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Aerial Gas Mapping LiDAR for Methane Emissions Management at Oil and Gas Infrastructure

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We present an overview of aerial Gas Mapping LiDAR (GML) technology and its application to methane emissions monitoring and informatics for oil and gas infrastructure. The GML sensor combines spatially scanned and coaligned topographic and path-integrated methane concentration LiDAR measurements with navigation data and aerial photography to provide episodic detection, localization, emission rate quantification, and emission source attribution of methane plumes within scanned infrastructure. Aerial deployment enables rapid and efficient coverage of large and dispersed infrastructure. High sensitivity LiDAR measurements allow detection of methane emissions at rates below 1.5 kg/h with greater than 90% probability of detection in most deployment conditions, resulting in the detection of more than 90% of emissions from typical oil and gas production basins. The high spatial resolution of the LiDAR scans provides geo-location of emission sources, typically to within 2 m, for targeted LDAR response and reliable emission source attribution. Well characterized emission rate estimates, produced by combining LiDAR methane concentration measurements with gas flow speed information, allow source-level prioritization of LDAR response and enable accurate source-resolved methane emissions inventories. Real-world examples of Gas Mapping LiDAR use cases will be presented and requirements for producing large-scale methane emission inventories including sample planning, facility and equipment identification, emission rate quantification accuracy, detection sensitivity, and statistical analysis methods will be covered. Specific applications of the GML technology include leak detection and repair (LDAR); measurement, monitoring, reporting, and verification (MMRV) programs; measurement-based methane emissions inventory and intensity benchmarking and reductions tracking; and differentiated gas certification programs. © 2024 The Author(s)