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Improved methane emission estimates using AVIRIS-NG and an Airborne Doppler Wind Lidar

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This study demonstrates the utility of combining Airborne Doppler Wind Lidar measurements and quantitative methane (CH4) retrievals from the Next Generation Airborne Visible/Infrared Imaging Spectrometer (AVIRIS-NG) to estimate CH4 emission rates. In a controlled release experiment, Twin Otter Doppler Wind Lidar (TODWL) observed wind speed and direction agreed closely with sonic anemometer measurements and CH4 emission rates derived from TODWL observations were more accurate than those using the sonic during periods of stable winds. During periods exhibiting rapid shifts in wind speed and direction, estimating emission rates proved more challenging irrespective of the use of model, sonic, or TODWL wind data. Overall, TODWL was able to provide accurate wind measurements and emission rate estimates despite the variable wind conditions and excessive flight level turbulence which impacted near surface measurement density. TODWL observed winds were also used to constrain CH4 emissions at a refinery, landfill, wastewater facility, and dairy digester. At these sites, TODWL wind measurements agreed well with wind observations from nearby meteorological stations, and when combined with quantitative CH4 plume imagery, yielded emission rate estimates that were similar to those obtained using model winds.