Monitoring and Modelling Changes in the Atmospheric Aerosol Properties and Surface UV Radiation over Northeast Asia (APN 2002-14)

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APN funding
US$ 60,000

Participating countries
Participants from the following countries were funded: Japan, Mongolia, P. R. China, and Republic of Korea.

Brief introduction and background
Atmospheric aerosol particles influence the Earth's radiation balance directly and indirectly and affect human health. The radiative forcing by anthropogenic aerosol particles due to the combined effects is estimated to be in the range between -0.4 and -3.0 W/m2 on a global scale. There is substantial uncertainty in the magnitude and spatial distribution of the radiative forcing by aerosols. This uncertainty significantly limits our ability to assess the effect of natural and human induced changes in the chemistry of the atmosphere on global climate.

Increased UV radiation has effects on human health, in particular human skin disease and has effects on the biosphere. Thus, it is necessary to monitor aerosols and UV radiation at ground stations. The spatial and temporal variations of aerosols are affected by regional meteorological conditions. Because emitted air pollutants have effects on not only the originating country but also neighbour nations, it is not national problems but an international issue. Therefore, there exists the need for international collaboration on characterizing atmospheric aerosols and their impact on UV radiation in Northeast Asia.

Outline of activities conducted
The activities conducted are listed below:

- *Chemical and physical properties of aerosols over Northeast Asia*

  Aerosol samples were collected with aerosol samplers such as PM2.5 cyclone and MOUDI (Micro-Orifice Uniform Deposition Impactor). The collected samples were analyzed to determine aerosol mass, ionic, and elemental composition, organic carbon and elemental carbon (OC/EC), and aerosol size distribution. We had conducted the intensive sampling twice over four countries simultaneously in August and November, 2002.

- *Aerosol radiative properties over Northeast Asia*

  By using RSR and MFRSR (Multi-Filter Rotating Shadowband Radiometer) AOD was monitored to investigate the changes in atmospheric aerosol loading in Northeast Asia. From October 2002, spectral AOD measurements in the UV wavelength range were taken using the Ultraviolet MFR. We monitored the atmosphere of four

countries from 2000 and constructed a database in order to perform a model of atmospheric transfer.

- *Surface UV radiation*

Changes in UV radiation were monitored by UV-A and UV-B radiometers at ground stations. The UV-B radiometers are located at Gwagnju, Ulaanbaatar, and Kyoto. Measured aerosol and UV data are to be analysed to characterize the impact of atmospheric aerosols on UV radiation and to provide information on atmospheric compositions changes.

- *Radiative transfer modeling*

Radiative transfer modelling was performed to investigate the effects of aerosols, clouds and ozone on the atmosphere transmission of UV radiation. The modeling of air mass back-trajectory analyses were also done by using the HY split programme, which covers major anthropogenic source and downwind regions.

Outcomes and products

Outcomes and products of the project are highlighted as follows:

- *Conference presentations*
  - UV Irradiance monitoring and effects of aerosol optical depth on the ground-based measurement of ultraviolet irradiance at Kwangju, Republic of Korea, Young J. Kim, Jeong E. Kim, Seong Y. Ryu, and Kehinde O. Ogunjobi (SPIE's Third Int'l Asia-Pacific Environmental Remote Sensing Symposium Remote Sensing of the Atmosphere, Ocean, Environment, and Space 2002, 23-27 October 2002, Hangzhou, China);
  - Spectral Aerosol Optical Depths and Atmospheric Turbidity in Kwangju, Republic of Korea, Ogunjobi Kehinde, Young J. Kim, Jeong E. Kim, and Seong Yun Ryu;
  - Comparisons of carbonaceous specious of PM2.5 aerosol over the Northeast Asia in 2001, Seong Yun Ryu, Jeong E. Kim, Young J. Kim, M. Kasahara, S. Guangyu; and
  - Surface UV Radiation Comparison over the Northeast Asia, Jeong Eun Kim, Seong Yun Ryu, Kehinde O. Olufunso, Young J. Kim (4th International Symposium on Advanced Environmental Monitoring, 4-6 December 2002, Jeju, Republic of Korea).

- *Web page access from March 2003*

  ADEMRC (Advanced Environmental Monitoring Research Center) will create and maintain a website dedicated to the APN project. Thus, all scientific results from the proposed study will be available for immediate dissemination to the scientific community.

Future directions and follow-up work

Aerosol intensive sampling and radiation monitoring will continue over four network sites (Gwangju, Kyoto, Mongolia and Beijing) in order to obtain a sufficient database to reduce the uncertainty in predicting aerosol forcing on the climate.