Atmospheric Halocarbons in Asia: A Review of Sampling, Analysis, and Modelling Approaches

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Abstract

Halocarbons are organic compounds containing one or more halogen atoms, such as chlorine, bromine, or fluorine. The release of these compounds into the atmosphere, whether as long-lived or very short-lived substances (VSLSs), significantly contributes to ozone depletion and climate change. Accurate measurement and analysis of halocarbons are crucial for assessing their environmental and health impacts. This review examines halocarbon studies in Asia, a hotspot for emissions and transport of halocarbons due to the unique geography and meteorological conditions, various industrial processes and natural sources, and rapid industrialisation in the region. The review focuses on measurement methods, analytical techniques, calibration, modelling tools, challenges, and future perspectives for research conducted between 2010 and 2022. Studies primarily cover East Asia (20 articles), Southeast Asia (13 articles), South Asia (2 articles), and other Asia-included regions (16 articles). Our findings suggest that monitoring and research on atmospheric halocarbons in Asia are progressing. However, significant challenges, primarily due to limited observational networks and insufficient monitoring and analysis infrastructure, have hindered a comprehensive understanding of halocarbon emissions, sources, trends, and spatial distribution. Effective halocarbon emission monitoring in Asia requires strategically located regional networks, advanced monitoring and modelling approaches, and international collaboration for local and regional capacity development.

Keywords: Halocarbons; ozone-depleting substances; Asia, atmospheric monitoring