# 6.2 DEVELOPMENT, OPERATIONAL USE, AND EVALUATION OF THE PERFECT PROG NATIONAL LIGHTNING PREDICTION SYSTEM AT THE STORM PREDICTION CENTER

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## 1. SPC PERFECT PROG EVOLUTION

The Perfect Prog (Prognosis) Forecast (PPF) system to predict probabilistic Cloud-to-Ground (CG) lightning (Bothwell 2002a) was first implemented at the Storm Prediction Center (SPC) in 2003. Originally, it was designed to aid in predicting dry thunderstorms (lightning with little rainfall) that spark major wildfires in the western United States. It was also designed to provide guidance for the prediction of thunderstorms with high lightning CG flash rates which, in addition to an enhanced threat from lightning, often can be related to severe weather and/or heavy rainfall.

The perfect prog (PP) system is designed to produce forecasts using any Numerical Weather Prediction (NWP) model data as input. It currently runs on four different data sets at the SPC, producing forecasts for one or more CG flashes as well as 10 or more CG flashes and 100 or more CG flashes. The input NWP model data come from the Global Forecast System (GFS), North American Mesoscale (NAM) model, the Rapid Update Cycle (RUC), and the SPC hourly three-dimensional gridded analysis (Bothwell et al. 2002). These differing model inputs result in a multi-model forecast system that provides three hour forecasts at 40 km resolution for periods from zero to 84 hours for the U.S. and out to 180 hours at 45 km resolution for Alaska in 2008. In addition, the three hour forecasts are combined (by using the maximum probability of any of the three hour time periods) to produce forecasts for other time intervals, such as 12, 15 and 24 hours.

When models are upgraded to newer version, no changes to the predictive equations are necessary using the PPF method. The timeliness and temporal coverage of the probabilistic forecast production has been greatly improved by faster computer processing speed, allowing the NAM forecasts to expand from two days to four days. Using the SPC hourly gridded analysis data, the 0 to 3 hour CG lightning forecasts are available about seven minutes past the top of each hour. The forecast from the RUC input data is available in about 45 minutes. The complete forecasts from the NAM and GFS input data are available in about two hours after model run time.

Examples of forecasts and verification of selected events have been presented previously (see Bothwell 2002b, 2005, 2006, 2008a and 2008b). The verification results for archived data from 2003 and 2005-2008 are also presented in this paper. (Computer hardware problems in 2004 had prevented results from being obtained.) Examples of the three hour forecasts from 21 to 00 UTC over the lower 48 states and 00 to 03 UTC for Alaska are used since they both correspond approximately to the peak in their afternoon convective (i.e., daily) activity.

## 2. METHODOLOGY

The objectives as originally detailed in Bothwell (2002a) were to 1) develop a statistical scheme to predict thunderstorms as well as thunderstorms with high CG flash rates 2) fill in the (short-term) gap between purely extrapolative systems and model based systems 3) run on any forecast model or gridded data set (e.g., hourly analysis) and 4) gain a better physical understanding of the differences between low and high CG flash storms.

For the original SPC development, a lightning climatology using data from 1995 to 2002 was developed both as a component of the statistical lightning predictor set and to provide insight into how lightning varied across the U.S. (spatially and temporarily). Climatologies of large CG flash events such as 100 or more CG flashes highlight where and when storms with large numbers of CG flashes might normally be more common.

The equations were produced at the time using a two year developmental sample from the RUC analyses and were designed to produce three hour forecasts at 40 km resolution. The equations can be changed to run on different forecast time periods and model grid resolutions.

Beginning in the summer of 2008, the perfect prog system was expanded to a 45 km grid over Alaska using the GFS model data as input. The Alaska perfect prog system had an 8 year development data set using the North American

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Regional Reanalysis (NARR). In 2009, plans call for using this 8 year NARR development set to develop new equations at 10 km for Alaska as well as for 12 km resolution forecasts over the western U.S. as well as allow the perfect prog system to run using ensemble model data as input in order to improve forecasts at the longer time ranges.

As described in Bothwell (2002a), a principal component analysis grouped over 200 candidate predictors from RUC analyses every three hours into a new predictor set of approximately 10 predictors, with each new predictor related to a distinct physical process. Finally, logistic regression was used to develop the perfect prog equations for 1 or more CG flashes, 10 or more CG flashes and 100 or more CG flashes. The equations were developed for 18 regions (Fig. 1) and 3 hour time periods for summer, fall, winter and spring. Figure 2 shows the actual grid points that were used in the forecast verification (called the enhanced thunder grid-used by SPC for enhanced thunder forecasts)

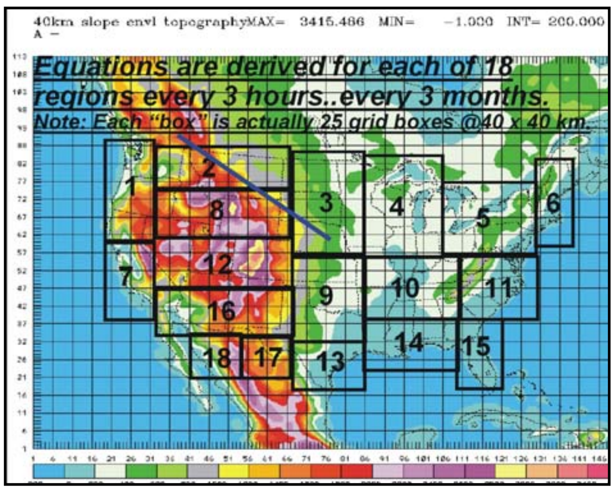


**Figure 1. Location of the 18 regions that use separate sets of prediction equations. Each of the large grid squares shown above contains 25 of the 40 km grid boxes.**

To support fire weather forecast experiments, since 2006 the PPF output has been provided to the Western Region (WR) National Weather Service (NWS) and the forecasters from the various Federal wildland fire agencies in the western United States. A set of automated perfect prog lightning forecasts are produced during the summer time climatological peak in the lightning started wildfires over the West. This experimental system provides guidance for the prediction of dry thunderstorms and is available on an SPC internet web page–see:
http://www.spc.noaa.gov/exper/fcstfirewxltg/loopmain.html.

