【Grant-in-Aid for Scientific Research(S)】

Integrated Disciplines (Environmental science)

Title of Project : Five-dimensional data assimilation of aerosol based on integrated analysis of multi-wavelength lidar and chemical transport model

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Research Area : Environmental dynamic analysis, Environmental science
Keyword : Lidar, aerosol, chemical transport model, data assimilation

【Purpose and Background of the Research】

Asia is one of the biggest emission sources of atmospheric pollutants in the world. Besides anthropogenic emissions, this region is also a major source of pollutants from biomass burning. Sulfates and black carbon particles in the air control and accelerate global warming, respectively. Aerosols exists in the atmosphere for 1 – 2 weeks and shows large temporal and spatial variation. Because the potential of aerosols to contribute to global warming depends on their composition, particle diameter and vertical profiles, it is necessary to integrate field measurements with chemical transport models which contain detailed aerosol information.

【Research Methods】

We will observe atmospheric aerosols from the main air pollutant sources in Asia using a newly developed multi-wavelength Lidar system located in three sites in Japan. This new Lidar system is designed to retrieve the composition of aerosols including black carbon, air pollutants, mineral dust and sea salt based on the measurement of the aerosol extinction coefficient, backscatter coefficient and depolarization ratio. We are planning to make multi-year continuous Lidar observations. These observations will generate a 5-D aerosol distribution database used to develop a new data assimilation model. Based on this integrated analysis, it will be possible to provide a detailed aerosol re-analysis field covering all of Asia.

【Expected Research Achievements and Scientific Significance】

The integration of different research fields is an important achievement of this research project. Ground-based and remote sensing measurements are combined with chemical transport models using data assimilation techniques, to produce an emissions inventory which is consistent between aerosol measurement and chemical transport modeling results. This new aerosol data assimilation method will provide accurate emission intensity estimate and correct aerosol distribution fields (database) necessary to study the impact of aerosols on human health and global warming. Our research project is mainly linked to our new multi-wavelength lidar observation data, however, the proposed method can also use data from traditional ground-base monitoring stations, and is at the forefront of next generation research for simulating the atmospheric environment.

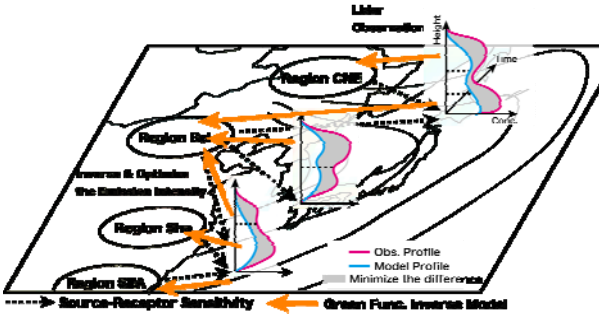

Fig. 1 Schematic showing the integration of Lidar measurement and data assimilation modeling

【Publications Relevant to the Project】

・Nishizawa, T., N. Sugimoto et al.: Algorithms to retrieve optical properties of three component aerosols from two-wavelength backscatter and one-wavelength polarization Lidar measurements considering nonsphericity of dust, *J. Quantitative Spectroscopy & Radiative Transfer*, **112**, 254-267 (2010).
・Yumimoto, K., I. Uno: Inverse estimate of long-term CO emission in China between 2005 – 2010 with Green's function method, *J. Jpn. Soc. Atmos. Environ.*, **47**, 162-172 (2012)

【Term of Project】 FY2013-2017

【Budget Allocation】 149,200 Thousand Yen

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