Java and Web-Based Tools for Interactive Learning

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In an effort to harness the power of the Internet and effectively use it in the classroom, the CoVis-Horizon group at the Department of Atmospheric Sciences (DAS) at the University of Illinois at Urbana-Champaign (UIUC) has been developing extensive and broadly useful Internet-based educational resources that support an interactive learning environment. *The Weather Visualizer*, a web-based visualization tool, allows users to generate customized weather images from real-time and archived weather data. In addition, with a point-and-click interface, the user has complete control over which features appear on the final product. Hypermedia helper sections have been incorporated to equip the user with the knowledge and skills required for valuable and correct interpretation of the images generated by the Weather Visualizer. These helper resources are part of a large collection of multimedia instructional modules known as *An Online Guide to Meteorology*. Through the use of colorful diagrams, video and audio, scanned images and text, these modules introduce and discuss essential concepts in atmospheric sciences (e.g., Pressure, Forces and Winds, Weather Forecasting and Severe Storms). Selected modules also contain embedded quiz questions that reinforce and assess a student's understanding of the concepts introduced.

A practical test-bed for the Weather Visualizer and instructional modules is accomplished through the NSF-funded CoVis project. Recently, these resources were integrated into CoVis curriculum focusing on winter storms. Module pages instructed students on the factors contributing to the development of winter storms while the Weather Visualizer provided access to archived weather data necessary for completing the project. These materials were then revised based upon user feedback.

The next generation of the Weather Visualizer uses the $Java^{TM}$ programming language, which allows for faster and more flexible user interaction with meteorological data than previously available using the World Wide Web. The current Java version of the Weather Visualizer provides access to a selected set of meteorological data for the United States and the user can instantly add or remove these fields in order to create the desired weather map. In addition, several atmospheric variables are computed and displayed by simply moving the cursor over the image. By pointing and clicking in the weather image, users can access the latest model forecasts from the National Centers for Environmental Prediction (NCEP) for that particular location, with selected variables graphically displayed for easier interpretation.

In the months to come, new developments of the Weather Visualizer and instructional modules will lead to increased interactivity between user and computer. Students will be able to better utilize actual weather data more than ever before in the study of weather phenomena. These learning tools, when coupled with other valuable Internet resources and curriculum, will support the creation of a learning environment, where the student becomes more actively involved in the learning process through increased interactivity with the scientific resources and data sets.