In 2007, this experimental guidance was expanded to the Weather Forecast Office (WFO) in Raleigh, NC, as part of their effort to forecast high flash density CG lightning events for the early morning Hazardous Weather Outlook. The guidance was similar to that for the western United States; however, the primary emphasis was on lightning events of 100 more CG flashes per 40 km grid box per three hours.

In 2008, the SPC PPF became part of an experimental program with the Eastern Great Basin Geographic Area Coordination Center (GACC) and the Salt Lake City Weather Forecast Office (SLC WFO). The goal was to produce better dry thunderstorm guidance by incorporating fuel data with the forecasts for 10 or more CG forecasts. These forecasts were transmitted to the SLC WFO where they were graphically displayed on the AWIPS computer system.

Through the Joint Fire Sciences Program, the SPC, in partnership with the USDA Forest Service, Pacific Wildland Fire Sciences Lab in Seattle, began development in 2007 of a new set of perfect prog lightning forecast equations for Alaska and ultimately for the western U.S. The first test and evaluation period for Alaska was during the summer of 2008 when three hourly experimental lightning forecasts for one or more and ten or more CG flashes out to 180 hours were made available on the Web to offices in Alaska.

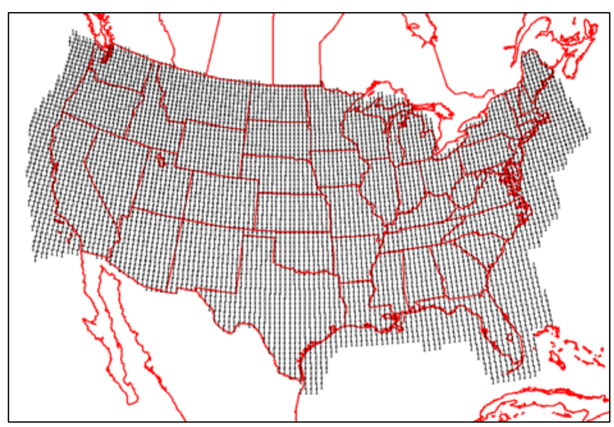

**Figure 2. Grid point locations (at 40 km resolution). These points are also the same points used for the verification (called the enhanced thunder grid)**

## 3. LIGHTNING CLIMATOLOGY

The lightning climatologies that have been developed for both the lower 48 states and Alaska have served to highlight both the spatial and temporal variability for a meteorologist as well as being used in the perfect prog predictor data set. In addition, the sample of lightning climatologies in Fig. 3 illustrates how certain areas are much more likely to experience a significant number of lightning flashes while other areas of the country experience very little lightning or significant lightning, in the mean. A single (i.e., isolated) flash in a grid box can correspond to an event caused by sub-grid scale events, while in all but the most lightning prone areas of the country, 100 or more CG flashes per three hours may occur very infrequently. After several years of evaluating lightning occurrences on the 40 x 40 km grid, and utilizing results in a study by Lengyel (2003), it appears that 10 or more CG flash forecasts (on the 40 x 40 km grid) may offer some of the best prognostic information for fire weather forecasts involving dry thunderstorms (lightning with very little rainfall). If the fuels are available and dry enough to burn, forecasts of approximately 10 or more CG flashes offer the best opportunity to improve fire weather forecasts. While it can take only one CG flash to ignite a fire, as more CG flashes occur, there is a greater chance in ignition with more flashes. Conversely, as the storms increase greatly in intensity, producing 100 or more CG flashes, it becomes more likely that significant wetting rains would also occur, keeping fire starts near zero or certainly at a minimum.

