

## Development of international air quality and sky research remote sensing (A-SKY) network

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The international air quality and sky research remote sensing (A-SKY) network has been developed. The idea for this new network comes from simultaneous observations by the multi-axis differential optical absorption spectroscopy (MAX-DOAS) and the skyradiometer. Such unique simultaneous observations are currently in operation at 5 sites, namely, Chiba (Japan), Fukue (Japan), Kasuga (Japan), Phimai (Thailand), and Haldwani (India). The primary objectives of A-SKY are 1) to quantitatively evaluate long-term variations of important trace gases and aerosols and 2) to understand their interaction with climate. Furthermore, the validation of satellite observations, climate model simulations, and data assimilations are also within the scope of the A-SKY activity. Recent findings from each of our improved MAX-DOAS and skyradiometer technologies and their simultaneous observations are highlighted in this talk. For example, the long-term MAX-DOAS observation at Chiba revealed the presence of almost-constant annual variations in the planetary boundary layer ozone concentration from 2013 to 2019, whereas reductions in nitrogen dioxide ( $\text{NO}_2$ ) and formaldehyde (HCHO) concentrations occurred at rates of approximately 6-10%/year. Under such dominant volatile-organic-compounds-limited conditions, the MAX-DOAS-derived concentration ratio of HCHO/ $\text{NO}_2$  was found to be below unity for all months. Beside, the partial column (column below an altitude of 1 km) absorption aerosol optical depth at ultraviolet wavelengths derived from the simultaneous MAX-DOAS and skyradiometer observations was found to be correlated well with the surface black carbon mass concentration data. With such new findings, the potential contribution to atmospheric chemistry is discussed.

Keywords: network, MAX-DOAS, skyradiometer, trace gases, aerosols