Summary:

Asia is one of the most highly populated and economically dynamic regions in the world, with much of the population located in growing mega-cities. It is a region with significant emissions of greenhouse gases, aerosols and other pollutants, which pose high health risks to urban populations. Emissions of these aerosols and gases increased drastically over the last decade due to economic growth and urbanization and are expected to rise further in the near future. As such, the continent plays a role in influencing climate change via its effluent of aerosols and gaseous pollutants. Asia is also susceptible to adverse climate change through interactions between aerosols and clouds, which potentially can have serious implications for freshwater resources.

Intellectual Merit. Through this project an integrated inter-disciplinary program is being developed to focus on Asia, its climate, air quality, and impact on humans that will include connections with hydrology, ecosystems, extreme weather events, and human health. The primary goal of this project is to create a team to identify key scientific questions and establish networks of specialists to create a plan for future studies to address these questions. A milestone is the organization of a workshop at the National Center for Atmospheric Research (NCAR) to develop this plan. A second goal of this project is to prepare a framework for investigating chemistry and climate over Asia by establishing several research facilities and frameworks. These facilities include producing high resolution Earth System Model simulations that have been evaluated with meteorological and chemical measurements, producing high-resolution emission inventories, analyzing satellite data, and analyzing the vulnerability of humans to air quality and extreme natural events.

Analyses of the model results and satellite data will give fine-scale (10-50 km) information on connecting climate change with air quality. In turn, the air quality and climate change information will be used to estimate the vulnerability of humans to these changes. The satellite data analyses and regional climate model simulations will also provide insight on aerosol-cloud interactions at the scales of interest. That is, the scale of convective systems should be better resolved in the high resolution simulations, thus providing a regional context of cloud-scale phenomena.

The project provides broader impacts to society by building a community for examining chemistry, climate and health risks over Asia. Visits and focused working group meetings will initiate collaborations with Asian scientists and students, while a workshop will provide a venue for establishing long-term collaborations of scientists interested in chemistry and climate over Asia. The project will provide a framework for many more detailed studies that would be part of a future comprehensive modeling and measurement project. Results of the model simulations will be linked to future field campaigns by identifying where and what observations are needed and by assisting the planning of ground-based and airborne experiments. Through the collaborative proposal a graduate student at the University of Iowa will be trained in running model simulations and manipulating emissions, and will have the opportunity to work closely with the scientists at NCAR. Each summer an undergraduate or early graduate student from
the NCAR SOARS (Significant Opportunities in Atmospheric Research and Science) program will be involved in the project (e.g., evaluating a component of the model simulations with observations).