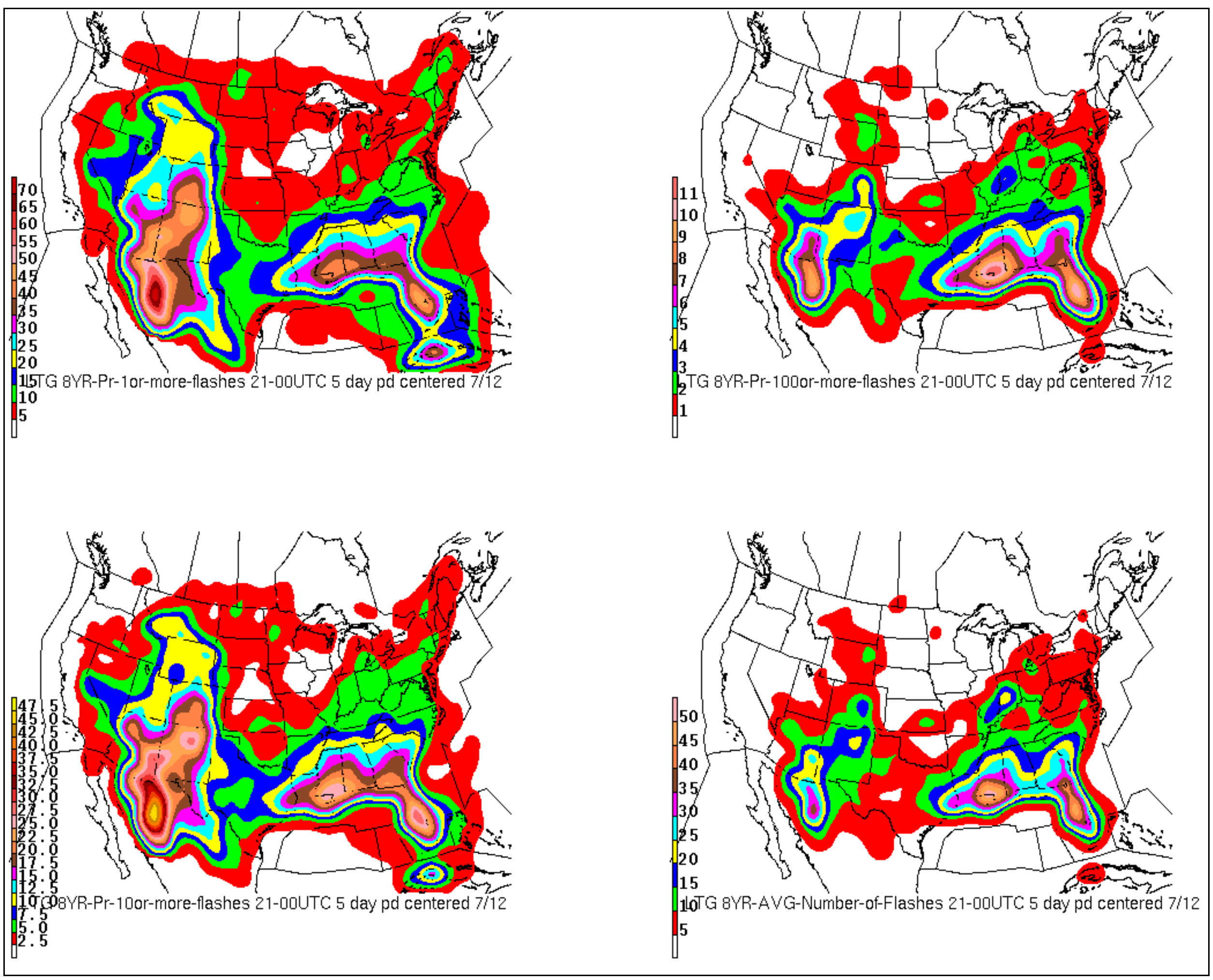


**Figure 3. Lightning climatology for 5 day period centered on 12 July for 21 to 00 UTC (approximate peak in convective activity). Upper left-probability of 1 or more CG flashes, lower left-probability of 10 or more CG flashes, upper right-probability of 100 or more CG flashes and lower right-average number of CG flashes (note color fill intervals along with color bar on left change for each figure)**

While this perfect prog lightning prediction method could be adapted for forecasting any number of CG lightning flashes, the purpose of this paper is to show the benefits of forecasts of general convection (defined here to be 1 or more CG flashes), CG flash rates deemed to be important for dry thunderstorm forecasts (10 or more CG flashes) as well as significant lightning events that pose a threat of power outages, problems with air traffic control, and the threats to life and property (100 or more CG flashes). Examples highlighting the importance of lightning climatology have been shown in Bothwell (2005, 2006, 2008a and 2008b). Since significant lightning outbreaks were the focus of the Raleigh, NC WFO early morning forecasts, Fig. 3 shows how, in examining the climatology or these higher end events, the probabilities are low for North Carolina when looking at 100 or more (less than 5 percent). Florida and the Gulf Coast are higher, with the maximum probability in the late afternoon (21 to 00 UTC) in the middle of the summer around 11 to 12 percent for 100 or more CG flashes and in excess of 50 percent for 1 or more CG flashes.

Beginning in 2007, a lightning climatology was developed for Alaska (Buckey and Bothwell 2009) on a subset of the AWIPS 216 grid (45 by 45 km grid). As Fig. 4 shows, the body of Alaska covers a large area when compared to the lower 48 states. Since lightning is less frequent in Alaska and it has a short season, peaking in June and July, Alaska was not subdivided into separate regions.

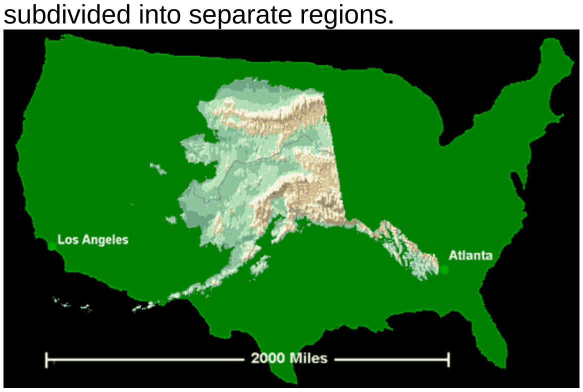


**Figure 4. Overlay of State of Alaska on U.S. map to illustrate size of Alaska.**

Figure 5 shows the area covered and the grids points for the 2008 experimental Alaska forecasts. In addition to having a very short convective season, the climatological values for 1 or more and 10 or more CG flashes (Fig. 6) are shown to be much lower than over much of the lower 48 states.

