



# NCEP Climate Prediction Center verification of week-2 NAEFS forecasts

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NCEP/NOAA

Acknowledgements:  
Dave Unger



# NAEFS Verification - Outline

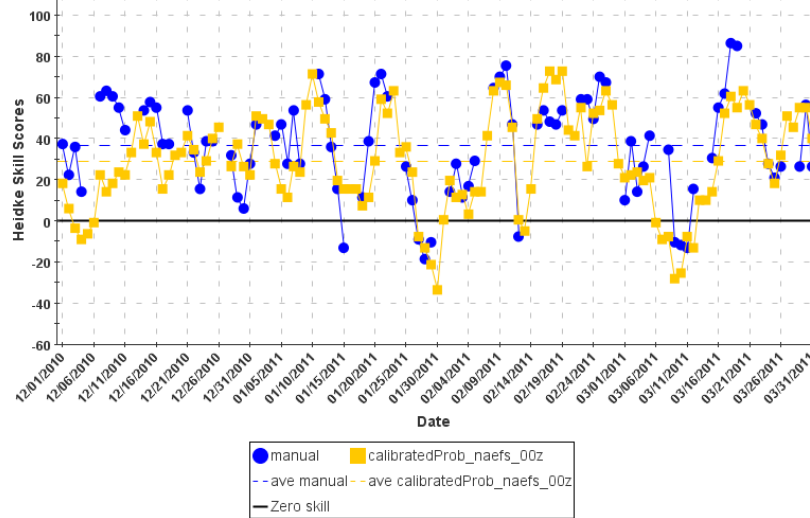
- CPC Verification Web Tool
  1. Standard CPC verification metrics / Time series
    1. Heidke Skill Score (Hit Rate as % over climatology)
    2. Rank Probability Skill Score (3 category CDF errors v. climatology)
    3. Reliability (slope of hit rate compared to forecast probabilities)
- DJFM 2010-2011, MJJA 2011, SON 2011 and Dec 2010-Nov 2011
- Threat Scores (July and Feb)
  - Frequency Bias
  - Spatial patterns and seasonality



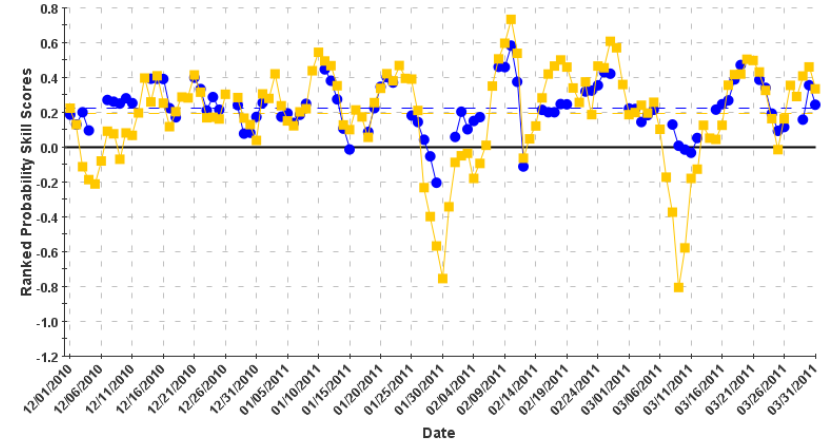
# Last Winter (DJFM 2010-11) 6-10 day Temperature Forecast



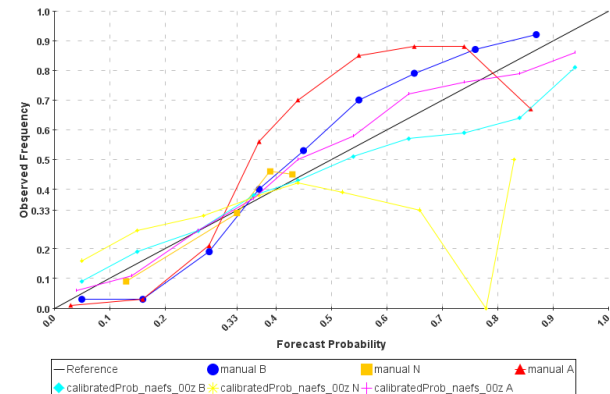
6-10 Day Temperature Heidke Skill Scores for all categories from 12/01/2010 - 03/31/2011



6-10 Day Temperature Ranked Probability Skill Scores for all categories from 12/01/2010 - 03/31/2011



6-10 Day Temperature Reliability Scores for separate categories from 12/01/2010 - 03/31/2011



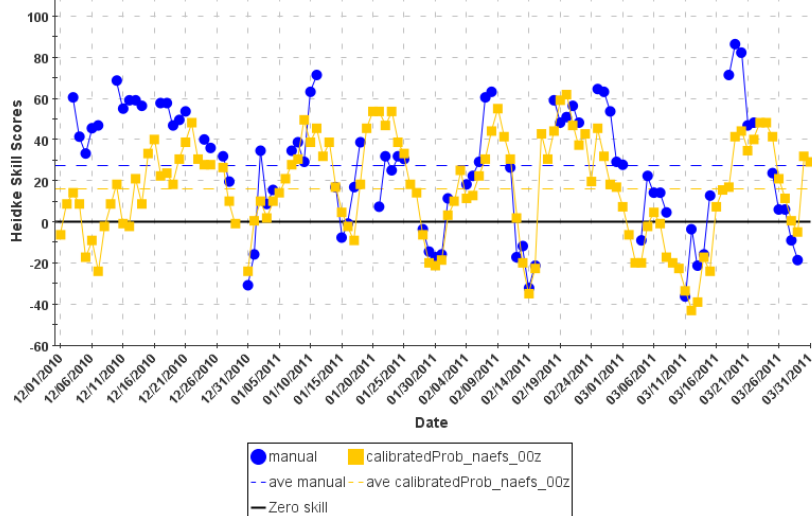
Temperature DJFM2011	6-10 day HSS	6-10 day RPSS
<u>Manual</u>	<b>36.8</b>	<b>.22</b>
<u>NAEFS</u>	<b>28.9</b>	<b>.19</b>



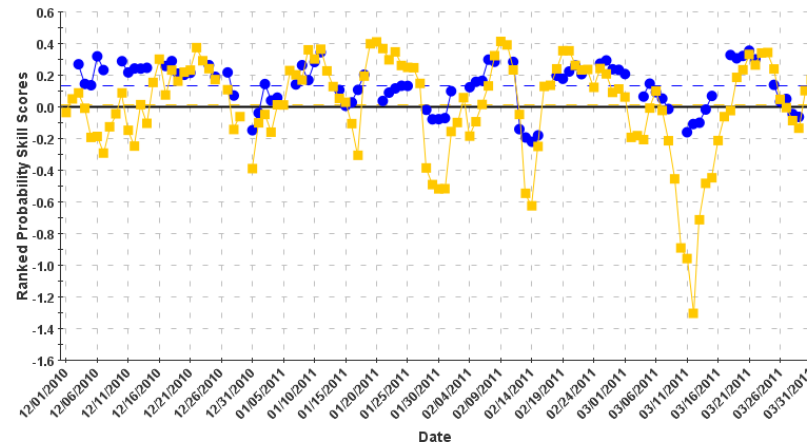
# Last Winter (DJFM 2010-11) 8-14 day Temperature Forecast



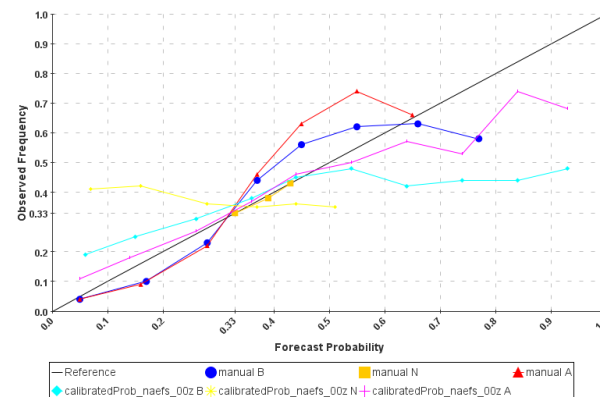
8-14 Day Temperature Heidke Skill Scores for all categories from 12/01/2010 - 03/31/2011



