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Airborne Detection and Dynamic Modeling of Carbon Dioxide and Methane Plumes[1] JAMEY JACOB, TAYLOR MITCHELL, SEABROOK WHYTE, Oklahoma State University — To facilitate safe storage of greenhouse gases such as CO_2 and CH_4, airborne monitoring is investigated. Conventional soil gas monitoring has difficulty in distinguishing gas flux signals from leakage with those associated with meteorologically driven changes. A low-cost, lightweight sensor system has been developed and implemented onboard a small unmanned aircraft that measures gas concentration and is combined with other atmospheric diagnostics, including thermodynamic data and velocity from hot-wire and multi-hole probes. To characterize the system behavior and verify its effectiveness, field tests have been conducted over controlled rangeland burns and over simulated leaks. In the former case, since fire produces carbon dioxide over a large area, this was an opportunity to test in an environment that while only vaguely similar to a carbon sequestration leak source, also exhibits interesting plume behavior. In the simulated field tests, compressed gas tanks are used to mimic leaks and generate gaseous plumes. Since the sensor response time is a function of vehicle airspeed, dynamic calibration models are required to determine accurate location of gas concentration in (x, y, z, t). Results are compared with simulations using combined flight and atmospheric dynamic models.

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