The Validation of the Operational AMSU Snowfall Identification Product

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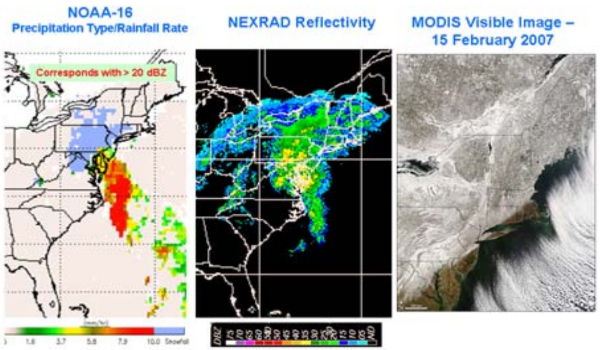
1. Introduction

For over a decade, NOAA/NESDIS has been generating operational precipitation estimates from The Advanced Microwave Sounding Unit (AMSU) and Microwave Humidity Sounder (MHS) on board the NOAA POES and EUMETSAT MetOp satellites. These estimates, the first ever from microwave sounders, have been extremely useful in precipitation retrievals, providing global estimates every 4 hours. Kongoli et. al. (2003) developed an extension to the rain rate product by using sounding channels on AMSU and MHS to determine regions of falling snow over land. This algorithm will work sufficiently well when the atmosphere remains relatively opaque to the surface at frequencies at 150 GHz or higher. This product has shown promise in detecting large scale snow systems in the temperate zones, usually on the southern edge of the established snowpack **(see example below).** Trying to quantify the meteorological conditions where the algorithm succeeds and fails has been difficult; **the purpose of this poster is to illustrate the various methods employed to validate the product and present some preliminary findings.** *It should be noted that work is well underway to develop a snowfall rate product, which is under evaluation, but is beyond the scope of this paper***.**

East Coast Snow/Ice Storm – 14 February 2007



2. Falling Snow Verification Issues

- Lack of coincident surface reports with satellite/AMSU
- Previous work indicates lag between satellite signal and surface snowfall
  - Terminal velocity of snow is slower than rain
  - Snow aloft/virga
- "Operational" radars
  - Don't make "objective" distinction between rain and snow
  - Snow aloft/virga
- Surface report of "light snow" can mean flurries or accumulating snow
  - Visibility and T-DP spread are better indicators
- Surface hourly water equivalent reports are unreliable

3. Study Parameters and Results

i. Let's look at the big picture, AMSU Snowfall Frequency "Climatology"

- 2000 – 2007 N15 and N16 seasonal means (% occurrence) **(IMAGE ON LEFT)**
- Qualitatively, these look "reasonable"
- How can we evaluate these? A. Dai (NCAR) has COADS surface report climatology *(J. Climate, 2001).*
  - Huge incompatibility when including ALL types of snow reports; maximum snowfall occurrence in COADS over 50 %
  - Better results when we restrict surface observations based on snow intensity and visibility **(IMAGE ON RIGHT)**
- This was a good start, but does not address our underlying scientific question

ii. Can we utilize a more comprehensive set of surface observations?

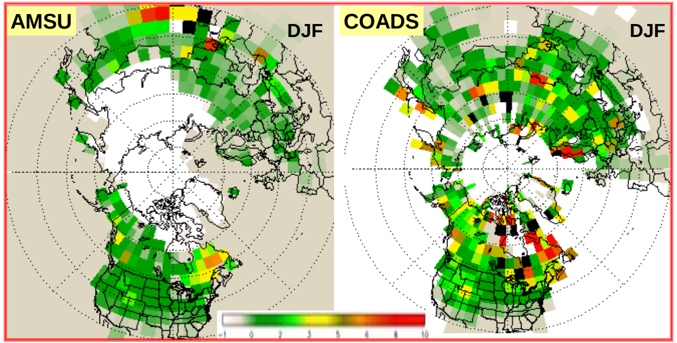
- Focus on North America validation with NCDC's Global Surface Summary of the Day (GSOD) Data
- Developed color coding scheme for hits, misses, false alarms
- Compile statistics at 0.25, 1.0 and 2.5 deg on daily and seasonal basis
- Again, results inconclusive due to incompatibility with daily surface vs. AMSU 4-observations/day, various snow intensities, etc.
- Intuitive feeling is that there is "skill" in the AMSU estimates but this is hard to quantify