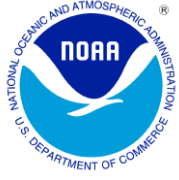
8-14 Day Temperature Ranked Probability Skill Scores for all categories from 12/01/2010 - 03/31/2011



8-14 Day Temperature Reliability Scores for separate categories from 12/01/2010 - 03/31/2011

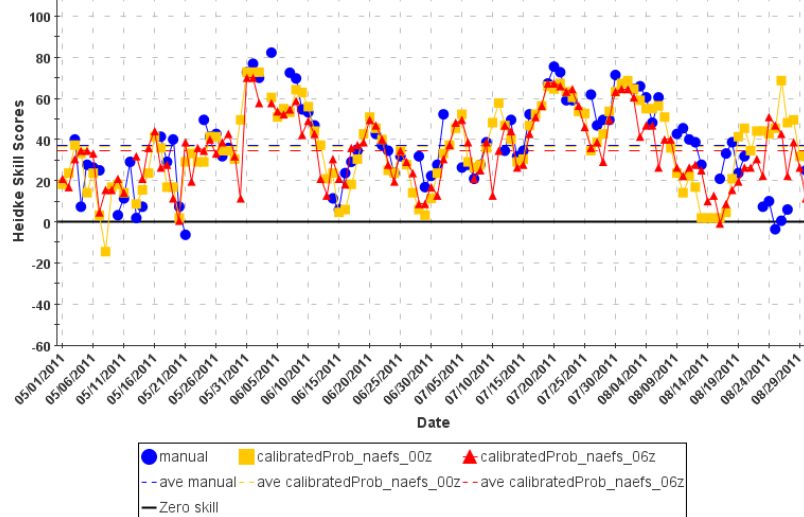


Temperature DJFM2011	8-14 day HSS	8-14 day RPSS
<u>Manual</u>	<b>27.1</b>	<b>.13</b>
<u>NAEFS</u>	<b>15.9</b>	<b>.01</b>

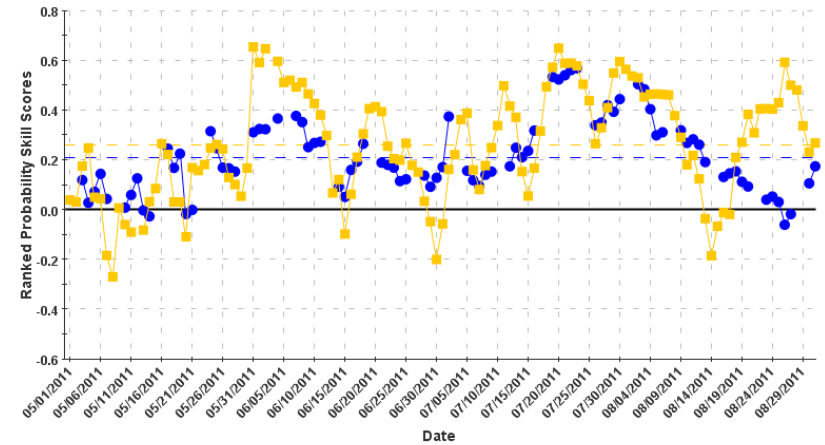


# Last Summer (MJJA 2011) 6-10 day Temperature Forecast

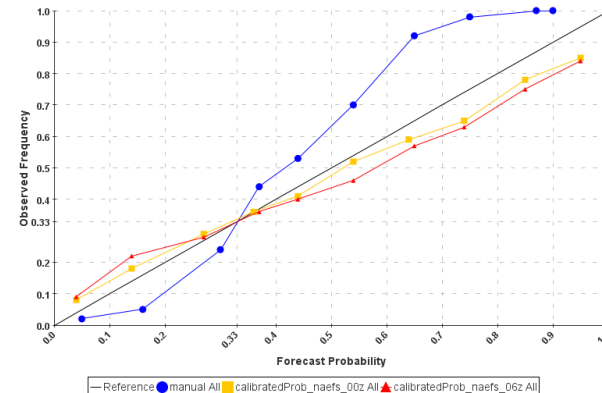
6-10 Day Temperature Heidke Skill Scores for all categories from 05/01/2011 - 08/31/2011



6-10 Day Temperature Ranked Probability Skill Scores for all categories from 05/01/2011 - 08/31/2011



6-10 Day Temperature Reliability Scores for all categories from 05/01/2011 - 08/31/2011



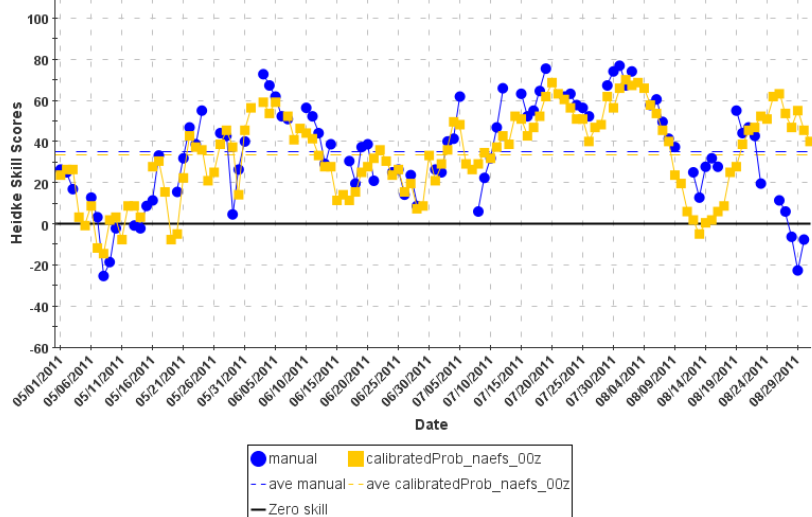
Temperature MJJA2011	6-10 day HSS	6-10 day RPSS
<u>Manual</u>	<b>37.2</b>	<b>.21</b>
<u>NAEFS</u>	<b>36.5</b>	<b>.26</b>
<u>GEFS 06Z</u>	<b>34.4</b>	<b>.23</b>



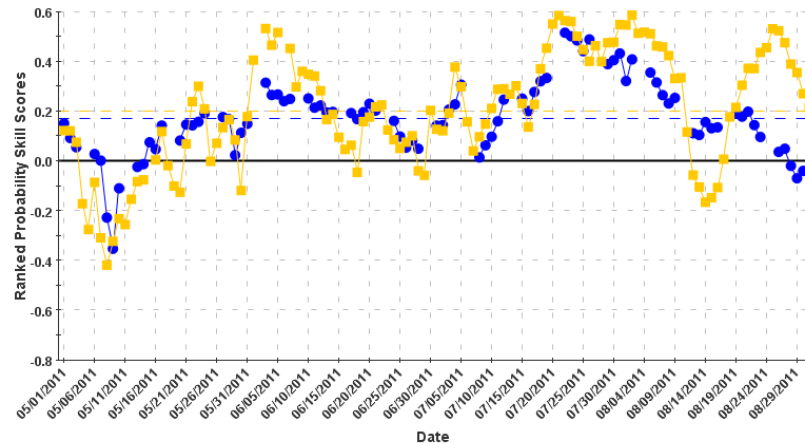
# Last Summer (MJJA 2011) 8-14 day Temperature Forecast



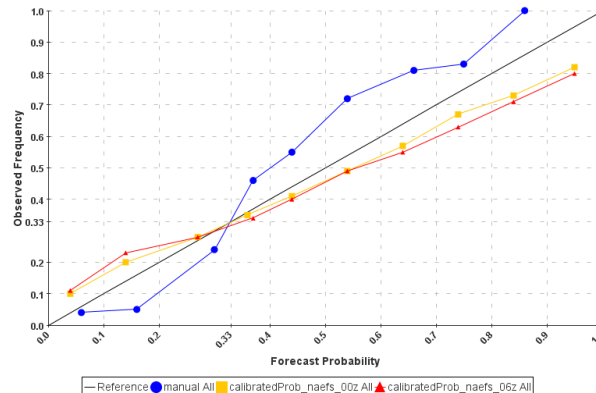
8-14 Day Temperature Heidke Skill Scores for all categories from 05/01/2011 - 08/31/2011



