1088-65-82 **Jay A. Stotsky*** (jay.stotsky@tufts.edu). *Solving the Diffusion Equation on the Sphere with the Finite Element Method and Multigrid Solvers.* Preliminary report.

We have developed an efficient method of solving the diffusion equation on the surface of a sphere using the Finite Element Method to discretize space and the Trapezoid Method to discretize time. A multigrid algorithm was used to solve the large system of linear equations arising in each time step. This is a challenging problem because there is no perfectly regular discretization of the sphere that involves more than 20 points. This complicates the computation of mass and stiffness matrices and multigrid operators. Using efficient techniques to calculate the multigrid operators and a (2,1)v-cycle, our method of solving the diffusion equation yields a convergence factor of around 0.175 per iteration and involves a computational effort that is linearly proportional to the number of grid points.

Additional research is being done to apply adaptive mesh refinement and the Fast Adaptive Composite-Grid Method to this problem. In particular, a Finite Element Method based approach to the Fast Adaptive Composite-Grid Method is being developed because of the natural way in which a Fast Adaptive Composite-Grid solver can be derived from a Finite Element Method discretization. Applications of this research can be found in the modeling of radiation beams and in climate models. (Received February 04, 2013)