Observational study on the response of aerosol optical depth over Japan to springtime transboundary air pollution in 2011-2019

*YING CAI[1]

1. chiba university

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Ying Cai*, Hitoshi Irie, Kodai Yamaguchi (Chiba University)

Abstract:

The air pollution level in China is thought to have been improved drastically in recent years. Accordingly, it is expected that the air pollution level in Japan has also been improved. At the end of May 2019, however, the photochemical smog advisory was issued in Nagasaki and Fukue Island for the first time in eight years. Thus, the recent response of air quality over Japan to transboundary air pollution has not been fully understood yet. Here we analyzed recent changes in springtime Aerosol Optical Depth (AOD) data (500 nm) observed by ground-based skyradiometers at SKYNET sites of Chiba (35.6^{o}N, 140.1^{o}E, 60 m), Fukue (32.7^{o}N,128.6^{o}E, 50 m), Kasuga (33.5^{o}N, 130.4^{o}E, 55 m), and Saga (33.2^{o}N, 130.2^{o}E, 21 m) from 2011 through 2019. Besides, AOD data (550 nm) from MODIS (Medium Resolution Imaging Spectroradiometer) instruments onboard NASA's Earth observation satellites Terra/Aqua were also analyzed. Skyradiometer AOD values showed decreasing trends at all four sites at a rate of about -1% per year, although year-to-year variations were sometimes significant. MODIS data showed expected decreasing trends in AOD over mainland China and Japan. We also found from MODIS data that a high AOD belt due most likely to transboundary air pollution crossed over around Sendai. It was likely that around Japan, a faster reduction in AOD occurred in an area south of Sendai than in an area north of Sendai. This is likely because the high AOD belt could be shifted to the north in recent years, causing more reduction in an area south of Sendai.

Keywords: Transboundary air pollution; Aerosol optical depth; Skyradiometer; MODIS.

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