8-14 Day Temperature Ranked Probability Skill Scores for all categories from 05/01/2011 - 08/31/2011



8-14 Day Temperature Reliability Scores for all categories from 05/01/2011 - 08/31/2011

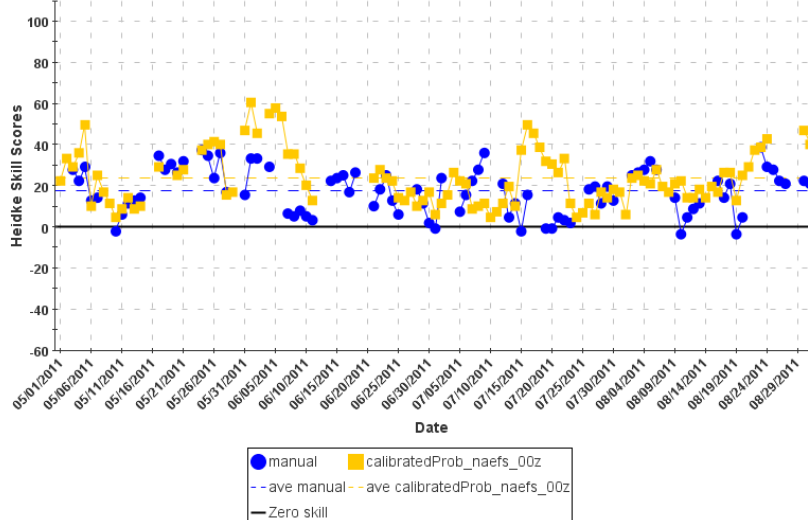


Temperature MJJA2011	8-14 day HSS	8-14 day RPSS
<u>Manual</u>	<b>35.1</b>	<b>.17</b>
<u>NAEFS</u>	<b>33.3</b>	<b>.20</b>
<u>GEFS 06Z</u>	<b>30.8</b>	<b>.17</b>

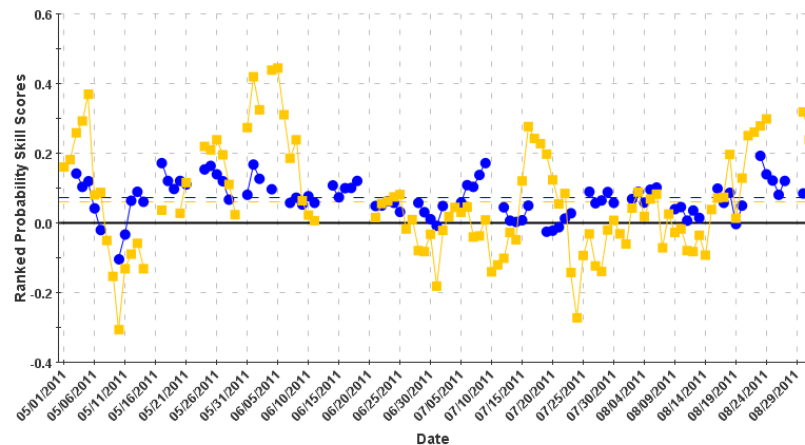


# Last Summer (MJJA 2011) 6-10 day Precipitation Forecast

6-10 Day Precipitation Heidke Skill Scores for all categories from 05/01/2011 - 08/31/2011



6-10 Day Precipitation Ranked Probability Skill Scores for all categories from 05/01/2011 - 08/31/2011



Precip  
MJJA2011

6-10 day  
HSS

6-10 day  
RPSS

Manual

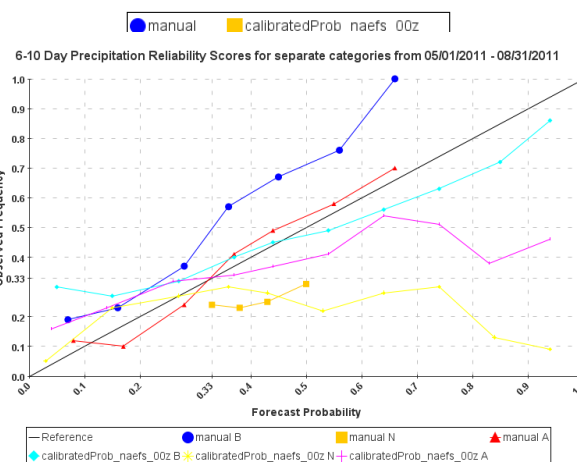
**17.3**

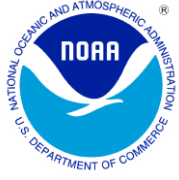
**.07**

NAEFS

**23.7**

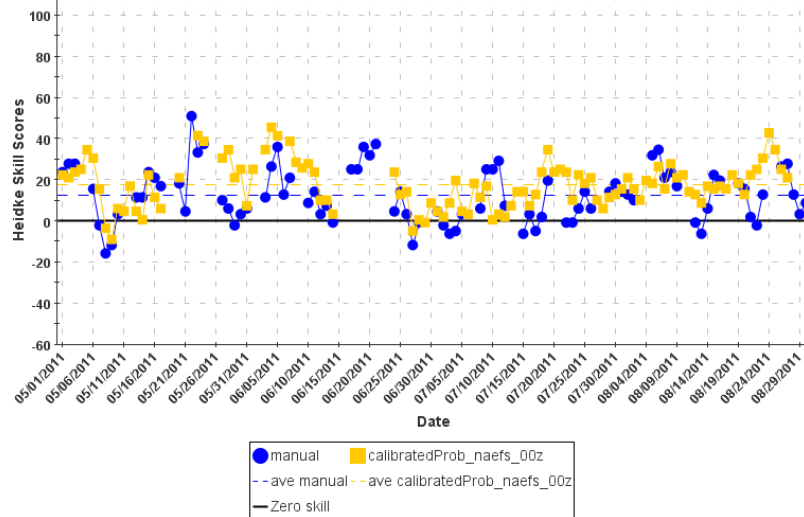
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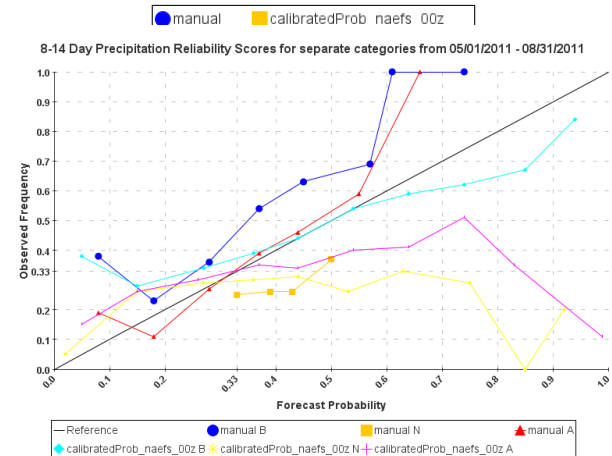
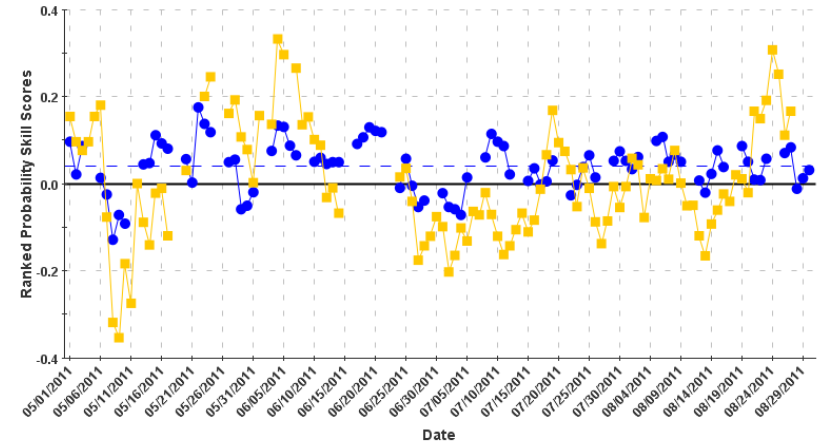


