FY 2016 PHASE I AWARD WINNER


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| AWARD: | $119,930.00 |
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| TITLE OF PROJECT: | A Direct Absorption Spectrometer for Low Drift and High Accuracy Measurements of Methane Isotopes |
| SUBTOPIC NUMBER: | 8.3.1C |

TECHNICAL ABSTRACT:


In order to understand how and why methane (CH4) concentrations change over time, it is necessary to understand their sources and sinks. Stable isotope measurements of 13CH4:12CH4 and CH3D:12CH4 ratios constrain these sinks and sources. This is particularly crucial for methane of microbial origin since other tracers such as ethane and propane are not co-emitted. Global measurements of these ratios are currently performed using isotope ratio mass spectrometry (IRMS) on flasks collected by NOAA's Cooperative Air Sampling Network. However, IRMS is labor intensive and costly.

We propose to adapt and improve an existing laser isotope monitor to enable fast, precise measurements of methane isotope ratios (δ13C and δ2H) of flask samples. A prototype sampling system will be implemented to measure low-pressure trapped samples of whole air and working standard in quick succession. This strategy allows for improvements in both precision and accuracy of the methane isotope measurements. No sample preparation will be required to achieve final precisions of 0.03‰ for δ13C and 1‰ for δ2H.

The proof-of-concept developments described within will set the stage for an overhaul of currently used mass-spectrometry-based isotope laboratory instrumentation that will make measurements of methane isotopes much easier, faster and less costly.


SUMMARY OF ANTICIPATED RESULTS:

The prototype instrument and sampling system will be inexpensive in both capital and operational costs (as compared to current isotope ratio mass spectrometers), require no preprocessing of samples, and offer excellent precision in well under 20 minutes per sample.