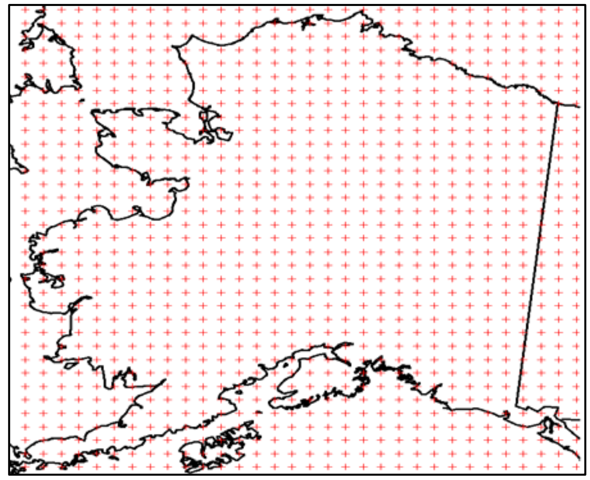

**Figure 5. Domain and 45 x 45 km grid used in 2008 lightning forecasts for Alaska.**

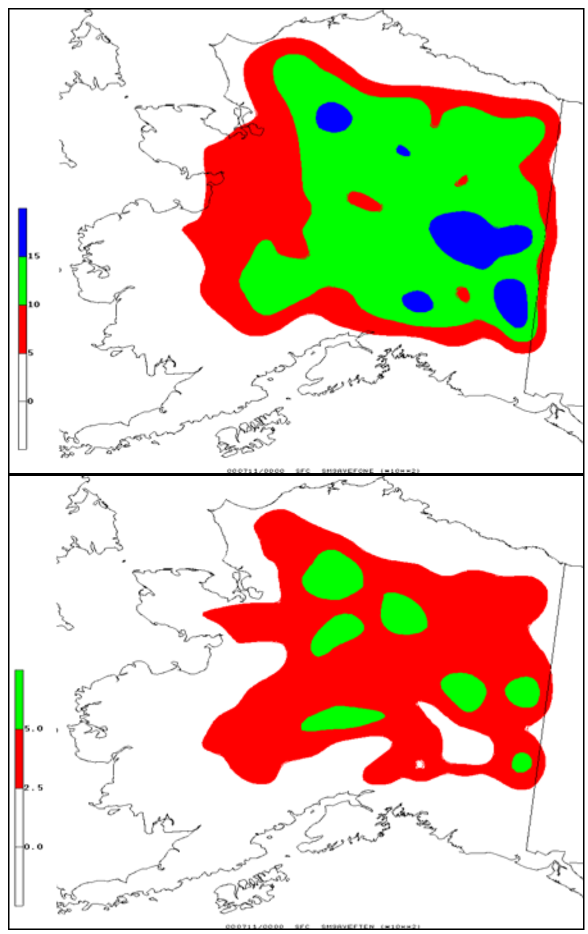

**Figure 6. Lightning climatology for Alaska for 5 day period centered on July 11 for 00 to 03 UTC (approximate peak in convective activity). Top is for probability of 1 or more CG flashes (every 5%) and bottom is for 10 or more (every 2.5%).**

## 4. LIGHTNING FORECAST COMPARISON WITH DIFFERENT MODEL INPUT

Reliability diagrams constitute a convenient method to compare lightning forecast verifications. The reliability diagram in Fig. 7 shows forecasts valid 21 to 00 UTC from differing models/gridded input data sets. All forecasts are for 1 or more CG flashes per 40 km grid box and for the time period from 21-00 UTC, one of the most convectively active times in the lower 48 states as shown in section 3. Generally, the diagram shows the slight under-forecasting below 40 percent with over-forecasting above that. The model and cycle with the poorest reliability is the 00 UTC NAM model run and the forecast time of 21 to 00 UTC represents a 21 to 24 hour forecast. As seen by the succeeding plots for 06 and 12 UTC, the NAM improves only slightly during the next 12 hours (2 model cycles).

All three NAM lines are closely grouped indicating only a small improvement from 00 to 06 and to 12 UTC. Forecast improvement might well be expected as each succeeding model run gets closer to the actual event. Although not shown here, subjectively it has been found that while there can be significant differences between the RUC and the NAM lightning forecasts, NAM forecasts tend to cluster around similar solutions unique to the NAM while the RUC forecasts cluster around solutions unique to the RUC. Both model forecasts can and do adjust to changing moisture and/or the timing of fronts/upper-level troughs, etc. and so the forecasts (for a given model (e.g. NAM) improve from model run to model run).

A significant improvement in the reliability comes with the 12 UTC RUC forecast which represents a 9 to 12 hour forecast (same forecast time as the 12 UTC NAM). Since the perfect prog method treats the forecast as "perfect", one of the reasons may be that the RUC is better able to forecast the lower level moisture and temperature profiles more accurately.

The short term or zero to three hour forecast has the highest reliability. This corresponds to the forecast produced by about 7 minutes past the top of hour from the SPC hourly three-dimensional analysis which combines current surface data with the 1 hour forecast of the RUC model from the previous hour.

Finally, these guidance forecasts demonstrate that using a perfect prog method, the forecaster is able to continually "tune" their own forecast, beginning at a longer time range, first updating as the NAM model runs every 6 hours, then going to the RUC forecast which runs out to 12 hours every three, and finally, zeroing in the event at 0 to 3 hours using the SPC gridded analysis input data.

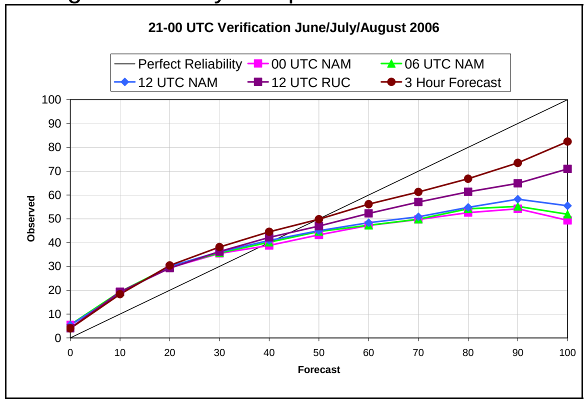


**Figure 7. Example of a reliability diagram comparing verification for all forecasts valid from 21 to 00 UTC during months of June/July/August 2006. Forecasts used input data from the 00, 06, and 12 UTC NAM, 12 UTC RUC and the hourly three-dimensional analysis developed at the SPC.**

## 5. FORECAST RESULTS FOR 1 OR MORE FLASHES

This section will examine forecast results for 1 or more CG flashes. Section 6 will cover forecasts for 10 or more CG flashes and Section 7 will be for 100 or more CG flashes. Figures 8 and 9 are for forecasts of 1 or more derived from the hourly three-dimensional data analysis produced at the SPC (Bothwell 2002). These are forecasts for the months of June, July and August of 2003, 2005, 2006, 2007 and 2008. As mentioned earlier, 2004 forecasts were unavailable due to computer problems. The forecasts (valid for the next three hours) are available in real time about 7 minutes past the top of the hour.