# Last Summer (MJJA 2011) 8-14 day Precipitation Forecast

8-14 Day Precipitation Heidke Skill Scores for all categories from 05/01/2011 - 08/31/2011



8-14 Day Precipitation Ranked Probability Skill Scores for all categories from 05/01/2011 - 08/31/2011



Precip  
MJJA2011

8-14 day  
HSS

8-14 day  
RPSS

Manual

**12.6**

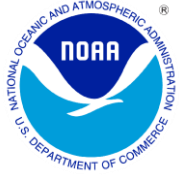
**.04**

NAEFS

**17.4**

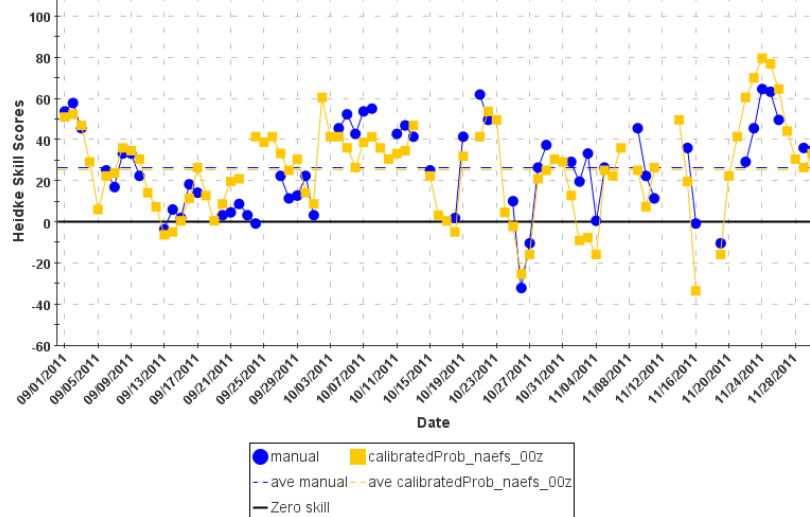
**.00**



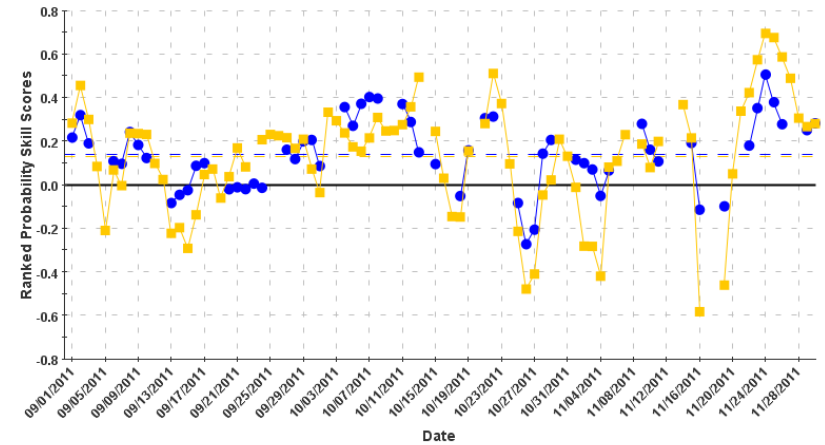


# Autumn (SON 2011) 6-10 day Temperature Forecast

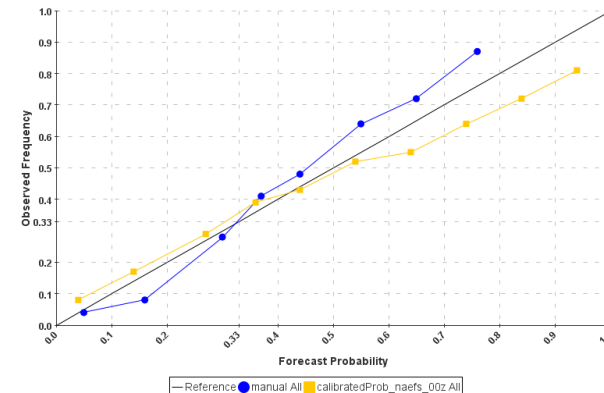
6-10 Day Temperature Heidke Skill Scores for all categories from 09/01/2011 - 11/30/2011



6-10 Day Temperature Ranked Probability Skill Scores for all categories from 09/01/2011 - 11/30/2011



6-10 Day Temperature Reliability Scores for category A from 09/01/2011 - 11/30/2011



Temperature  
SON2011

6-10 day  
HSS

6-10 day  
RPSS

Manual

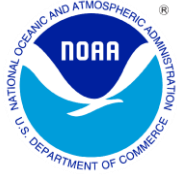
**26.1**

**.14**

NAEFS

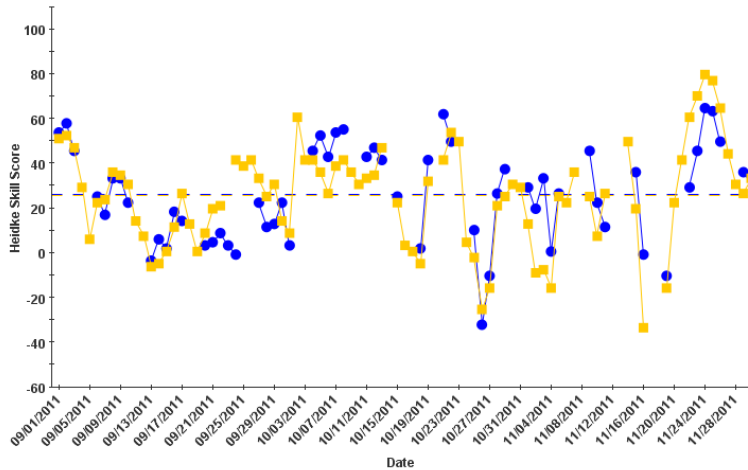
**25.3**

**.13**

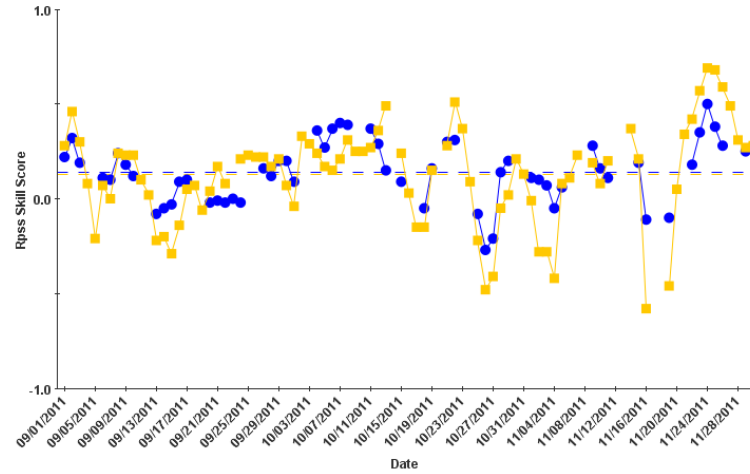


# Autumn (SON 2011) 6-10 day Precipitation Forecast

Heidke Skill Scores Valid Dates: 09/01/2011 - 11/30/2011



Rpss Skill Scores Valid Dates: 09/01/2011 - 11/30/2011



● manual All    ■ calibratedProb\_naefs\_00z All  
 - - ave manual    - - ave calibratedProb\_naefs\_00z

● manual All    ■ calibratedProb\_naefs\_00z All  
 - - ave manual    - - ave calibratedProb\_naefs\_00z

