P8.15 RAPID UPDATE OF THE NATIONAL SEVERE STORMS LABORATORY SEVERE WEATHER DETECTION ALGORITHMS

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1. INTRODUCTION

The National Severe Storms Laboratory (NSSL) has developed a Severe Storm Analysis Package (SSAP) containing a suite of algorithms for detection of severe weather parameters. Algorithmic output is displayed at the end of each volume scan. The time lag between occurrence and identification of severe weather features can be as long as six minutes. A new version of SSAP (version 4.0) contains a rapid update system (Wyatt et al. 1998) that allows algorithmic information to be disseminated in a more timely manner at the end of each elevation scan. This would have a positive impact on the warning decision process for users such as the National Weather Service and Federal Aviation Administration.

Four algorithms within SSAP have been modified to contain a rapid update capability: the Storm Cell Identification and Tracking (SCIT) algorithm (Johnson et al. 1998), including the Hail Detection Algorithm (HDA; Witt et al. 1998); the Tornado Detection Algorithm (TDA; Mitchell et al. 1998); and the Mesocyclone Detection Algorithm (MDA; Stumpf et al. 1998).

The Warning Decision Support System-Integrated Information (WDSS-II) is the National Severe Storms Laboratory's (NSSL) warning decision technology platform. WDSS-II can ingest data from multiple observational platforms and WSR-88D data from multiple radars in addition to displaying SSAP algorithmic output. WDSS-II also has the capability of displaying rapid update output so that severe weather features are updated on the display after each elevation scan.

2. RAPID UPDATE SYSTEM

The rapid update system is initiated after the first elevation scan of data. New 2D features from SCIT, MDA, and TDA are identified. Two-dimensional components include horizontal runs of adjacent reflectivity gates above a specified threshold (SCIT) and regions of horizontal shear above a specified threshold (MDA and TDA). The 2D features are matched with their corresponding 3D features from the previous volume scan. Forecasting where the 3D feature will be located at the beginning of the next volume scan allows features from both volume scans to be associated. The 2D feature is matched to the closest 3D feature forecasted position.

Associating features after the first elevation scan allows the range and azimuth of severe weather features to be updated immediately in the current volume scan. The position of the icon representing the severe weather feature in the WDSS-II display is changed accordingly.

At this time the 2D feature of the current volume scan inherits the attributes of the associated 3D feature. For example, for a tornado vortex detection within TDA, the 2D feature inherits the following attributes: identification number (ID), circulation type, mesocyclone ID and storm cell ID the TDA feature is associated with, the base height, top height, depth, low-level velocity difference across azimuths, maximum velocity difference, low-level shear, maximum shear, and propagation speed and direction. A list of feature attributes that are passed from a 3D feature within the previous volume scan to a new 2D detection in the current volume scan for each SSAP algorithm is given in Table 1.

As each additional elevation scan of data is made available within the current volume scan, vertically adjacent 2D features are associated to produce a 3D feature (Johnson et al. 1998; Witt et al. 1998; Mitchell et al. 1998; Stumpf et al. 1998). Once the 3D feature is completely built (or topped), which typically occurs prior to the end of the volume scan, the attributes of the new 3D feature are updated to reflect information from the current volume scan.

However, 3D feature attributes are allowed to be modified while the 3D feature is being built only if the attribute has become more severe. For example, if the maximum velocity difference within a TDA vortex detection has become greater than the same attribute within the 3D detection in the previous volume scan, then the attribute information within the current volume scan is updated immediately. In this way, 3D feature attributes can change in the current volume scan even before the 3D feature is completely built.

3. TESTING AND IMPLEMENTION WITHIN ORPG

The rapid update system as part of SSAP version 4.0 is being tested for robustness and accuracy at this time. The rapid update system will be included within the WSR-88D Open System (Saffle and Johnson 1998). Currently, it is being considered for implementation within Open Radar Product Generator Build 5.0.

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TABLE 1: Attributes for SSAP algorithmic features that can potentially be updated after each elevation scan within the rapid update system.

SCIT	Base Height Top Height Maximum Reflectivity Height of Maximum Reflectivity Storm motion direction Storm motion speed Probability of Hail Probability of Severe Hail Hail Size Estimate VIL
MDA	Circulation type Base Height Top Height Depth Low-Level Diameter Maximum Diameter Low-Level Rotational Velocity Maximum Rotational Velocity Low-Level Shear Maximum Shear Low-Level Gate-to-Gate Velocity Difference Maximum Gate-to-Gate Velocity Difference Mesocyclone Strength Rank Mesoscyclone Strength Index Probability of Tornado Probability of Severe Weather
TDA	Circulation type Base Height Top Height Depth Low-Level Velocity Difference Maximum Velocity Difference Low-Level Shear Maximum shear Propagation speed and direction
HDA	Probability of Hail

A more comprehensive review of the rapid update system including display graphics can be viewed at http://www.nssl.noaa.gov/~porter/rapidupdate.

5. References

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