November 2, 2010

Storm-Based Auto PRF Details

The following function logic is suggested for inclusion in the baseline software as non-operational to support further testing:

Add two options to the Auto PRF function.

Option 1: Operator-Selected Storm-Based Auto PRF:

The Operator-Selected Storm-Based Auto PRF function will automatically track a selected storm of interest and assign the best PRF for that storm.

Upon selection of this option, this function will accept a storm ID, as input by the operator, and use the Storm Cell Identification and Tracking (SCIT) algorithm output to project the location of the selected cell for the next volume scan. Then, for this forecast location, the function will select the PRF that provides the fewest number of obscured 1km bins over the storm of interest. Each subsequent volume scan, the function would automatically use the SCIT Storm ID forecast location for the storm of interest and select the "Best PRF" based on this forecast location.

Detail:

1. Modify the PRF Selection function to accept a Storm ID
2. Use the "forecast position" from SCIT to project where the storm of interest will be next volume scan
3. Using this forecast location, calculate a "storm circle". The "storm circle" is defined as the boundary of a 20km[*1] radius circle around the projected storm location
4. Modify the Auto PRF algorithm to:
   Calculate the number of "obscured" 1km bins within the "storm circle" for each Doppler PRF
   Select the PRF that results in the fewest obscured 1km bins within the "storm circle"
   Download the modified VCP to the RDA
5. Each subsequent volume scan, recalculate the "storm circle" based on the new projected location of the storm ID
6. Repeat steps 2 through 5 until the one of the following conditions are satisfied
7. Continue to use this storm ID as the basis for the Auto PRF algorithm until either:
   the Storm ID moves beyond 230 km from the radar,
   the particular Storm ID is no longer identified by SCIT,
   the operator turns off the Storm-Based Auto PRF option, or
   the operator selects a different "storm of interest"
8. If one of the conditions in step 7 are met, then disable the Storm-Based Auto PRF function.

The result of this application is a dynamic PRF that tracks a storm of interest and continuously assigns the "Best" Doppler PRF for that storm.

Option 2: Fully Automated Storm-Based Auto PRF:

The Automated Storm-Based Auto PRF function automatically tracks the $3^{*2,3}$ most significant storms (based on Cell-Based VIL from the Storm Tracking and Forecast algorithm (SCIT) output) and assigns the PRF that results in the fewest range-obscured 1km range bin for those storms.

Upon selection of this option, this function will identify the $3^{*2,3}$ most significant storms based on Cell-Based VIL. Using SCIT output, project the location of the $3^{*2,3}$ identified cell for the next volume scan. For each projected storm location, calculate a "storm circle". Calculate the number of range obscured 1km range bins within each storm circle for each Doppler PRF. Select the PRF that provides the fewest total number of range folded 1km bins. Each subsequent volume scan, repeat this sequence to dynamically forecast the location of the $3^{*2,3}$ most significant storms and select the best PRF for those storms.

The result of this application is a dynamic PRF that tracks the most significant storms and continuously assigns the "Best" Doppler PRF for those storms.

Detail:

1. When this option is enabled, automatically select the $3^{*2,3}$ most significant storms based on the Cell-Based VIL
2. Use the "forecast position" from SCIT to project where these storms will be next volume scan
3. Using the forecast locations, calculate a "storm circle" for each storm. The "storm circle" is defined as the boundary of a $20km^{1}$ radius circle around the projected storm location
4. Modify the Auto PRF algorithm to:
   Calculate the number of "obscured" 1km bins within each "storm circle" for each Doppler PRF
   Select the PRF that results in the fewest obscured 1km bins within the "storm circles"
   Download the modified VCP to the RDA
5. Each subsequent volume scan, select the top $3^{*2,3}$ storms from the ranking of Cell-Based VIL
6. Recalculate the "storm circles" based on the new projected location for each storm
7. Repeat steps 1-6 until there are no storms identified by the SCIT algorithm
8. If the condition in step 7 is not met, then disable the Automated Storm-Based Auto PRF function.

Note*[1]: The 20km radius was based on the same logic as used in determining the correlation distance for Mesocyclone Detection Algorithm to associate a “Low Core” circulation with a SCIT identified cell location.

Note*[2]: The function will track and process up to 3 storms. If there are fewer than 3 storms then use the number of storms available.

Note*[3]: The number of storms should be adaptable for testing. Range 2 to 5.

Background Information:

Reasoning: 1) Comments from operational field personnel like the following; “In a mini-postmortem this morning I learned that forecasters had a difficult time locating the correct storm to warn on because of data quality issues. I examined data from the closest radar, KFDR, and soon discovered that the storm was located near the beginning of the second trip most of the time which resulted in significantly degraded velocity data. The radar was in VCP 12 with auto PRF on. Unfortunately, the auto PRF moved the PRF three times, each time placing the storm in a few miles inside second trip. The answer would be to try VCP212 or set a manual PRF that places the storm back in the first trip. ” KTLX SOO Dave Andra. 2) Data analysis has strongly suggested that a Storm-Based Auto PRF function should reduce the impact of range folded velocity obscuration in many isolated severe storm cases. However, with only replay data we are very limited in our ability to test this concept.

Goals: 1) Support a working version of Storm-Based Auto PRF to test on KCRI. 2) Use the information gained to modify, if required, the Storm-Based Auto PRF decision logic. 3) Use the information gained through testing to develop an operational CONOPS for Storm-Based Auto PRF. 4) If the Storm-Based Auto PRF function provides improved velocity data support a field test to ascertain its operational usefulness. 5) If warranted, use this information to support a fleet-wide fielding decision.

Results: Please refer the slide presentation (CCR 10-0004/ECP 0475 attachment SBAP_SREC_Apr_2010_Slides.pdf) for example results of the desktop analysis.

The Storm-Based Auto PRF function is an additional capability that the operator may select/control. It DOES NOT remove or replace any current capability.