Testing a Promising Remote Sensing of Methane with in situ Observations of Emissions from a Natural Marine Hydrocarbon Seep

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ABSTRACT

The seeped vents of methane from an important coastal gas seep, are poorly constrained. Remote sensing (RS) can specifically improve our understanding of sources and sinks. Field and laboratory studies used optical and in-ultraviolet measurements of methane emissions from marine natural seeps, with the epi-photometric calculations to test the feasibility of remote sensing from the AVIRIS platform. The marine vents were found to be highly avian, producing a large volume of methane per unit area. The feasibility of MODTRAN simulation ideas that although most of the spectral range, between 3000 and 2100 nm, was covered was found to be a very high correlation. Overhead and on-the-ground studies were performed to test the feasibility of remote sensing.

A multipronged approach to assess the feasibility of remote sensing to measure atmospheric methane emissions was tested through laboratory and in situ studies. Methane absorption features were confirmed by spectra obtained from the laboratory studies. Furthermore, the in situ approach identified atmospheric methane sources from both bubble transport and air-water exchange from a dissolved plume. Using a Gaussian plume to fit to in situ measurements of the methane plume originating from a seep area, radiation transfer calculations demonstrated that methane signatures from this seep were estimated to be feasible both from a Twinotter (3 km altitude), and the ER-2 (20 km altitude). Field efforts are planned for 2008.

Field Study Phase 1 - Plume Chemical Characterization

Approach: Repeated transects of the plume with flame ion detection, contour the data, and fit with a Gaussian plume using boat measured wind data. Site: Shane Seep

Field Study Phase 2 Plume Spectral-Chemical Characterization

Approach - Collect FID data at 3 heights and spectral data during a plume transect Site - Seep Tent Seep

Radiative Transfer Calculation of AVIRIS Feasibility

Atmospheric methane and carbon dioxide absorption coefficients calculated from HITRAN 2004 at a 1 cm spectral interval, including a Lorentz shape 

Conclusion and Future Efforts

A multipronged approach was tested to assess the feasibility of remote sensing to measure atmospheric methane emissions. The peak approach is to use both laboratory and in situ studies to calibrate the methodology. The feasibility of remote sensing is determined by the high-concentration plume emissions from both bubble transport and air-water exchange. The AVIRIS approach is shown to be feasible for marine seeps. The data are then converted to vector output for use in the future for the AVIRIS approach. The feasibility of the AVIRIS approach is shown to be feasible for marine seeps.