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Temporal variations of atmospheric methane observed at three JMA stations

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The Japan Meteorological Agency (JMA) has been operating three monitoring stations of Ryori, Minamitorishima and Yonagunijima to observe several trace gases such as methane (CH₄), carbon monoxide (CO), carbon dioxide and ozone for more than 10 years. Recently, the JMA replaced from old measuring system to new one in order to remotely watch and control it at the JMA headquarter in Tokyo. All trace gas species are measuring in situ using continuous and high-precision instrumentations to collect hourly data sets. These high-frequency data could provide us detailed information for changing the chemical environment of the atmosphere over the western North Pacific region. In particular, the JMA data are useful for investigating the widespread Asian continental outflows, which are often passed over the stations by the long-range transport driven by the synoptic-scale weather perturbations.

In this study, we present seasonal cycles and long-term trends of CH₄ at the JMA stations as well as particularly focus on short-term variations associated with synoptic-scale CH₄ enhancements from the continental CH₄ outflow. It is clearly found that CH₄ and CO are simultaneously enhanced for the synoptic-scale events throughout the year, but their enhancement ratios of CH₄ and CO are highly variable from event to event. These results strongly suggest that not only anthropogenic pollutions but also natural CH₄ emissions such as rice paddies influence the chemical composition for the continental air masses. To confirm this, we evaluated the relative contributions of natural CH₄ emissions on the Asian continent based on the CO data analysis as an anthropogenic tracer.

Keywords: methane, monitoring, ground-based observation, asia continental influence