

## A Two-dimensional Model of the Atmosphere

Relevance to the Automotive Industry:	The Earth's climate is altered by the change in its atmosphere, which is partly due to automobile exhaust. The two-dimensional model of the Earth's atmosphere developed in this project can be used to predict the atmosphere's future development in correlation to various influences, as different amounts of exhaust released into it.	
Research Location:	TUD <i>Fachgebiet Numerische Berechnungsverfahren im Maschinenbau (fnb)</i>	VT <i>Computational Science Laboratory (CSL)</i>
Homepage (Engl.):	<a href="http://www.fnb.tu-darmstadt.de/en/index.php">http://www.fnb.tu-darmstadt.de/en/index.php</a>	<a href="http://people.cs.vt.edu/~asandu/CSL/index.php">http://people.cs.vt.edu/~asandu/CSL/index.php</a>
Faculty Mentor:	Prof. Dr. rer. nat. Michael Schäfer	Prof. Adrian Sandu, Ph.D.
Faculty Mentor Email:	<a href="mailto:schaefer@fnb.tu-darmstadt.de">schaefer@fnb.tu-darmstadt.de</a>	<a href="mailto:sandu@cs.vt.edu">sandu@cs.vt.edu</a>
Graduate Mentor:		
Graduate Mentor Email:		
Project Description:  Jun 9 - Aug 1, 2008; (8 weeks, 40h/week)	<p>This project seeks to develop a two-dimensional model of the Earth's atmosphere dynamics. The model will implement a numerical solution of the two-dimensional shallow water equations. This model will be useful to illustrate the different types of dynamics in the atmosphere, and will provide a good exercise in the numerical solution of hyperbolic flows. The steps to be taken are as follows:</p> <ol style="list-style-type: none"> <li>1. Implement several numerical schemes for discretizing the shallow water equations on the sphere. The schemes include Lax-Wendroff, limited flux/slope, and WENO discretizations.</li> <li>2. Implement two mechanisms to avoid pole singularity (a single pole grid point and the cubed sphere).</li> <li>3. Visualize the results in MatLab and GrADS.</li> <li>4. Illustrate the model results with several standard sets of boundary conditions.</li> </ol> <p>One NSF REU student will be assigned to each research location. They are expected to work together transatlantic on this joint project, and to interact and communicate intensely with each other on a daily basis using communication and collaboration technologies like instant messenger, email, Teamcenter and video conference system.</p>	
<b>Necessary Skills/ Knowledge:</b>	<ul style="list-style-type: none"> <li>• Basic knowledge of MatLab</li> <li>•</li> <li>• Basic knowledge of numerical methods, for example discretizing of flows</li> </ul>	
Desirable Skills/ Knowledge:	<ul style="list-style-type: none"> <li>•</li> </ul>	
Additional Online Resource:		

NSF REU Students must have completed at least two semesters of engineering studies prior to the proposed summer research, and they must have at least one semester remaining before they can earn their BS in Engineering.