The Aerosol and Air Quality Laboratory (AQL), run by Professor Taehyoung Lee at the Department of Environmental Science, Hankuk University of Foreign Studies (HUFS), conducts a wide range of research activities to identify the causes of air pollution and provides solutions for air pollution-related problems in Korea and Northeast Asia. The AQL has real-time advanced measurement instruments, including High-Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-ToF-AMS), Vocus Proton Transfer Reaction Time-of-Flight Mass Spectrometer (Vocus PTR-ToF-MS), Vocus Chemical Ionization Mass Spectrometer (Vocus-AIM CIMS), and Oxidation Flow Reactor (OFR). Using these advanced instruments, the AQL analyzes the concentration and chemical composition of particulate matter and gas-phase precursors in real time to examine the physical and chemical properties of air pollutants, along with the mechanisms underlying the production of air pollutants (Figure 1). Moreover, the AQL comprehensively analyzes air pollution across several platforms, such as ground, air, mobile lab, and ship, using real-time advanced analytical instruments and field measurement techniques.

Figure 1. The AQL has real-time advanced measurement instruments for various research (HR-ToF-AMS, VOCUS PTR-ToF-MS, VOCUS-AIM (CIMS), OFR)

The AQL conducts ground observations in collaboration with other national research institutes and universities to investigate the current status of air pollutants by region, the occurrence of particulate matter, and its impact on Korea and other regions. The AQL measures particulate matter and gas-phase precursors in the atmosphere in general and conducts wide research on air pollution from specific sources, including roadsides and incinerators, and atmospheric chemical reactions in the smog chamber, which can simulate specific conditions. Furthermore, the AQL has its own mobile lab, allowing for conducting field research freely and measurements across different locations (Figure 2).

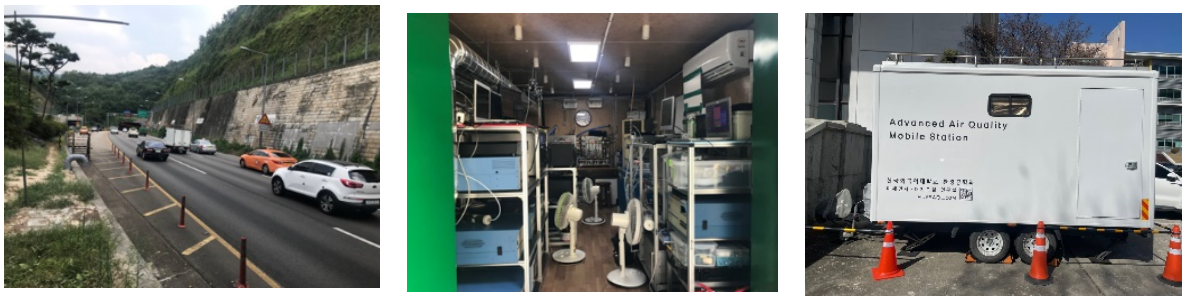

Figure 2. The AQL's research (ground observation on roadsides and urban and suburban areas using a mobile lab).

The AQL conducts aerial observations on the current status and emission characteristics of air pollutants in the atmosphere in Korea with real-time advanced instruments on research aircraft (e.g., Beechcraft 1900D and KingAir C90GT) (Figure 3). Starting with KORUS-AQ in 2016, the AQL has collaborated with many other organizations, such as the Center for FRIEND Project and the National Institute of Environmental Research, to assess the current status of air quality in the atmosphere in Korea, including background regions, the Seoul metropolitan area, and large sources of emissions, along with long-range transport (LRT) of air pollutants.