Figure 8 is the reliability diagram for all three hour forecasts valid from 21 to 00 UTC. For forecasts up to about 40 percent, there is a trend in the forecasts from 2003 to 2008 towards the line for perfect reliability. However, above 40 percent, there is a noticeable trend in the forecasts towards over-forecasting. Several changes related back to the RUC model itself and the original perfect prog equations can explain some of these changes. First, the original development of the equations was limited (at that time) to only two years of RUC data as development data. Plans are already in place to greatly increase the development sample size which should improve the equations. Secondly, as a model improves (such as the RUC), the results should also improve for the perfect prog forecasts.

In the cases from 2003 through 2008, there is evidence that over the years, the RUC model has itself become more moist and with higher CAPE. An examination of individual plots of each of the forecasts and lightning from the summers of 2003 and 2008 support the idea that the RUC is indeed becoming more moist with time. The plots for 2008 (not shown) highlight many more areas of higher lightning probabilities (greater than 70 percent) but generally over small (or very small) areas. While the number of "hit points" for correct forecasts of lightning in the greater than 70 percent areas has stayed roughly the same, the number of forecasts points for greater than 70 have greatly increased. Information on the RUC model changes since 2003 indicate a significant "moistening" in the RUC model came between 2003 and 2005 as data assimilation techniques changed. This is shown in the reliability diagram as a shift by 2005 towards over-forecasting at higher probabilities. Also, while normally these three hour forecasts use a 1 hour forecast from the previous hour's RUC model data for all data above the surface, about 20 percent of 2003 had been reprocessed using data valid for that hour which could lead to improved forecasts. The "moistening of the input data" is likely a least partially responsible for the shift towards increased reliability at or below 40 percent as mentioned earlier. It is anticipated that a new set of perfect prog equations under development can address the over-forecasting at the higher percentages.

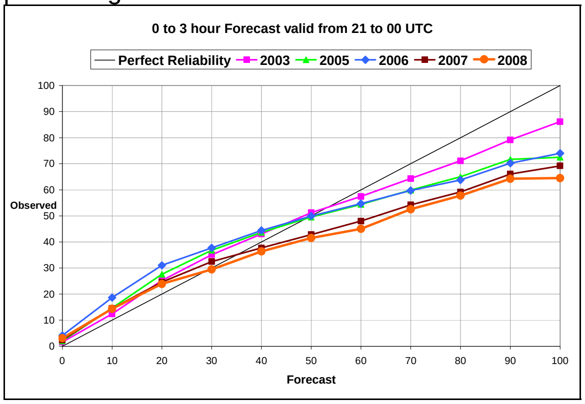


**Figure 8. Reliability diagram for time period 21 to 00 UTC for the zero to three hour forecasts (June, July and August for 2003, and 2005-2008).**

In order to illustrate the performance of the three hour forecasts over the course of the entire day, Fig. 9 shows all three hour forecasts combined (start times of 00, 03, 06, 09, 12, 15, 18 and 21 UTC). These results (Fig. 9) indicated the best performance (higher reliability) from the perfect prog is around the time of the convective maximum (Fig. 8).

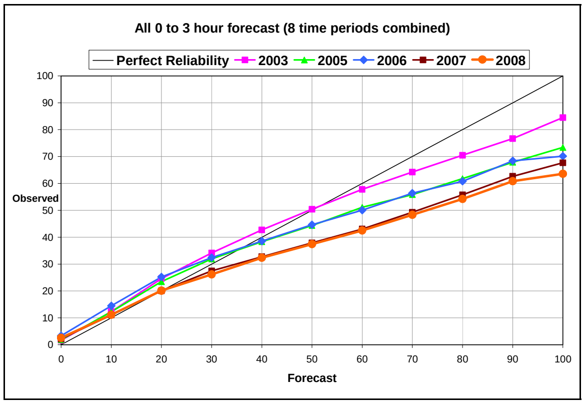


**Figure 9. Same as Fig. 8, but for all 8 forecast times combined (00-03, 03-06, 06-09, 09-12, 12-15, 15-18, 18-21 and 21-00 UTC)**

As mentioned earlier, the three hour forecasts can be combined to form 12, 15 and 24 hour forecasts using a method that simply takes the maximum of any three hour time period in the time interval at each grid point and assigns that as the forecast value. Since the RUC is currently run out to 12 hours (every three hours), the perfect prog method applied to the 3 hour forecasts produces a 15 hour forecast every 3 hours (the last perfect prog forecast interval being valid from 12 to 15 hours). For comparison with using NAM model input data, the 12 UTC NAM results are also shown. They are very similar to the 12 UTC RUC and all RUC 15 hour forecasts throughout the day. Results from 2008 (June, July and August) are shown in Fig. 10 and represent the best overall reliability for the perfect prog forecasts. As shown in the insert box in Fig. 10 (upper left), probability of detection (POD) for forecasts of 20 percent and higher is over 90%.

An examination of all individual three hour forecasts made using RUC input data (Bothwell 2008b) shows the perfect prog performance does indeed decrease in the overnight hours. This may be partially due to the fact that the current perfect prog method does not consider ongoing activity and storms ongoing at the start

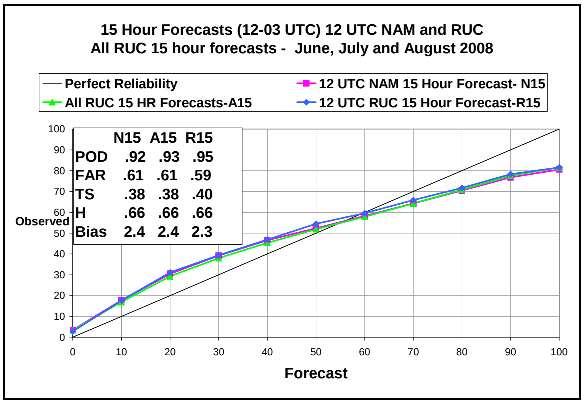


**Figure 10. Perfect Prog 15 hour forecasts using NAM and RUC input data at 12 UTC, and all RUC 15 hour forecasts produced at 00, 03, 06, 09, 12, 15, 18 and 21 UTC. Insert box shows Probability of Detection (POD), False Alarm Ration (FAR), Threat Score (TS), Hit Rate (H) and Bias.**

of the forecast may diminish and/or end, yet if CG flashes are occurring at the start of the period, any scoring of the forecasts will show less positive results. It may also indicate that it may be harder to forecast around the normal convective (nighttime) minimum vs. the convective maximum. Elevated storms are more frequent at night and elevated instability is harder to predict.

