P1.11

THE USE OF CODE
(COMMON OPERATIONS AND DEVELOPMENT ENVIRONMENT)
AT THE WSR-88D OPERATIONAL SUPPORT FACILITY

Anderson White[1] and William J. Armstrong
WSR-88D Operational Support Facility, Norman OK

J. T. Johnson
National Severe Storms Laboratory, Norman OK

1. INTRODUCTION

The planned transition from legacy hardware and software to a more open environment offers numerous opportunities for improvement to the Weather Surveillance Radar, 1988-Doppler (WSR-88D) system. One such improvement is CODE, (Common Operations and Development Environment) (Saffle, et al.1998; Istok et al. 1999). Not yet operational, CODE is envisioned as a process for facilitating introduction of new and improved algorithms and products into the WSR-88D system. The purpose of this manuscript and its companion poster is to summarize the use of CODE at the WSR-88D Operational Support Facility (OSF).

2. ALGORITHM DEVELOPMENT

2.1 *Current algorithm development process*

In the past, WSR-88D radar algorithms, products, and system enhancements have been developed at external laboratories and delivered to the OSF for inclusion in the baseline. For the most part, candidate algorithms and products have been developed and tested on workstations, off-line, using archived Level II data. Limited real-time testing was done using the National Severe Storm Laboratory's (NSSL) Warning Decision Support System (WDSS) (Johnson et al. 1999). These methods of algorithm development often resulted in software implemented in an artificial environment and written with little adherence to software engineering standards; consequently, successful candidate algorithms underwent the time and resource consuming process of software re-engineering prior to implementation in the WSR-88D system. As the WSR-88D program matures, it is time for a more efficient algorithm acceptance and implementation process.

2.2 *Future algorithms*

A recent survey by Elvander et al. (1997) indicated that by year 2000 there could be as many as 60 algorithms vying for inclusion in the WSR-88D baseline. In addition, more than 70 NWS forecast offices, universities, and DoD organizations are using the WSR-88D Algorithm Testing and Display System (WATADS) to improve existing algorithms through post-event studies (Johnson et al. 1999). Historically, these studies often produced significant scientific improvement; however, introducing improvements to a baselined operational system proved cumbersome. The advent of a more open platform offers the opportunity to introduce a better and faster pipeline for system improvement. In addition, CODE promises to open the algorithm development process to more researchers.

3. CODE CHARACTERISTICS

The objectives of CODE center on standardization, reuse of software, ease of including new software in the baseline, ease of data transfer, and common functionality. CODE will be a software system and a development environment running on a workstation separate from the Open System Radar Product Generator (ORPG.) It will behave much like the current WATADS with notable additions, namely, the ability to add an algorithm to the baseline, to enhance existing algorithms and products, and to develop new algorithms with minimal software re-engineering using modular common functionality. With CODE, it will be possible to test algorithms using archived or real-time data. As noted by Saffle et al. (1998), when applications are created in CODE, both the developer and the OSF will be able to run the applications on a common system during initial testing and validation. Applications thus introduced can be integrated into the ORPG much faster because the need for re-engineering and re-coding will be reduced greatly.

4. USE OF CODE AT THE WSR-88D OPERATIONAL SUPPORT FACILITY

There are two main views of CODE: that of application developer and that of application maintainer (Saffle et al. 1998.) In this section, we discuss both with emphasis on the planned role of the OSF as maintainer. In addition, we include a discussion on algorithm testing and validation, necessary adjuncts to the algorithm implementation process.

4.1 *CODE for the developer*

[1] *Corresponding author address:* Anderson White, WSR-88D Operational Support Facility, 1200 Westheimer Drive, Norman OK 73069; email, awhite@osf.noaa.gov

CODE promises great benefits to application developers. It will provide a programming infrastructure and guidelines for software design, testing, and documentation via two pathways to programming services: the Application Programming Interface (API) and the Visual Programming Tool (VPT). Both API and VPT are intended to help developers deliver mature software in minimum time, ready for testing, verification, and implementation in the WSR-88D baseline. In the future, it may be possible that software developed under CODE could cross platforms and be implemented on other systems such as AWIPS.

4.2 *CODE for the maintainer (OSF)*

Assuming application developers fully use CODE and produce software capable of running in the ORPG, the role of the OSF as software managers is simplified when compared with the same role under the legacy system (Istok et al. 1999) and centers around standards, testing, validation, and implementation.

4.2.1 *Software standards*

Software will be developed either as prototype or production algorithms. The former will require re-engineering to WSR-88D standards perhaps by a dedicated group; the latter should arrive at the OSF ready for testing, validation, and implementation.

4.2.2 *Testing and validation*

The OSF Applications Branch will provide test data sets or approve developer-supplied test data sets and conduct or monitor algorithm and product testing. Testing should conform to the scientific method and should show success in a variety of geographical, climatological, seasonal, and meteorological regimes. In addition, a validation data set which could be a partition of the test data set or a fully independent data set may be used to confirm algorithm performance. Operational or beta testing guidelines have not yet been created, and a series of standards for objective evaluation of test results for reflectivity and velocity based algorithms is yet to be developed.

In the legacy software, adaptable parameters were used to regionalize algorithms; under Open Systems, this practice could continue, or slightly modified algorithms could be implemented in different locations as long as the generation of some set of products with consistent parameters for national mosaics is preserved.

4.2.3 *Baseline implementation*

Following successful testing and validation, the algorithm or product will be presented as a WSR-88D Configuration Change Request. The System Recommendation Enhancement Committee and the Program Management Committee will continue to determine the content of software implementations.

4.2.4 *Training*

The OSF Training Branch will develop written training materials and distance learning sessions to teach proper application and interpretation of new algorithms or products.

5. SUMMARY

The transition from a legacy hardware and software environment presents opportunities for significant system improvements. The implementation and integration of new algorithms into the system historically have been expensive in terms of time and resources; the introduction of CODE is intended to reduce both burdens. Additionally, CODE should open application development to a broader field of contributors.

CODE will serve different purposes to different groups. To developers, CODE will offer structure, standards, and, eventually, re-usable software modules. To the OSF, CODE will streamline software engineering, testing, validation, and implementation. To users of WSR-88D products, our goal simply is for CODE to help create a more responsive system, especially for more accurate and timely severe weather warnings.

6. REFERENCES

Elvander, R. C., L. D. Johnson, and S. M. Holt, 1997: The NEXRAD algorithm survey and analysis for the rehosted radar product generation (RPG) subsystem. Preprints, 13th Conference on IIPS for Meteorology, Oceanography, and Hydrology, Long Beach, CA, Amer. Meteor. Soc., 228-233.

Istok, M. J., Armstrong, W., D. Burgess, M. Eilts, R. Saffle, and A. White, 1999: Next generation WSR-88D applications development – a change in paradigm. Preprints, 29th Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 4 pp.

Johnson, J. T. M. D. Eilts, A. White, W. Armstrong, T. Ganger, and M. Istok, 1999: The Common Operations and Development Environment: A new paradigm in application development. Preprints, 29th Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 6 pp.

Saffle, R., J. Cappelletti, W. Carrigg, T. Ganger, M. Jain, D. Miller, S. Smith, 1998: Accelerating the integreation of new meteorological algorithms into the WSR-88D– The Common Operations and Development Environment. Preprints, 14th IIPS, Phoenix, AZ, Amer. Meteor. Soc, 30-34.