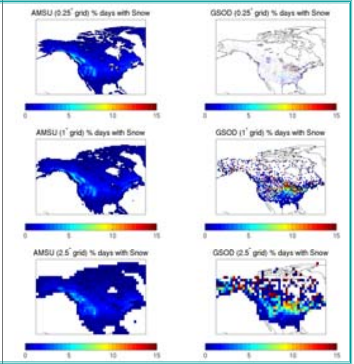
iii. Final option, time/space matchups with hourly synoptic observations **(in progress)**

- All NOAA satellites 2000 – 2008; surface reports of precipitation; 0, 1, 2 hour from AMSU observation times
- Query data base by location, synoptic observations like visibility, synoptic code, hourly precipitation
  - This should allow us to "zero in" on the meteorological conditions where the AMSU retrievals succeed and fail
  - Some preliminary results for December 2005 - 07
    - When the visibility is 1 mile or less, AMSU detects snowfall 15 % of the time.
    - For moderate and heavy snow categories, AMSU detects snowfall 60% of the time

4. Summary and Future Plans

The validation of the AMSU falling snow product has been on ongoing challenge. The creation of a large data base of co-located AMSU and surface synoptic reports will allow us to get a better handle on under which meteorological conditions the algorithm performs the best.





Obs Lat	Obs Lon	Day	Mon	Min	Vis (km)	Wx	Tsfc	RH	Precip (mm)	Delta Time	Delta Km	RainRate
41.01	-85.13	25	20	54	1.6	S-	0.6	92	1.5	60	49.8	0
43.35	-118.57	1	10	53	1.2	S-	-2.2	88	1.0	0	46.0	1
42.1	-76.53	31	19	53	1.2	S-	-0.6	96	0.8	60	34.5	1
46.52	-68.02	24	7	54	1.6	S-	-5.6	92	0.8	60	35.8	1
46.52	-68.02	24	7	54	1.6	S-	-5.6	92	0.8	60	17.0	1
46.52	-68.02	24	7	54	1.6	S-	-5.6	92	0.8	60	34.6	1
42.1	-76.53	31	19	53	1.2	S-	-0.6	96	0.8	60	17.2	0
42.1	-76.53	31	19	53	1.2	S-	-0.6	96	0.8	60	4.1	0
42.1	-76.53	31	19	53	1.2	S-	-0.6	96	0.8	60	18.8	0
42.1	-76.53	31	19	53	1.2	S-	-0.6	96	0.8	60	36.1	0
46.52	-68.02	24	7	54	1.6	S-	-5.6	92	0.8	60	18.2	0
46.52	-68.02	24	7	54	1.6	S-	-5.6	92	0.8	60	0.9	0
42.1	-76.53	31	18	53	1.2	S-	0.0	88	0.5	0	34.5	1
42.1	-76.53	31	18	53	1.2	S-	0.0	88	0.5	0	17.2	0
42.1	-76.53	31	18	53	1.2	S-	0.0	88	0.5	0	4.1	0
42.1	-76.53	31	18	53	1.2	S-	0.0	88	0.5	0	18.8	0
42.1	-76.53	31	18	53	1.2	S-	0.0	88	0.5	0	36.1	0
41.59	-87.55	28	7	56	0.8	S-	3.3	97	0.3	0	34.3	0
41.59	-87.55	28	7	56	0.8	S-	3.3	97	0.3	0	9.4	0
41.08	-75.23	31	19	53	0.4	S-	-3.9	96	0.1	60	4.1	0
41.08	-75.23	31	19	53	0.4	S-	-3.9	96	0.1	60	21.6	0
41.08	-75.23	31	19	53	0.4	S-	-3.9	96	0.1	60	39.1	0