td>
<td>9.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>


Light <= 2.4 inches (Approx. 6 cm)
Heavy >=2.5 inches

*Event duration is meant to be a rough estimate for our area. Advisory caliber events usually last 12 hours or less, warning caliber events are usually 12-24 hours, or longer.

Ascent vs. Subsidence - Events with upward vs. downward motion at 700 hPa
Forecast Methodology

- Hard to create SnowAmt grids in GFE that portray the spatial variability in NWFS events
- Limited by QPF guidance from operational models
- But we do know that snow-to-liquid ratio changes throughout NWFS events
Forecast Methodology

Snow-to-Liquid Ratio - Flat Springs, NC

Average SLR
January Event – 30.8
February Event – 21.3

Average SLR
January Event – 30.8
February Event – 21.3
Forecast Methodology

• SLR trends upward throughout NWFS events

• Perhaps use UWM snow ratio probability to settle on an “average” SLR

• Then, using the SnowAmtFromQPF smart tool gradually increase the SLR used as the event progresses

• Can be done with 3 hour or 6 hour snow grids to capture increasing trend in SLR
Forecast Methodology

- My method:
  1. Figure out QPF blend (NAM, GFS, SREF, etc.)
  2. Run QPF_SmartTool to create some upslope enhancement/downslope shadowing
  3. Use graduated SLR values in SnowAmtFromQPF, usually finishing at or just over 20:1
Forecast Methodology
Forecast Methodology
Forecast Methodology

- A more representative storm total snow grid
- More beneficial now that we are advertising on briefing web page
Summary and Conclusions

• Office has a good handle on NWFS events

• Field studies have provided beneficial information about event details

• We know SLR increases throughout NWFS events

• Can use this information to create SnowAmt grids and a more representative storm total snow depiction