A study of the influence of Chinese pollution on air quality in Japan

Project Summary

In the latter part of the 20th Century, China began its emergence from a primarily agrarian economy to become a major political and economic force. At the same time, and not coincidentally, China has also had a major impact on the environment, with soaring pollution levels (e.g., *Irie et al.*, 2005; *Richter et al.*, 2005), and greenhouse gas emissions that will exceed those from the United States by 2010 (World Energy Outlook, 2006). Numerous studies have revealed that air quality, like climate change, is not just a local, but also a regional and global issue that recognizes no political boundaries (e.g., *Morris et al.*, 2006; *Wotawa and Trainer*, 2000), a fact that presents challenges for international relations. For example, ozone levels over Japan rose 11 – 20% from the 1970's to 1990's as a result of China's enhanced NO_x emissions (*Naja and Akimoto*, 2004), and pollution from China is projected to significantly impact the U.S.A. in the 21st century (*Yienger et al.*, 2000). Global climate change will further exacerbate these problems. How will the international community address and solve such complicated environmental issues?

The Olympics in Beijing during August 2008 provide an unprecedented opportunity to examine and quantify the impact of China's air pollution regionally and globally. China has promised cleaner air for the games, meaning at least temporary emissions reductions. I propose to examine ground-based, balloon-borne, and satellite observations of pollution made before, during, and after the Olympics. Through direct comparisons, I will quantify the impact of Chinese pollution on Japan and beyond.

Naja and Akimoto (2004) identify Kagoshima as an ideal location for this study. This site in Western Japan is regularly influenced by pollution from China and provides an excellent base from which to make observations. Japan has a long record of environmental monitoring data that will be useful for comparison with the data gathered in this study. In addition, since many of the world's leading experts on East Asian pollution live in Japan, I hope to work closely with them, residing in Japan while conducting this research.

The proposed research will lead to an improved scientific understanding of regional and long-range pollution transport and to improved air quality forecast models, useful for personal and urban planning. The study leverages and will enhance my current research program of pollution transport within the U.S.A. Data from this study will enable scientists to more accurately quantify local and remote sources of pollution, thereby assisting government environmental agencies to better tailor plans for improving air quality. Furthermore, this project will provide critical information to policymakers in Japan, the U.S.A., and the international community that could shape international relations, help refine international law, and inform future international environmental agreements.

Objectives:

1) Review the impact of Chinese pollution on Japan's air quality from historical measurements.
2) Determine the effectiveness of Chinese air pollution controls implemented during the Olympics.
3) Determine Chinese contributions to air pollution in Japan.
4) Demonstrate the effectiveness of new, ground-based air quality monitoring equipment from NASA.

Specific Tasks:

1) Evaluate historical pollution measurements in Japan to establish a pollution baseline.
2) Deploy NASA O_3 lidar and NO_2 instruments in Kagoshima before the Olympics.
3) Make pollution measurements in Japan before, during, and after the Olympics in 2008 and 2009.
4) Examine satellite data and use transport models to track pollution to source regions.
5) Compare data with air quality forecast model predictions.
6) Evaluate differences in NO_2, O_3, SO_2, and aerosols measured in Japan before, during, and after the Olympics to evaluate China's contribution to Japan's air quality.