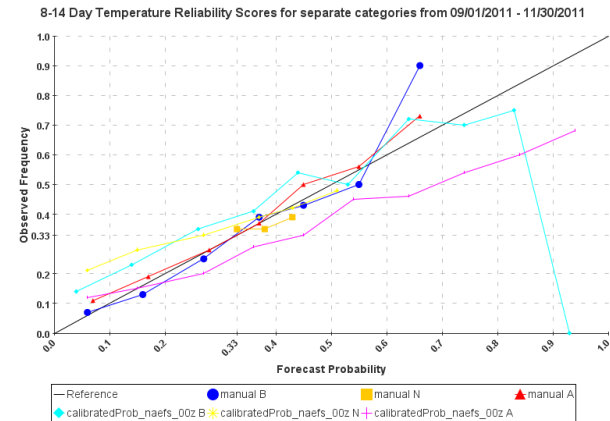
Precipitation SON2011	6-10 day <u>HSS</u>	6-10 day <u>RPSS</u>
<u>Manual</u>	<b>19.0</b>	<b>.03</b>
<u>NAEFS</u>	<b>17.7</b>	<b>-.02</b>



# Autumn (SON 2011) 8-14 day Temperature Forecast



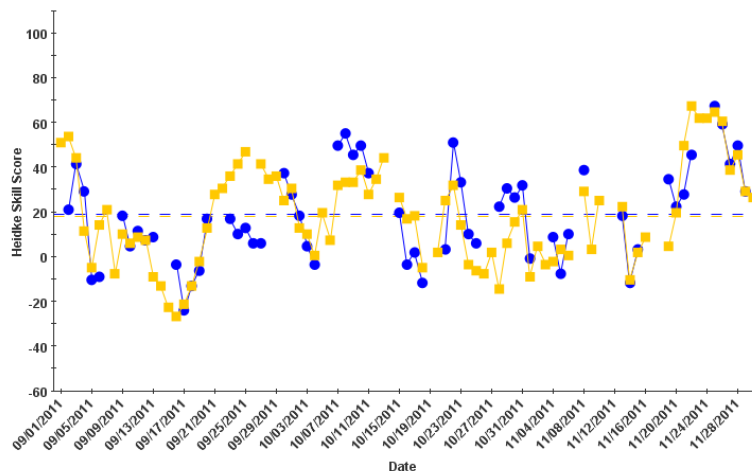
Temperature SON2011	8-14 day <u>HSS</u>	8-14 day <u>RPSS</u>
<u>Manual</u>	<b>36.8</b>	<b>.27</b>
<u>NAEFS</u>	<b>38.4</b>	<b>.29</b>



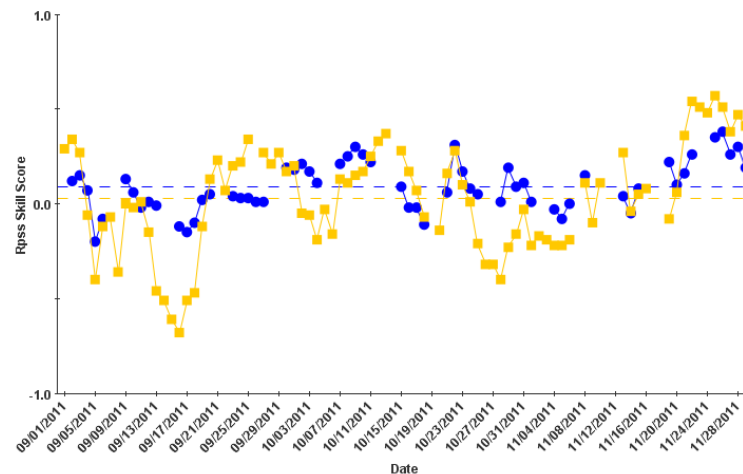


# Autumn (SON 2011) 8-14 day Precipitation Forecast

Heidke Skill Scores Valid Dates: 09/01/2011 - 11/30/2011



Rpss Skill Scores Valid Dates: 09/01/2011 - 11/30/2011



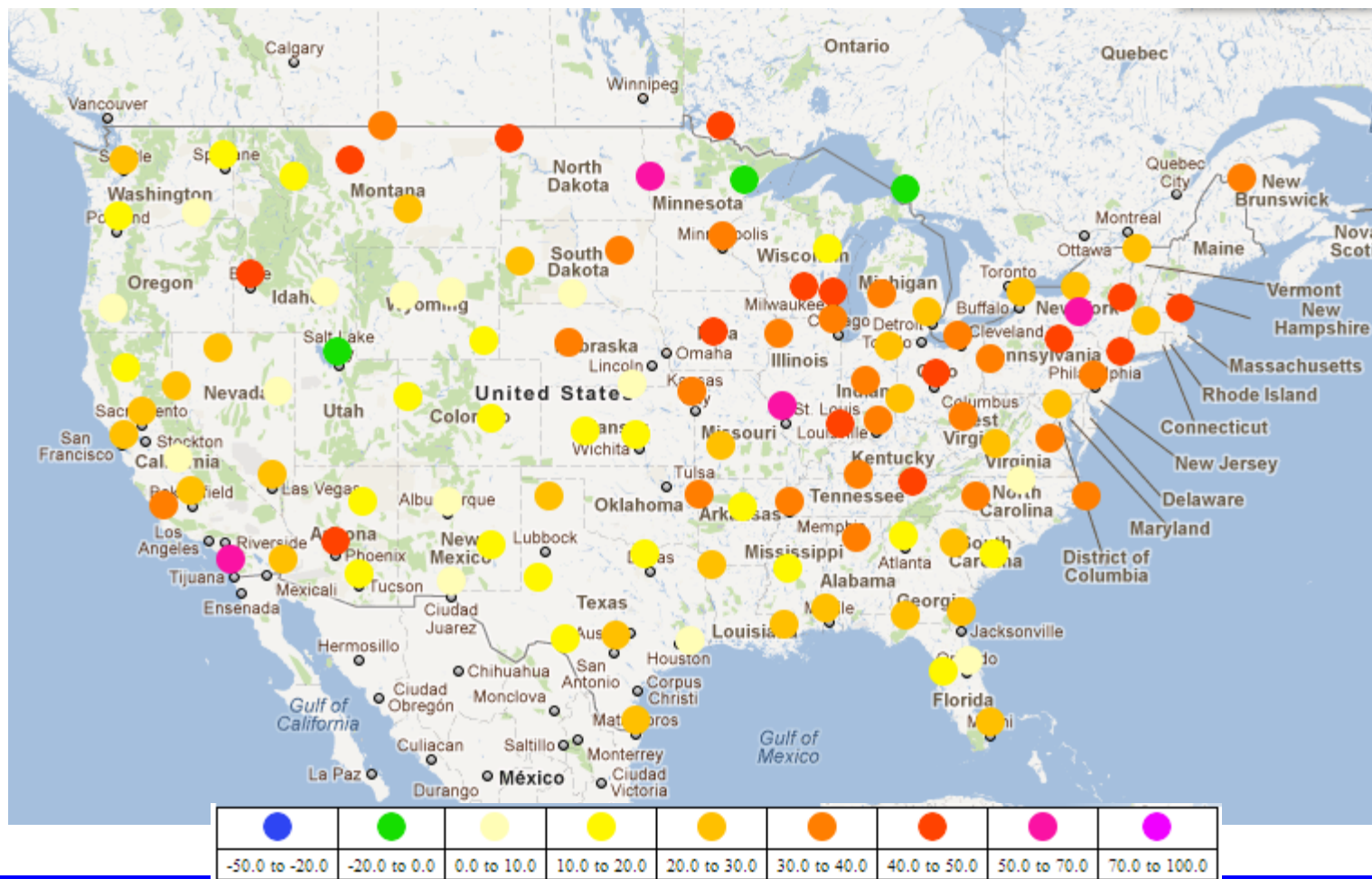
● manual All    ■ calibratedProb\_naefs\_00z All  
 - - ave manual    - - ave calibratedProb\_naefs\_00z