Since lightning starts the majority of the wildfires in the West each summer, forecasts of 1 or more CG flashes for the West have been available on the Web since 2006 for fire weather forecasters. Figure 11 shows results for the June, July and August forecasts from 12 to 12 UTC for 2006 through 2008 using NAM input data from 06 UTC. In this case, the 06 UTC NAM run was chosen as that would the first available model run for forecast input in the early morning. The results for the U.S. enhanced thunder domain (Fig. 2), the western U.S. (west of 102 west longitude) and for Utah exhibit significant under-forecasting for 1 or more CG flashes. In Bothwell (2002a), it was found that in the West; about 20 percent of each 40 x 40 km grid box had only one flash, making it a less frequent event. However, since we know from experience that it only takes one flash to start a wildfire, it remains difficult to forecast for single flash/rare events, which by their very nature may be forming under convectively unfavorable conditions.

The final figure (Fig. 12) in this section shows the results for 2008 for the Alaska perfect

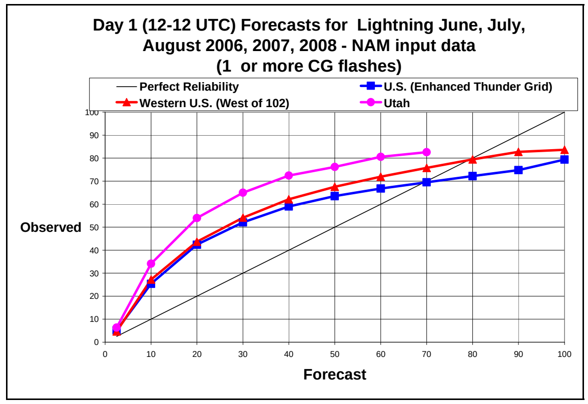


**Figure 11. Reliability diagram for 1 or more CG flashes for Day 1 (24 hours) forecasts using 06 UTC NAM input for the U.S., Western U.S. and for Utah.**

prog forecasts for both 1 or more CG and 10 or more CG flashes. The full results for the Alaska perfect prog forecasts are detailed in Bothwell and Buckey (2009). As shown in a lightning climatology (Buckey and Bothwell 2009), a relatively short convective season for Alaska has a peak (over 35 percent total flashes) in the daily activity about 3 hours later than for the lower 48 states (i.e., 00 to 03 UTC vs. 21-00 UTC). Thus, Fig. 12 (all 00 to 03 UTC forecasts) is a substantially different time period from Fig. 11 (24 hour forecasts from 12 to12 UTC). The reliability diagram in Fig.12 does show fairly good reliability for 1 or more CG flashes although the POD is only .51. Since the majority of Alaska is dominated by grid boxes with no lightning, the Hit Rate is 0.95. Another way to view this is given by the percentage correct forecasts (Hit rate*100%) or 95 percent.

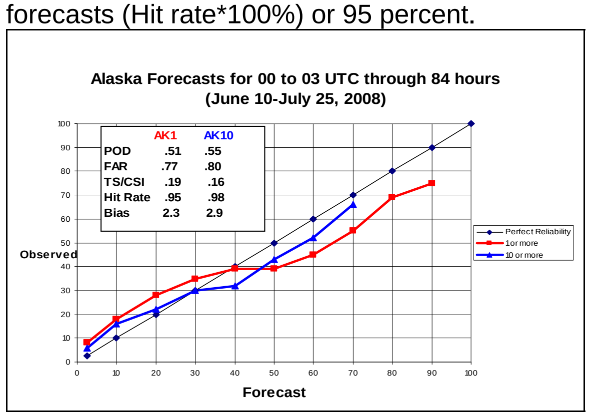


**Figure 12. Reliability diagram for both 1 or more as well as 10 or more CG flashes for majority of Alaska summer convective season during 2008. Insert box shows Probability of Detection (POD), False Alarm Ration (FAR), Threat Score/Critical Success Index (TS/CSI), Hit Rate and Bias.**

## 6. FORECAST RESULTS FOR 10 OR MORE FLASHES

For the summer of 2008, the SPC worked with the Salt Lake City National Weather Service Office and the Eastern Great Basin Geographic Area Coordination Center to provide forecasts for 10 or more CG flashes (using NAM model input). Fig. 13 shows the verification and reliability of these forecasts for the June, July and August 2008 for a "Day 1" time period from 18 to 06 UTC. Note that this 12 hour period is a different time period than has been used in the past, but matched the first forecast time period that was required for the experiment. For the region west of 102 west longitude, there is under-forecasting below 50 percent and over-forecasting above 50 percent. The results for just Utah (area of the experiment) for 18 to 06 UTC are also shown as well as the 21-00 UTC time period (near maximum convection). There were too few points to plot above 60 percent on the reliability diagram except for all points west of 102. Although the reliability diagram shows under-forecasting for Utah at 21 to 00 UTC, the 3 hour forecast around this maximum convection actually exhibits the highest POD (0.74), and the best threat score of 0.35 (all for 10% and above forecasts).

