I.1 INTERNATIONAL COLLABORATION

The project will include important international collaboration in the area of open source GIS development, testing and applications. The development of new software tools will be coordinated with an international multidisciplinary team of GRASS5 developers which includes software engineers, geographers, geologists, DBMS experts from more than 10 countries; see map at *http://www.geog.uni−hannover.de/grass/index2.html*. The collaboration has a typical open source form, based on the on−line GRASS developers forum, see *http://www.geog.uni−hannover.de/grass/grassdevel.html* where development issues are discussed and changes and additions to the software are approved. We plan more intensive collaboration including exchange visits with the current leader and coordinator of the GRASS5 development Markus Neteler from the Institute of Physical Geography and Landscape Ecology, Schneiderberg 50 30167 Hannover, Germany and with Dr. Jaroslav Hofierka from Geomodel s.k., Slovakia.

The Institute of Physical Geography and Landscape Ecology has been involved in open source GIS since 1995 and coordinating the GRASS development since 1998. The intensified collaboration will focus on the development and effective application of new tools, especially in the area of modeling of dynamic landscape processes, which is also a focus at the Institute of Physical Geography and Landscape Ecology (Prof. Dr. Th. Mosimann). In particular, we will intensify our efforts in the development of tools for effective representation and visualization of 3D (volumetric) phenomena in GIS which is crucial for coupling of surface and subsurface transport and processes in water bodies, such as lakes and estuaries. This development will provide GIS support for application of multidimensional path sampling simulations by providing the tools to process and derive the input data as well as analyze and visualize the modeling results. To support modeling and visualization of spatio−temporal phenomena, results of dynamic models and monitoring activities, we will evaluate the functionality of the current date−time support in GRASS5 and design the necessary improvements. The spatio−temporal and volumetric tools will be developed, tested and applied using a 3D model of soil properties and simulation of relevant processes in 3D space and time. The educational aspects of the collaboration will be enhanced by planned participation of Dr. H. Mitasova in an intense GIS graduate course at the Institute of Physical Geography and Landscape Ecology which is currently in application process at Deutsche Forschungsgemeinschaft (German NSF).

The previous collaboration with Dr. Jaroslav Hofierka and Geomodel s.k. over the past 10 years has been extremely useful and productive and resulted in significant contributions to open source GIS infrastructure as well as to efficient solutions for environmental projects. The developers in Slovakia have contributed several core programs to the GRASS GIS, especially the original flow tracing program, spatio−temporal solar energy distribution program and recently also a crucial tool for volumetric modeling supporting map algebra for volumetric raster data. Their testing, bug fixing and enhancements to the existing programs for spatial interpolation, multidimensional visualization and many others has been invaluable. The USA−Slovakia collaboration also provided a substantial help in solution of the environmental projects funded by the Slovak as well as European Union funds. These research projects were solved in close collaboration with the experts at the Institute of Geography, Slovak Academy of Sciences (Dr. Marcel Suri) and Slovak State Geological Survey (Peter Paudits) as well as other private and state organizations. Some of the most important results related to the planned collaboration with the NCSU team are listed in the letter of commitment by Geomodel s.k. (see Supplementary documentation, Section I). The planned collaboration will focus on further development of multivariate spatial interpolation and surface/hypersurface analysis which are crucial components of data pre–processing for spatial simulations. The issue of uncertainty and predictive accuracy estimates will be also addressed. In the area of terrestrial surface process modeling we will focus on modeling of impacts of concentrated flow and testing of tools supporting multidimensional preferential flow simulations. The development and testing will be performed on several projects aimed at identification and minimization of various environmental risks neglected during a previous political system in Slovakia for more than 40 years, including the problems of selecting secure nuclear waste sites from nuclear power stations and environmental safety issues of petroleum transport through the Slovak territory.

To support the described developments and dissemination of the results we plan 2 visits of our collaborators from Europe in USA and 1 visit of US participants in Europe. The visits will combine active participation at international conferences especially the planned GIScience 2002 in USA and GIScience 2004, probably in Europe, with presentations and seminars at the Triangle Universities, (North Carolina State University in Raleigh, the Duke University in Durham and the University of Carolina, Chapel Hill) which have strong computer science/GIS, environmental and open source research efforts and initiatives.