● manual All    ■ calibratedProb\_naefs\_00z All  
 - - ave manual    - - ave calibratedProb\_naefs\_00z

Precipitation SON2011	8-14 day <u>HSS</u>	8-14 day <u>RPSS</u>
<u>Manual</u>	<b>14.7</b>	<b>-.03</b>
<u>NAEFS</u>	<b>10.9</b>	<b>-.11</b>

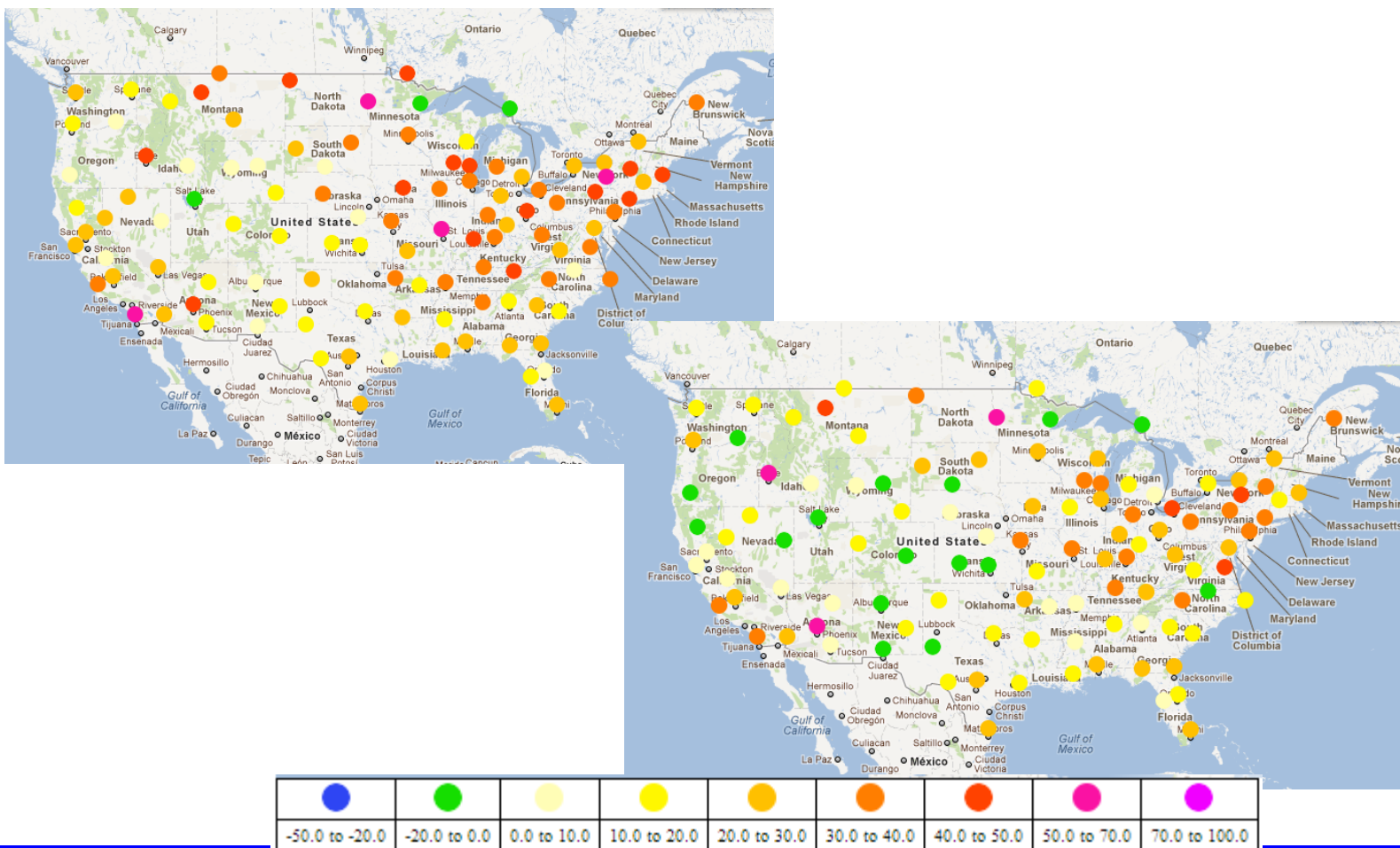


# 6-10 day NAEFS Heidke Skill SON2011



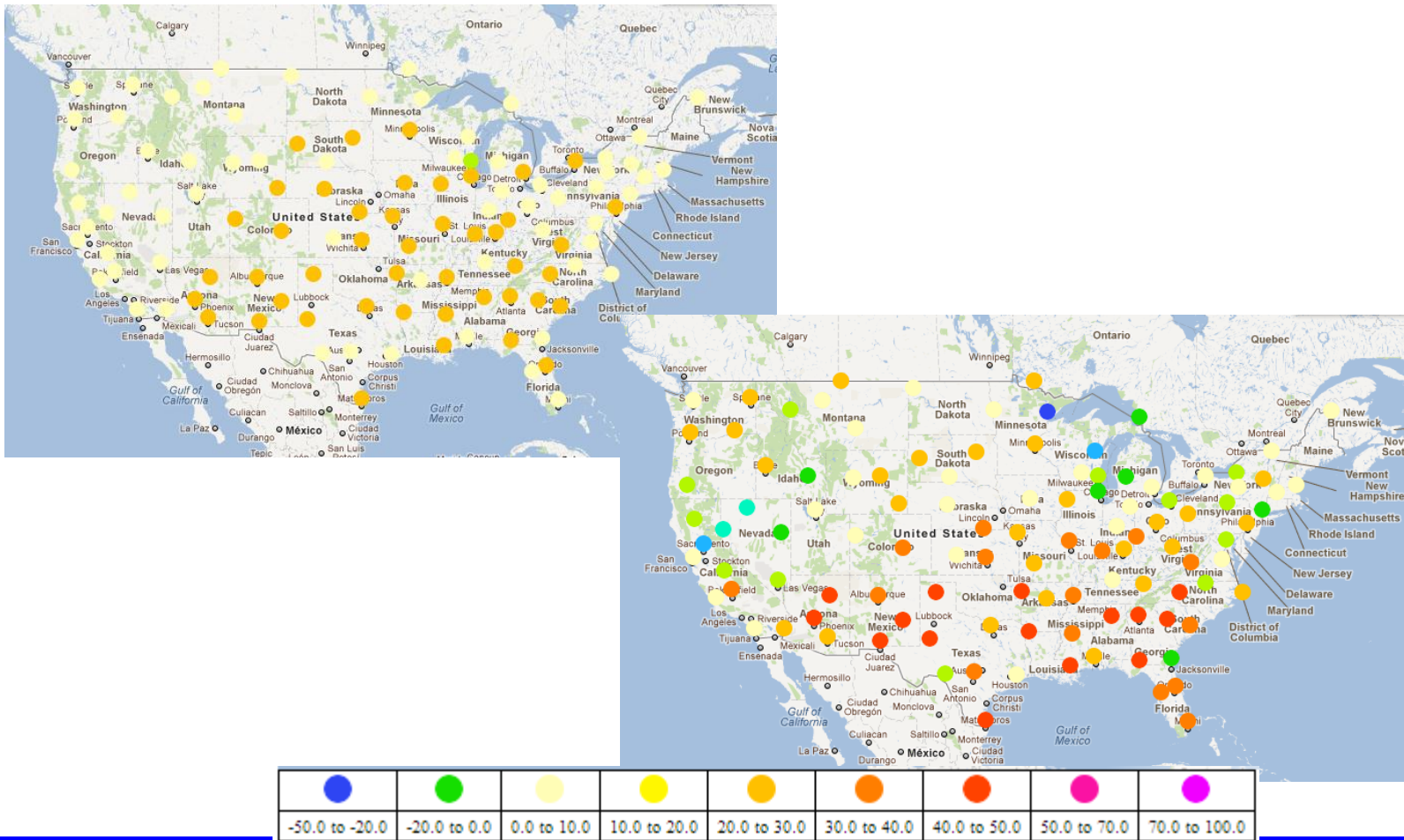


# 6-10 day and 8-14 day NAEFS forecast Heidke Skill Score SON 2011

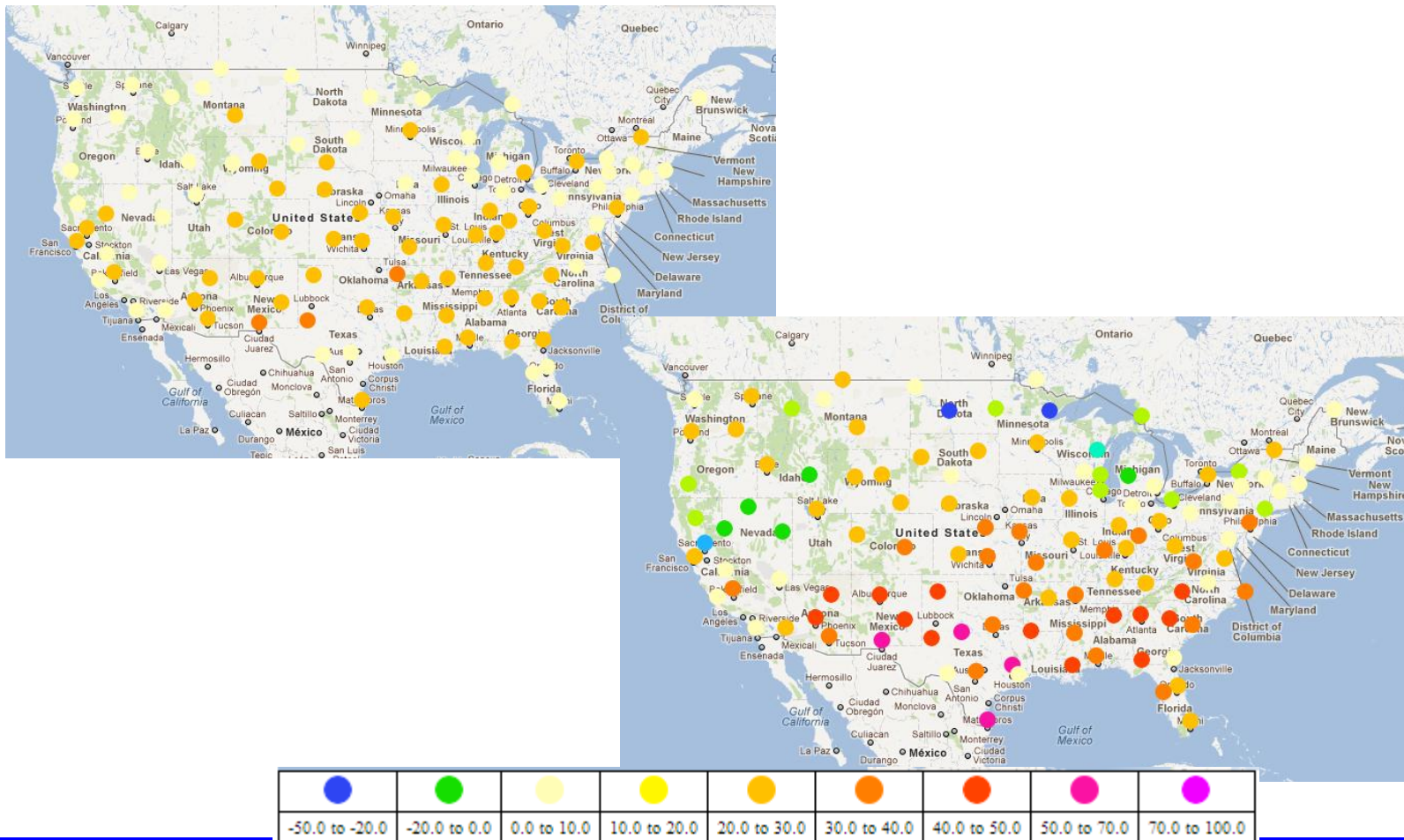




# 8-14 day Official and NAEFS T forecast Heidke Skill Score MJJA 2011



# 6-10 day Official and NAEFS T forecast Heidke Skill Score MJJA 2011







## 6-10 day Precipitation CPC Heidke Skill Score May 1, 2011 – November 30, 2011



	<u>All Areas</u>	<u>West/High Plains</u>	<u>South</u>	<u>Midwest/N ortheast</u>
<b>Manual</b>	13.8	10.3	17.5	14.8
<b>Auto</b>	15.4	17.9	14.5	13.9
<b>CDC</b>	20.3	25.2	19.3	15.3
<b>NAEFS</b>	24.0	30.7	23.1	16.7

