Analyzers for Ambient CH$_4$, CO, and N$_2$O Monitoring based on Mid-IR Difference Frequency Lasers

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The new mid-infrared sensor platform Iris is described that combines difference frequency generation (DFG)-based tunable laser sources with simple direct absorption spectroscopy. The analyzers are capable of sub-ppb detection of key greenhouse gas species as well as isotopologues of greenhouse gases and common pollutants.

DFG lasers operating in the 3-5 micron window are tuned to access a variety of species and their isotopologues in the C-H, N-O, and C-O stretch region. Examples of analyzer data obtained for methane, nitrous oxide, and carbon monoxide are presented, including relevant time series data. Associated Allan Variances from laboratory experiments demonstrating ppt-level precision and ppb-level accuracy with long calibration intervals are also shown. Emphasis on achieving key performance metrics driven by WMO guidelines for Global Atmospheric Watch (GAW) and other applications is highlighted. Additionally, first results from field tests and initial field validations are described demonstrating field performance comparable to that obtained in the laboratory.