

## Dr. Georgiy Stenchikov

### Statement of Research and Teaching Interests

I earned my M.S. and Ph.D. degrees from the Moscow Physical Technical Institute (the *MIT* of Russia) in applied mathematics and physics. Since 1976 I worked in the top Russian Research Computing Center specializing in numerical methods, fluid dynamics, and simulating absorption of laser radiation in plasmas for laser fusion applications. In the 1980s I became interested in climate modeling. I developed a coarse-resolution General Circulation Model (GCM) and in 1983 used it to conduct the first 3-D GCM simulations of a Nuclear Winter. From 1986 until 1992 I led a research group that studied anthropogenic impacts on the Earth's climate and environmental systems. My group collaborated with the similar groups in the Computing Center that worked on ecological and societal impacts.

In 1992 I began work in the U.S., first at the University of Maryland and then at Rutgers University. A solid physical and computational background and diverse scientific experience allowed me to conduct interdisciplinary studies in the broad field of climate modeling, atmospheric physics, and environmental sciences. I have developed an extremely interdisciplinary research program at Rutgers University, collaborating with and using super-computer facilities at NOAA Geophysical Fluid Dynamics Laboratory (GFDL), NASA Goddard Space Flight Center (GSFC), and NASA Goddard Institute for Space Studies (GISS). In fact, for 3 months per year, during the last 3 years, I worked at GFDL as a visiting scientist. I calculated environmental flows of different scales and studied physical processes that cause climate change and variability by combining analysis of simulations and observations. Recently I have implemented volcanic aerosols in the new GFDL climate modeling system, and led a study on intercomparison of climate responses to volcanic forcing in the IPCC AR4 models. I contributed to Chapter 2 of the International Panel for Climate Change (IPCC) Fourth Assessment (AR4) climate report. I am testing the new GEOS-5 model of GSFC with respect to volcanic impacts. I have used GISS modelE to study effects of high-latitude volcanic eruptions on climate. I have calculated effects of severe thunderstorms on chemical balances in the troposphere and stratosphere-troposphere exchange using non-hydrostatic cloud models, developed a stretched-grid general circulation model, and conducted regional climate modeling using a limited area model. I collaborated with the Environmental and Occupational Health Science Institute and atmospheric chemists from the Department of Environmental Sciences to conduct air-pollution studies, and recently completed fine-scale simulations of aerosol plume from the fire and collapse of the World Trade Center on September 11, 2001. This work was featured by New Jersey News and ABC News. I would formulate my research interests as follows:

- Study causes of climate change, calculate effects of tropospheric and stratospheric aerosols on climate.
- Simulate stratosphere-troposphere dynamic interaction to clarify physical mechanisms of the Arctic Oscillation.
- Conduct a very fine climate downscaling using non-hydrostatic nested models and stretched-grid GCMs to better understand interaction of global- and regional-to-cloud-scale processes in the climate system.
- Simulate severe convective events, associated stratosphere-troposphere exchange, vertical mixing of chemical tracers,  $\text{NO}_x$  production by lightning, and their effect on ozone chemistry. Study air pollution processes in an urban environment, calculate hydrodynamic flows in city street canyons using CFD models.

Most of my work is based on high performance computing. I have a solid expertise in numerical methods, fluid dynamics, atmospheric physics combined with diverse experience in simulating multiscale environmental flows. I am interested in further development of modeling capabilities for the fine-scale processes to analyze cross-scale interactions in the atmosphere and the climate system.

I am delighted to teach climate modeling, geophysical fluid dynamics, atmospheric physics, radiation, and cloud physics, at undergraduate and/or graduate levels. In Russia I taught a course on climate modeling at the Moscow Physical Technical Institute for graduate students majoring in applied mathematics, numerical fluid dynamics, and physics. I also taught calculus and numerical methods for engineers. At Rutgers University I taught the Physical Meteorology course for undergraduates in Spring 2007 and the Climate Modeling graduate course in spring of 2000 and in fall of 2002. This course was based on my radiative-convective model. The model-based teaching appeared to be very fruitful. I plan to further expand this approach and use also the GCM and regional model for teaching graduate and undergraduate students.

In Russia I supervised 2 Ph.D. and 8 M.S. students. At the University of Maryland I supervised 2 Ph.D. and 3 M.S. students, and was on advisory committees for 3 Ph.D. students. At Rutgers University I supervised 3 Ph.D. students, worked with 2 graduate students, 2 undergraduate students, and 1 high school senior. I also collaborated with 2 postdoctoral fellows and 1 research scientist, and am on the advisory committee for 4 graduate students. For my NSF project on stratospheric aerosol data assimilation I have hired a Ph.D. student from the Department of Mechanical and Aerospace Engineering (MAE) and joined the MAE graduate program. I strongly believe that collaboration with MAE will be extremely helpful for studies on the under-approximated fine-scale processes in the atmosphere like turbulent mixing, aerosol microphysics, aerosols-cloud interactions, deep convection.