## 8-14 day Precipitation CPC Heidke Skill Score May 1, 2011 – November 30, 2011

	<u>All Areas</u>	<u>West/High Plains</u>	<u>South</u>	<u>Midwest/No rtheast</u>
<b>Manual</b>	7.3	5.7	8.6	8.2
<b>Auto</b>	10.4	12.6	9.1	9.2
<b>CDC</b>	12.2	15.3	13.5	7.1
<b>NAEFS</b>	15.8	20.7	16.7	9.3

8-14 day Temperature CPC Heidke Skill Score  
 May 1, 2011 – November 30, 2011



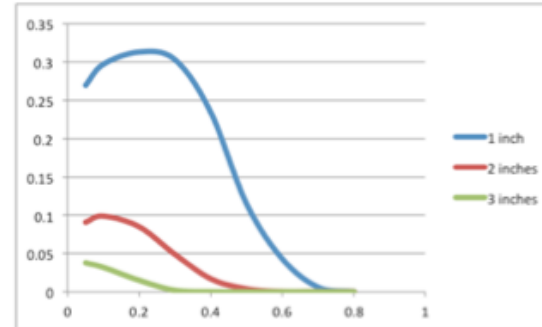
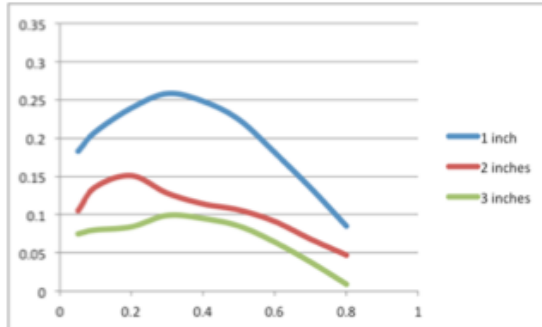
	<u>All Areas</u>	<u>West/High Plains</u>	<u>South</u>	<u>Midwest/N ortheast</u>
<b>Manual</b>	23.0	20.2	29.3	21.0
<b>Auto</b>	17.6	19.4	17.3	15.8
<b>NAEFS</b>	23.6	17.0	34.7	22.0

8-14 day Temperature CPC RPSS  
 May 1, 2011 – November 30, 2011

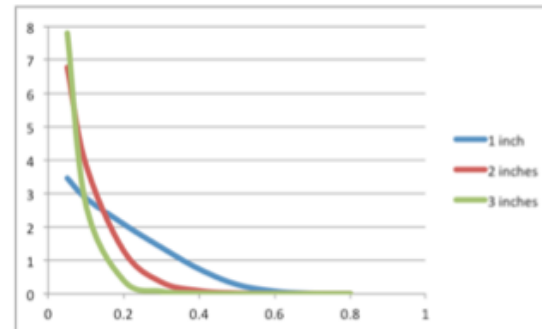
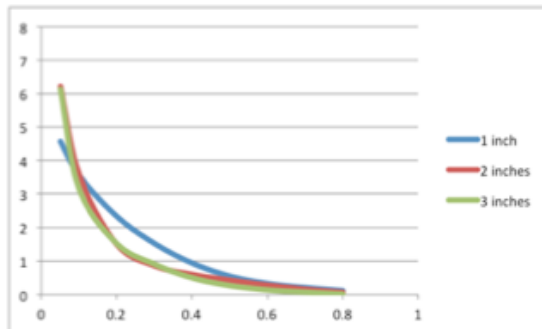
	<u>All Areas</u>	<u>West/High Plains</u>	<u>South</u>	<u>Midwest/N ortheast</u>
<b>Manual</b>	.10	.09	.13	.09
<b>Auto</b>	.04	.08	.00	.04
<b>NAEFS</b>	.11	.04	.20	.06



