ATMOSPHERIC ENVIRONMENTS FOR MODELING AND SIMULATIONS PE 0602435N (NRL BE 035-02-21)

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LONG-TERM GOALS

Develop a capability to quickly assess the impact of the atmospheric environment on tactical operations. Enhance mission performance and improve simulation effectiveness by increasing the utilization of atmospheric data in simulations and mission rehearsal systems.

OBJECTIVE

Provide visualization tools to analyze and interpret the tactical impacts of atmospheric environmental conditions. Develop objective techniques, data bases, and data access methodologies for incorporating atmospheric data into simulations used for training, mission planning and rehearsal, and in the Cost and Operational Effectiveness Analysis (COEA) process.

APPROACH

Derive sensible weather parameters and develop data interfaces, automated processing techniques, and graphics software to display mesoscale model output and derived data for tactical assessment. Develop techniques for Navy simulation systems that allow them to access atmospheric data for the purpose of analyzing realistic impacts on tactical operations. Adapt standards established by the Defense Modeling and Simulation Office (DMSO) for formulating the interface between the atmospheric databases and the simulators. Utilize field demonstrations to solicit feedback from potential users and to gain user insight and acceptance.

WORK COMPLETED

A Graphical User Interface (GUI) was developed which allows a non-expert user to run the atmospheric component of the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS). In coordination with the ONR 6.2 EM/EO Testbed/Diagnostics Demonstration project (PE 0602435N 035-71), a tool kit was developed for visualizing multiple mesoscale data sets simultaneously. An automated interface was developed between COAMPS and the Radio Physical Optics (RPO) range-dependent electromagnetic propagation program.

The methodology was developed to create a 3-dimensional “out the window” cloud scene in a simulation for aircraft mission rehearsal. This scene was rendered using the total precipitable water derived from numerical mesoscale model output. The derived cloud field was demonstrated to be physically consistent with the atmospheric state used in the simulation.

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RESULTS

The ability of an inexperienced user to set up and run COAMPS on a workstation has been improved by the development of a user friendly GUI. The GUI has the capability to read, save, and delete COAMPS jobs, and allows the user to set up the computational grids and nests, the vertical coordinate system, the forecast length and data assimilation interval. It also has an extensive capability to request output data products for any grid at any forecast time. To allow some users access to traditional visualization programs, interface filter programs were developed to automatically couple COAMPS model output with the VIS-5D visualization program and a 2-dimensional graphics package (GrADS) for product dissemination over the World Wide Web. This capability was extended to develop two visualize products: model diagnostics (COAMPS forecast output plotted with verifying observations) and electromagnetic propagation loss from the RPO model.

The methodology for generating, incorporating and rendering fine scale cloud elements in a flight mission rehearsal system, including the effects on visibility, allows more realistic scene visualization for training and mission rehearsal. This accomplishment represents the first time that physically consistent clouds have been incorporated into a flight mission rehearsal system. The prototype integration of clouds into the PowerScene mission rehearsal system was completed by using a cloud feature model to create 3-dimensional cloud liquid water fields based on mesoscale model output. The resultant fields were than rendered by the Cloud Scene Simulation Model and interfaced with the PowerScene system. The demonstration showed that physically consistent atmospheric data can be successfully incorporated into simulations, including both training and mission planning and rehearsal systems. The important result is that the pilot's "out the window" view, which is constantly updated by the system, can be affected by physically consistent atmospheric parameters such as cloud elements, temperatures, winds, drop size distribution, etc., and is not just a cartoon effect selected for its visual impact.

IMPACT

Visualization techniques developed have direct application to the On-Scene Tactical Atmospheric Forecast Capability (STAFC), and TESS/NC projects.

The integration of atmospheric cloud data into the PowerScene simulation was a significant accomplishment. The techniques and software developed have direct application in the both the Navy and DoD M&S community.

TRANSITIONS

The COAMPS graphical user interface and Web-based visualization products have transitioned to the 6.4 STAFC project PE 0603207N X2343-10.

The cloud scene simulation capability was transitioned to the TopScene program.

RELATED PROJECTS

The related 6.2 project within PE 0602435N is 035-71, which focuses on the development of on-scene mesoscale data assimilation technology. The related 6.4 project under PE 0603207N is X2343-10, which focuses on the transition of the 6.2 developments to the STAFC demonstration project.

REFERENCES

Web address – http://www.nrlmry.navy.mil/~wakefiel/