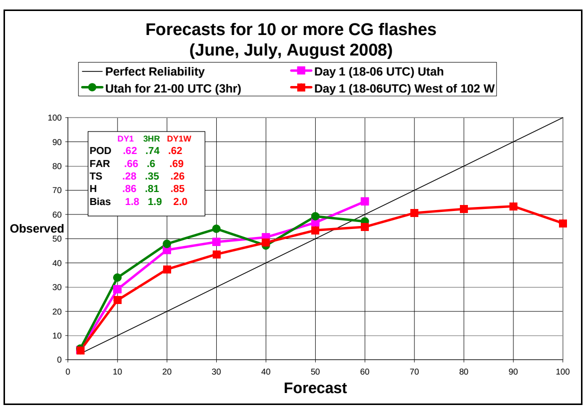


**Figure 13. Reliability diagram for summer 2008 probability of 10 or more CG flashes for 18 to 06 UTC for western U.S., Utah and for Utah from 21-00 UTC using 12 UTC NAM (approximate convective maximum). Insert box shows Probability of Detection (POD), False Alarm Ration (FAR), Threat Score (TS), Hit Rate (H) and Bias.**

Finally, Fig. 14 is an example of the forecasts for 10 or more CG flashes for Alaska. For further details see Bothwell and Buckey (2009) and Buckey and Bothwell (2009). Using an 8 year developmental sample and GFS model real-time input, the perfect prog method has been able to capture significant lightning events for Alaska. This figure shows both the forecast and lightning. The forecast probabilities of 10 to over 20 percent are extremely significant since this is about 4 times higher than the climatological value for 10 or more CG flashes.

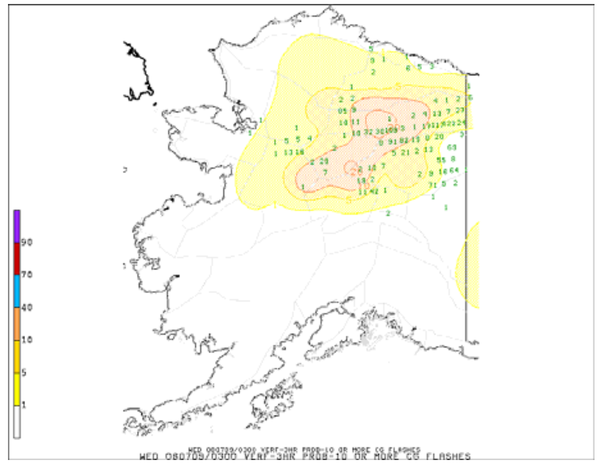

**Figure 14. 72 to 75 hour forecast from GFS model input. Valid from 00 to 03 UTC 9 July 2008. Forecast is for 10 or more CG flashes (contours) and lightning (plotted numbers).**

## 7. FORECAST RESULTS FOR 100 OR MORE FLASHES

Previous methods at predicting significant lightning events starting with Reap (1986) have generally not been successful. Starting with Bothwell (2002a) and as shown in Bothwell (2005, 2006, 2008a and 2008b), the PPF method has demonstrated the ability to predict significant lightning events. The value of what is a significant number of lightning flashes is not uniquely tied to a number or range such as 100 or more CG flashes. Rather, whatever CG flash rate is chosen, the most important part of forecasting and the verification is to relate it to the appropriate climatology of the event, time of day as well as the size of the grid box. For 100 or more CG flashes, when examining the U.S. lightning climatology (Fig. 3), for the late afternoon time period in the middle of the summer, the maximum observed percentage is only about 11 to 12 percent and that is mainly along the Gulf Coast and in Florida. Across the majority of the U.S., it is less than 5 percent.

Figure 15 examines the 24 hour forecasts from12 to 12 UTC for 100 or more flashes for three areas; 1) east of 102 longitude, 2) Florida and 3) North Carolina for the summer months of 2006-2008. There is under-forecasting for all three areas below 30 percent and a lack of resolution for the higher probability values where over-forecasting is evident. Also, it is important to note that only about 1 to 2 percent of forecasts for Florida or North Carolina are 70 percent or higher, and Florida does have a very high POD with 0.82.

In addition, sometimes with numerical scoring techniques, a high probability (especially relative to climatology) may be forecast, yet slightly off spatially. These forecasts are still valuable to signal "big event days", even if spatially, the areas are not exactly in the correct location. Areas with higher forecast probabilities should still be monitored, especially for model run to run consistency.

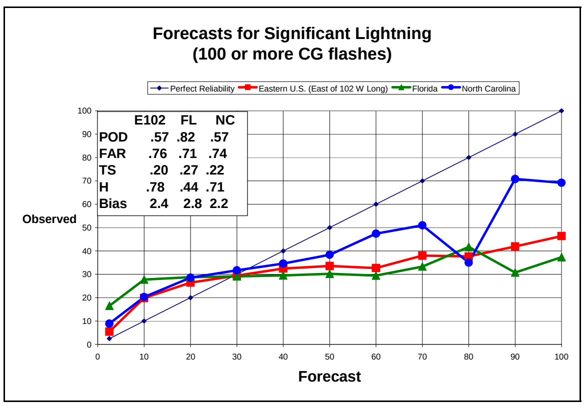


**Figure 15. Reliability diagrams for 100 or more CG flash forecasts from June, July and August 2006-2008 for eastern U.S., Florida, and North Carolina. Insert box shows Probability of Detection (POD), False Alarm Ration (FAR), Threat Score (TS), Hit Rate (H) and Bias.**

As an example of a forecast for a "big day", Fig. 16 shows the area including Raleigh, North Carolina from 12 to 12 UTC 2 August to 3 August 2008. A large portion of the area had very high probabilities and many areas exceeded 100 CG flashes during this time period.

