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Asian dust transported one full circuit around the globe

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Trans-Pacific transport of mineral dust and air pollutants originating from Asia to North America is well known. Eguchi et al. (2009) pointed out that the Taklimakan Desert supplies mineral dust for upper troposphere and can play an important role in intercontinental-scale dust transport. Asian dust is also detected from ice cores on Greenland and French Alps. The effects of Asian dust on cloud systems and the associated radiative forcing can extend over the Northern Hemisphere. In this study, we report the detailed structure of Asian dust during the global transport using integrated analysis of observations by CALIOP on-boarded NASA/CALIPSO satellite and a global aerosol transport-radiation model.
We used the CALIOP Level 1B data products (ver 2.01), containing the total attenuated backscatter coefficients at 532/1064 nm and the volume depolarization ratio at 532 nm. Dust extinction coefficients are then derived from the Fernald's inversion method by setting the Lidar ratio to S1=50 sr. As for a global aerosol transport-radiation model, we used the Spectral Radiation Transport Model for the Aerosol Species (SPRINTARS; Takemura et al., 2005). We performed a sensitivity experiment that aims at an analysis specified for a single dust event originating from the Taklimakan. The simulation was performed over May 2007.
A sever dust storm occurred on 8-9 May 2007 in Taklimakan Desert. Dust cloud emitted during this dust storm is uplifted to altitude of 8-10 km and starts the travel of full circuit around the globe. It has a meridional width of 100-200 km. About one tenth of the original uplifted dust mass (8.1 Gg) is encircling the globe taking about 2 weeks. Because of its high transport height, the dust cloud almost unaffected by wet removal so that the decay of its concentration level is small. Over the western North Pacific of 2nd circuit, the dust cloud pulls down to the lower troposphere by anticyclonic down draft, and finally it settles on North Pacific because of wet removal process. We found that Asian dust can influence the global radiation budget by stimulating cirrus cloud formation and marine ecosystems by supplying nutrients to the open ocean. We will show the results of a quantitative analysis using the SPRINTARS model sensitivity experiment for dust deposition and effects on cloud distribution.