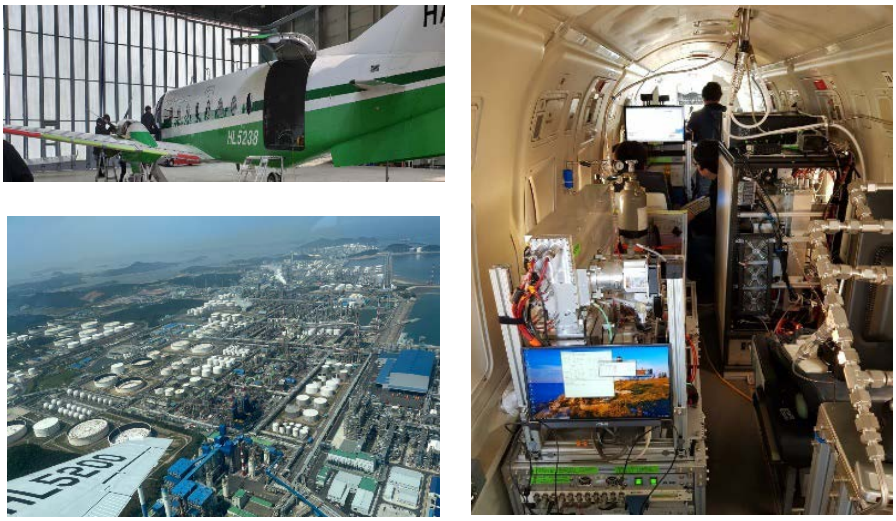

Figure 3. The AQL conducts aerial observations using Beechcraft 1900D and King Air C90GT.

In addition to direct measurements and observations, the AQL develops measurement instruments deriving from the experience in operating air pollutant analytical instruments (Figure 4). For instance, the Particle Condensation Sampler (PCS) developed herein is a quasi-real-time capture instrument, which condenses particulate matter and captures it as a liquid sample, thereby making it possible to analyze chemical composition in quasi-real-time in connection with other analytical instruments. The AQL has also developed a system that can measure and analyze HNO3, a gas-phase substance, in quasi-real-time and uses the system for addressing several research problems.

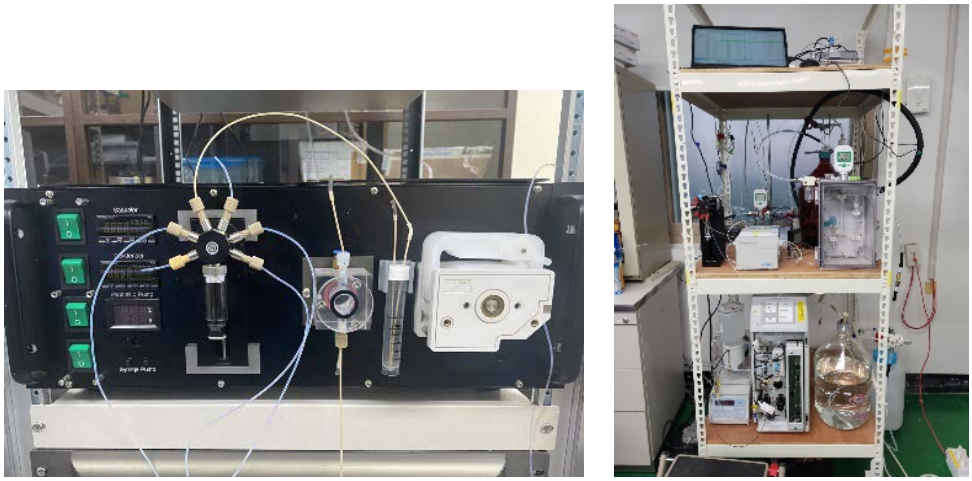

Figure 4. The AQL develops instruments (Particle Condensation System (PCS) for Aerosol and semi-continuous HNO_3 measurement system for atmospheric HNO_3.

Investigating the current status, physical and chemical properties, and mechanism of air pollutants across different regions and environments can help better identify the current status of air quality and the cause of high air pollutant concentrations in Korea. This will aid in proposing scientific approaches to improve air quality. The AQL at HUFS provides experience in operating real-time advanced instruments to nurture and train future generations of researchers and offers opportunities to acquire a better understanding of air quality measurement and analytical techniques and build individual research capacity.