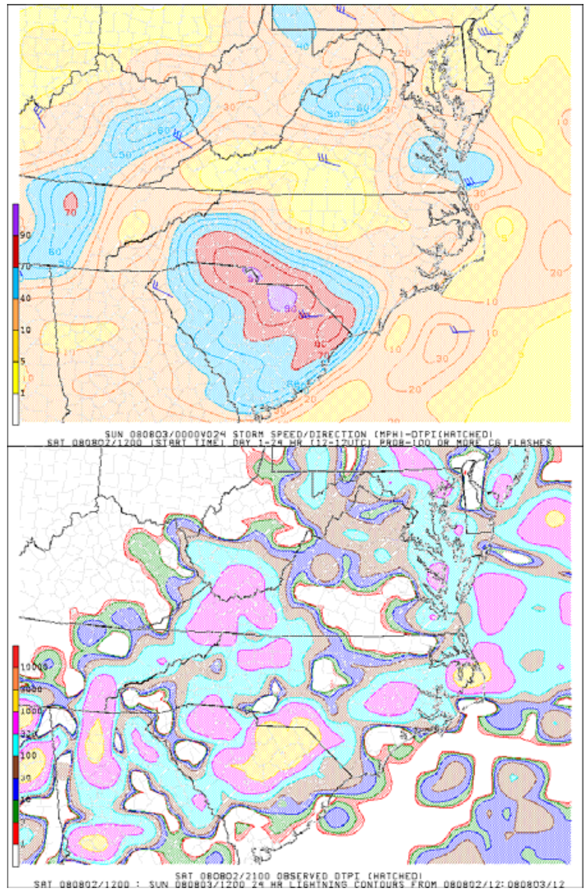

**Figure 16. Forecast for 100 or more CG flashes from 12 UTC 2 August to 12 UTC 3 August 2008 (top figure) and observed lightning during same time period (bottom figure). 2 August 2008 00 UTC NAM input data.**

Another significant event affected Chicago and surrounding areas on 4 August 2008 (Fig. 17). In this case, the perfect prog forecasts were able to highlight the most affected area.

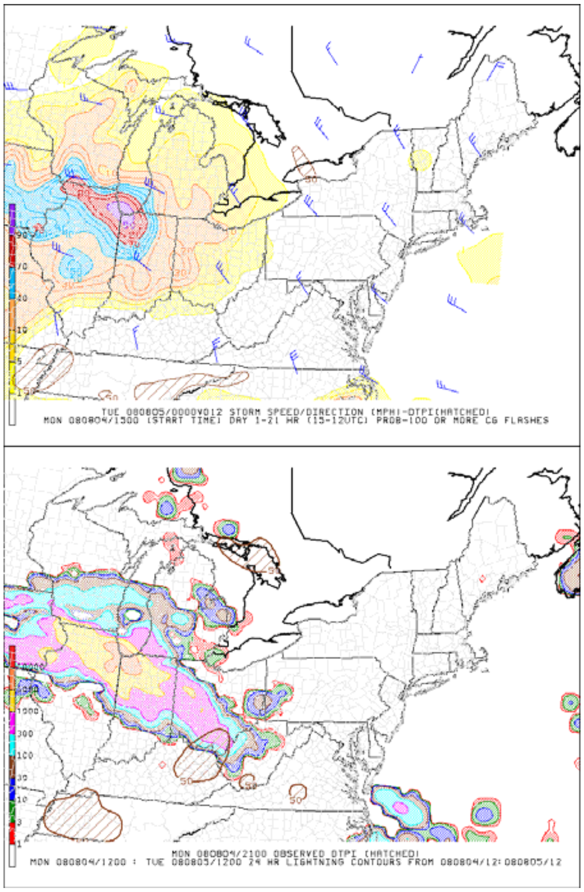


**Figure 17. Forecast for 100 or more CG flashes from 12 UTC 4 August to 12 UTC 5 August 2008 (top figure) and observed lightning during same time period (bottom figure). Note that small brown hatched areas are related to a dry thunderstorm potential index and should not be considered important for this paper. 4 August 2008 12 UTC NAM input data used.**

## 8. CONCLUSIONS AND FUTURE WORK

The perfect prog forecast system at the SPC provides useful guidance on lightning and significant lightning from zero to 84 hours for the lower 48 states and out to 180 hours for Alaska. Generally superior results were obtained for the Alaska forecasts, and this is likely due in part to having a much larger training data set comprised of 8 years. Efforts are underway to produce new forecast equations for the lower 48 states at higher resolution using the longer developmental samples available. The Alaska forecasts are being upgraded from the 45 km grids in 2008 to 10 km grids for 2009 and plans are for the lower 48 states to have 12 km gridded forecasts (both of the grids would be compatible with the AWIPS grids for Alaska and the lower 48 states).

The most skill is in the zero to three hour forecasts which are available within seven minutes past the top of the each hour. The RUC individual 3 hour forecasts, when combined to produce the 15 hour forecasts are the most reliable with a high probability of detection. The NAM perfect prog lightning guidance, while not as reliable as the hourly or RUC guidance, provides guidance for much longer periods of time (through Day 3 and part of the Day 4 forecast period). One possible reason for the lower NAM scores is due to moisture problems within the lower levels of the NAM. Improvements in the moisture forecasts of the NAM would likely improve the perfect prog forecasts. Finally, these results are not totally unexpected since the NAM extends the farthest in time when predictability typically decreases. As the forecast time nears the actual time, the perfect prog forecasts have been shown to improve dramatically.

With the forecast grid spacing from 45 to 10 km for Alaska and from 40 km to 12 km for the lower 48 states, and new predictive equations are developed, they are expected to cover 1, 2, and 3 CG flashes per smaller grid box (due to the decreased area within each grid box).

In cooperation with the NWS Western Region and the western U.S. Geographic Area Coordination Centers in the west (2009), forecasts will be available on the SPC internet web page and disseminated into the NWS AWIPS Graphical Forecast Editor. This experimental data will be displayed and evaluated for the production of new and improved dry thunderstorm forecasts, incorporating both the meteorology as well as important fuel data.

## 9. ACKNOWLEDGEMENTS

Andy Dean of the SPC Science Support Branch provided very valuable support in helping to produce the verification data.

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