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WARNING DECISION SUPPORT SYSTEM – INTEGRATED INFORMATION (WDSS-II) PROGRESS AND PLANS

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1. INTRODUCTION

Previous publications (Hondl, 1997, and Hondl, 2003) have detailed the early development of the Warning Decision Support System – Integrated Information (WDSS-II) at the National Severe Storms Laboratory (NSSL). Our purpose in developing WDSS-II was to support the mission of NSSL to improve NOAA's capabilities to provide accurate and timely warnings of hazardous and severe weather. The WDSS-II system is the culmination of 10+ years of research in the development of automated tools and guidance products to help forecasters diagnose severe weather.

This paper is intended to be an overview of the current state of the WDSS-II development effort and highlight some the new applications and uses of WDSS-II. A more detailed description of WDSS-II products may be obtained in the forthcoming publication (Lakshmanan, et al., 2007c).

2. OVERVIEW OF WDSS-II

An operational version of the WDSS-II system is running 24/7 at NSSL and is ingesting the national network of WSR-88D Level II data, GOES satellite data, RUC model analysis products, surface observation data, and lightning data. These data are ingested and made available for further processing by a distributed cluster of Linux servers.

The individual WSR-88D data are quality controlled by an automated neural network algorithm (Lakshmanan, et al., 2007a) to remove non-precipitation echoes, velocity dealiased, and derive an estimate of the azimuthal shear (Smith and Elmore, 2004).

The WSR-88D reflectivity data are then mapped to a 3D coordinate system using intelligent agents (Lakshmanan, et al., 2007b) across the conterminous United States (CONUS). The 3D CONUS product is further integrated with thermodynamic data from the RUC model to indentify regions of hail and estimates of hail size as a 2D product. The hail products were extensively

evaluated during the Severe Hail Verification Experiment (SHAVE, Smith, et al., 2006) during the summer of 2006. The azimuthal shear products from the individual WSR-88D radars were also combined over the CONUS to produce a "rotation track" product that may be used to identify the paths of mesocyclonic circulations.

3. DISPLAY DEVELOPMENT ACTIVITIES

The WDSS-II display application has undergone considerable development during the last couple years. Most notable is the development of the Four Dimensional Storm Cell Investigator (FSI, Stumpf, et al, 2006) which will port the WDSS-II display capability to run as an external application on the AWIPS display.

The FSI application is being developed to provide NWS forecasters with a greater capability to visualize radar data of severe storms using continuously and dynamically updating cross section displays. The FSI is scheduled to be alpha-tested at select NWS forecast offices in early 2007.

The WDSS-II display application is now also supported on Windows XP platforms.

4. R&D APPLICATIONS OF WDSS-II

The WDSS-II applications have been used within several ongoing research projects that NSSL has been involved in over the last couple of years. These projects have been able to integrate their datasets with other observational sensors allowing researchers to visualize and analyze their unique datasets.

The National Weather Radar Testbed (NWRT, Forsyth et al., 2007) facility is using WDSS-II to display Phased Array Radar data during real-time operations. The PAR data are ingested radial-by-radial and processed by several meteorological algorithms and available for display within seconds. The faster volumetric data rate of the NWRT-PAR means that forecasters will have less time to analyze the observational data and therefore algorithms will be required to perform the initial data reduction analysis. The WDSS-II software tools have also been used to statistically compare NWRT data to coincident WSR-88D data.

The Engineering Research Center (ERC) for Collaborative Adaptive Sensing of the Atmosphere (CASA, Brotzge, et al., 2007) is also utilizing WDSS-II

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software within their initial testbed activities. The WDSS-II system has been used to develop and test several severe weather detection algorithms for storm cell and circulation signature detections.

WDSS-II applications have also been developed to ingest other non-WSR-88D data, including data from the KOUN Dual Polarization WSR-88D prototype, the Canadian radar network and the Shared Mobile Atmospheric Research and Teaching Radars (SMART-R). The Canadian radar data is being evaluated to augment the coverage of the WSR-88D radar network along the northern border of the US. The SMART-R is being evaluated as a potential emergency replacement for the WSR-88D and the addition of the WDSS-II system will allow radar data to be provided to NWS forecasters in the event of an emergency.

The Lightning Mapping Array (LMA) system installed by NSSL also uses the WDSS-II system to process the lightning source points in real-time (Lakshmanan, et al., 2004). The source points are converted into 3D lightning source density values as well as vertical composite values. These products are then converted to AWIPS NetCDF format and sent to the Norman NWS Forecast Office for evaluation.

5. FUTURE PLANS

Several new and exciting projects are on the schedule for development this year. The evaluation of the NWRT-PAR data and its application to improve severe weather detection will result in adaptive scanning strategies. The WDSS-II display and algorithms will need to be able to handle these data.

The feasibility of generating 3D isosurface displays with rapidly updating data is currently being investigated both for use with NWRT-PAR data and for inclusion in the FSI display. These tools will be used to identify severe weather precursor signatures that may lead to improved warnings.

6. EVALUATION OF WDSS-II PRODUCTS

Experimental products generated by the NSSL WDSS-II system are routinely tested and evaluated in NWS operations. A recent addition to the WDSS-II system is the capability to output product files in AWIPS NetCDF format and in Grib2 format for use in NAWIPS at the Storm Prediction Center.

The rapid development of multi-radar, multi-sensor applications has created a multitude of WDSS-II products that need to be evaluated. As such, many of the development products are available from the WDSS-II website (http://wdssii.nssl.noaa.gov) as either static images or georeferenced products suitable for viewing in GIS systems such as Google Earth or NASA WorldWind.

In addition, a research version of WDSS-II is available for download from the http://www.wdssii.org website. The downloadable version has proven to be popular with both university students and researchers. The website also contains some operator/usage documentation. A web-based forum has also been setup to assist remote users of the WDSS-II system.

7. ACKNOWLEDGEMENTS

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