# U.S. Mean Threat Score & Frequency Bias by Month and Probability of Exceeding 1 to 3 inches



Threat Score



Bias = Forecasts / Observations

February 2011

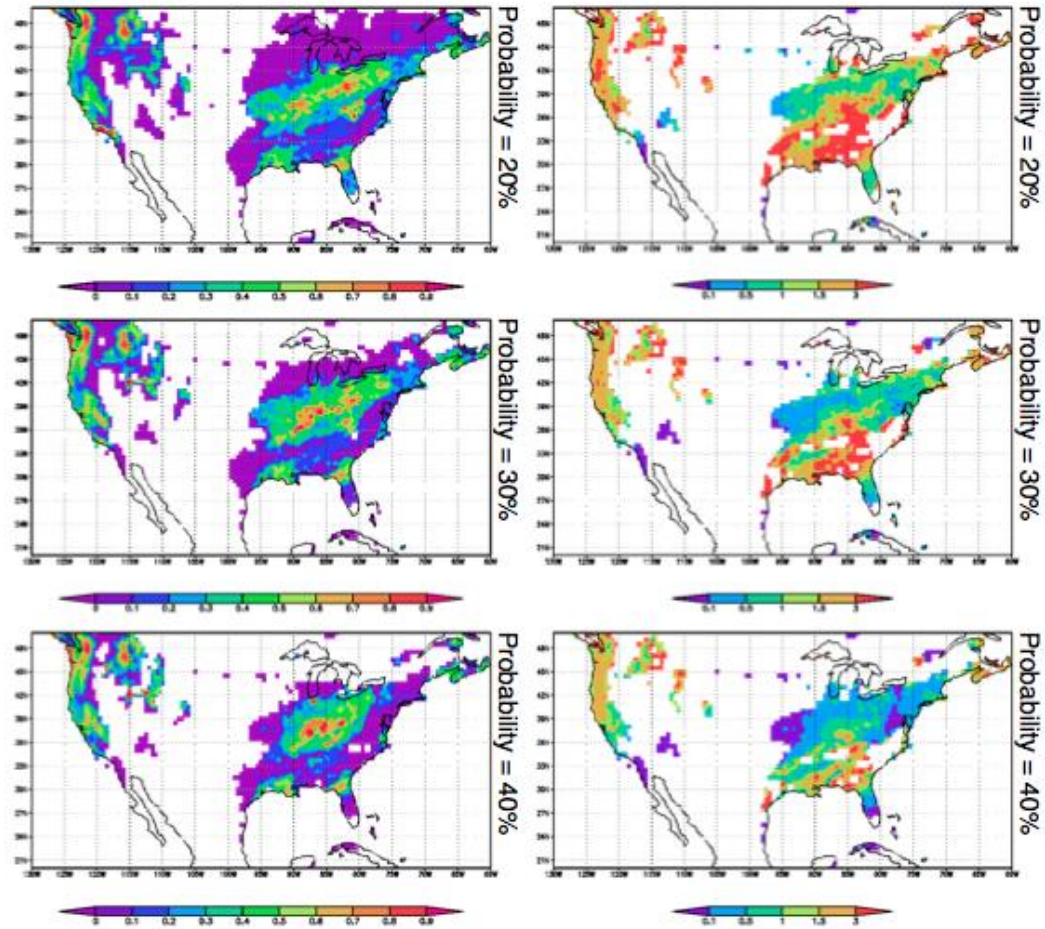
July 2011

**Threat Score:** Percent of correct event forecasts, out of the total number of times an event was either forecasted or observed.

**i.e.** Percent correct event forecasts, ignoring correct non-event forecasts.

**Frequency Bias:** Number of event forecasts divided by number of observations

# Mean Threat Score (Left) & Frequency Bias (Right) For Probability of Exceeding 1 inch and July





# Conclusions

## Threat Scores:

- Hit rate to false alarm rate of threat of precipitation amounts from 1 to 3 inches is optimized with probabilities of exceedence from 20 to 40 %
- Greater skill for winter than summer precipitation; Especially true in areas of convective precipitation
- Lower probability precipitation amounts are predicted with skill by NAEFS for some regions and seasons

## Week-2 T and P:

- NAEFS temperature skill comparable to official NWS manual forecast at many times
  - NAEFS skill greater variability with location and season
- Skill of NAEFS bias-corrected precipitation often exceeds that of manual forecasts
- NAEFS temperature forecasts are slightly overconfident, while manual forecasts are under-confident
- NAEFS precipitation forecasts are over confident and less reliable
  - Very good Heidke Skill but poor Rank Probability Skill



**Thanks!**

Dan.Collins@NOAA.gov



## NAEFS operational forecast compared to Official Manual forecast

Temperature SON2011	6-10 day <u>HSS</u>	6-10 day <u>RPSS</u>	8-14 day <u>HSS</u>	8-14 day <u>RPSS</u>
<u>Manual</u>	<b>26.1</b>	<b>.14</b>	<b>36.8</b>	<b>.27</b>
<u>NAEFS</u>	<b>25.3</b>	<b>.13</b>	<b>38.4</b>	<b>.29</b>

Precipitation SON2011	6-10 day <u>HSS</u>	6-10 day <u>RPSS</u>	8-14 day <u>HSS</u>	8-14 day <u>RPSS</u>
<u>Manual</u>	<b>19.0</b>	<b>.03</b>	<b>14.7</b>	<b>-.03</b>
<u>NAEFS</u>	<b>17.7</b>	<b>-.02</b>	<b>10.9</b>	<b>-.11</b>



## NAEFS operational forecast compared to Official Manual forecast

Temperature	6-10 day	6-10 day	8-14 day	8-14 day
MJJA2011	<u>HSS</u>	<u>RPSS</u>	<u>HSS</u>	<u>RPSS</u>
<u>Manual</u>	<b>37.2</b>	<b>.21</b>	<b>35.1</b>	<b>.17</b>
<u>NAEFS</u>	<b>36.5</b>	<b>.26</b>	<b>33.3</b>	<b>.20</b>
<u>GEFS 06Z</u>	<b>34.4</b>	<b>.23</b>	<b>30.8</b>	<b>.17</b>

Precipitation	6-10 day	6-10 day	8-14 day	8-14 day
MJJA2011	<u>HSS</u>	<u>RPSS</u>	<u>HSS</u>	<u>RPSS</u>
<u>Manual</u>	<b>17.3</b>	<b>.07</b>	<b>12.6</b>	<b>.04</b>
<u>NAEFS</u>	<b>23.7</b>	<b>.06</b>	<b>17.4</b>	<b>.00</b>





## NAEFS operational forecast compared to Official Manual forecast

Temperature DJFM2011	6-10 day <u>HSS</u>	6-10 day <u>RPSS</u>	8-14 day <u>HSS</u>	8-14 day <u>RPSS</u>
<u>Manual</u>	<b>36.8</b>	<b>.22</b>	<b>27.1</b>	<b>.13</b>
<u>NAEFS</u>	<b>28.9</b>	<b>.19</b>	<b>15.9</b>	<b>.01</b>
<u>GEFS 06Z</u>	<b>28.9</b>	<b>.19</b>	<b>15.9</b>	<b>.01</b>

Precipitation DJFM2011	6-10 day <u>HSS</u>	6-10 day <u>RPSS</u>	8-14 day <u>HSS</u>	8-14 day <u>RPSS</u>
<u>Manual</u>	<b>18.0</b>	<b>.07</b>	<b>10.1</b>	<b>.03</b>
<u>NAEFS</u>	<b>23.7</b>	<b>.04</b>	<b>15.3</b>	<b>-.09</b>