Airborne Hyperspectral Trace Gas Sensors as Testbeds for Geostationary Air Quality Mission Validation

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Next generation air quality sensors are currently planned to launch within the next couple of years. The Tropospheric Emissions: Monitoring of Pollution (TEMPO-United States) and Geostationary Environment Monitoring Sensor (GEMS-South Korea) are two such missions that will probe the boundary layer/lower troposphere at unprecedented spatial and temporal scales. These missions are designed to provide constraints on chemical forecast models and specifically to answer the question: "What are the temporal and spatial variations of emissions of gases and aerosols important for air quality and climate?" In preparation for these missions a number of airborne air quality field missions have been performed to collect data at similar spatial and temporal scales, and during relevant seasonal air quality episodes including fires. This data is being used to improve the trace gas retrieval algorithms and explore the unique spatial scales and diurnal patterns that will be encountered when the geostationary experiments are operational. This overview will present details of two of the instruments used during these campaigns, the GeoCAPE Airborne Simulator (GCAS) and the Geostationary Trace Gas and Aerosol Sensor Optimization (GeoTASO) instruments. Maintained at the Goddard Space Flight Center's Radiometric Calibration and Development Facility (RCDF), these instruments are similar in design and sensitivity to what will be measured on-orbit by the TEMPO and GEMS sensors. Results of the retrieval of high spatial resolution nitrogen dioxide and formaldehyde will presented. Examples of vertical column retrievals will be presented under various source/weather conditions as well as the uncertainties that result from both instrument and radiative transfer assumptions.