

Acquisition of AWIPS II CAVE Client Computing Infrastructure at the College of Charleston 2020 Unidata Equipment Award Final Report

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In March 2020, the College of Charleston Department of Physics and Astronomy requested a UNIDATA Equipment Award to build computing infrastructure to support educational, research, and outreach use of UNIDATA AWIPS-2. Our Department recently developed a new program in meteorology and atmospheric physics and based upon recent infrastructure improvements and new recruiting strategies, it is anticipated that program enrollment will continue to grow by 30-50% over the next 3-5 years. For this reason, the primary goal of this project was to install the Common AWIPS Visualization Environment (CAVE) clients for weather analysis and forecasting classroom settings.

Six machines were purchased as part of this project. Each CAVE client is a custom-build Dell Precision 3640 Mini Tower that consists of

- Intel Core i9-10900 (10 Core, 20 M cache, base 2.8 GHz, up to 5.2 GHz)
- 32 (2 x 16 GB) DDR4 2933 MHz UDIMM Non-ECC Memory
- 2GB Nivida Quadro P620 video card
- 256 GB PCIe NVMe Class 440 M.2 SSD primary hard drive
- 2TB 5400 rpm SATA 2.5" HDD secondary hard drive
- Dell 24" Widescreen LCD Monitor
- CentOS/Red Hat 8 Operating System

In late 2020, PI Williams and Co-PI Lindner installed the CAVE clients in our Mesoscale Modeling laboratory along with various software for student and faculty use. UNIDATA software currently running on the CAVE clients include: MetPy (version 1.0), netCDF (version 4.8.0), and IDV (version 5.7). In addition, we have installed Cloud Model 1 (CM1) for the purposes of introducing our student to mesoscale modeling and Hurricane WRF model (HWRF) for the purposes of tropical cyclone research. During the summer 2021, the PI will install the Regional Atmospheric Modeling System (RAMS) for the purposes of convective storm research. After testing and student feedback, the CAVE clients were ready for use in Spring 2021.

PI Williams used the CAVE clients in his Spring 2021 course "PHYS 425: Mesoscale Meteorology". Williams was able to successfully use the CAVE clients to perform forecasting and nowcasting of severe weather events, such as the tornado outbreak sequence of March 24-28th, 2021. After demonstrating the weather visualization and forecasting tools in the class, students were required to use CAVE/AWIPS-2 for the final forecasting project in the course. Formal and informal student feedback from the course indicate that the use of real-time weather data served as a good supplemental to the traditional lecture material in the course. In particular, students found that the weather visualization tools helped to emphasize the conceptual and mental models discussed in the class.

After training students to use the Linux environment, our senior undergraduates used the CAVE clients for their senior capstone projects and undergraduate research. PI Williams was the faculty mentor of a student who used Cloud Model 1 (CM1) to examine the diurnal variations of the tropical cyclone boundary layer using idealized axisymmetric hurricane simulations. Currently (as of Summer 2021), the PI and co-PI are mentoring students who are actively using AWIPS-2 to examine Carolina coastal fronts and the effect of the marine boundary layer on squall line propagation in the Lowcountry.

Thus far, our implementation and initial use of the CAVE clients have been successful. Based upon admission statistics, the incoming Fall 2021 class have the largest number of declared meteorology majors since our program's introduction in 2016. We plan to use the CAVE clients throughout the entire curriculum, starting with our introductory meteorology class "PHYS 105: Introduction to Meteorology" which will be offered in Fall 2021. Furthermore, the CAVE clients will be used for the first time in our synoptic meteorology course in Spring 2022. Thus, the continued use of the CAVE clients in future classes (particularly in future semesters when more students will be comfortable attending computer labs in person) will provide us additional student feedback on how the CAVE clients can be better used in our program.