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Computer Modeling III: An Eulerian Simulation Model of Particulate Dispersion in the Atmosphere

Computers are used to model the outcome of complex events. The goal of this project was to implement a computer model which accurately shows changing pollution concentrations in the atmosphere, and can be easily extended in future project phases. The model I developed was able to show an accurate representation of pollution dispersion as effected by wind and diffusion. By programming using modular techniques, the model is easy to extend with new variables and algorithms. I used the Eulerian technique, which employs a grid to track the data. This technique is well suited for calculating the rate of change between adjacent cells. The finite difference method was used to numerically approximate the differential equations. I used open source tools for my development, and employed function calls to reduce code complexity and increase extensibility. The data was analyzed by plotting concentrations in 3-dimensions, looking for areas not matching expectations. Program variables were constant per test run; therefore, the expected results were predictable. The graphs were analyzed for data errors allowing the program to be debugged. The analysis of the erroneous data showed that boundary conditions were the primary source of program errors. My project has proved that modeling is an interesting computer application. It can perform complex calculation over large volumes of input that would be impractical without a computer. While the calculations can be done manually, the domain would be limited and not applicable to real-world situations. This project completes the first stage of programming an accurate atmospheric computer model.