

OSU Ice Core Lab Methane Activity

Session Leaders: Jon Edwards, Kaden Martin, Katie Wendt

Session Objective: How do climate scientists measure greenhouse gases in the past?

Activity 0 – Lab Tour

Total Time: ~10 minutes

At the start of the session, Katie will take participants on a tour of the lab to discuss different stations. What are some of the compounds we measure in the lab, what are the different techniques to measure each compound, and what are some of the things we learn from each measurement.

Activity 1 – Sample preparation and Chronology

Activity Objectives: Participants will...

1. experience the process for preparing a gas measurement sample (up through melting)
2. be able to use a chronology to estimate the age of a sample

Total Time: ~30 minutes

Activity Details: Begin in the lab and transition to freezer. Go over sample preparation, from cutting and loading a flask through to loading the line and melting the sample. Begin in freezer room for cutting and loading, transition to lab space. Kaden will load a sample for melting (offcuts from Siple Dome). Samples will be loaded into spare flasks, covered with parafilm, then melted. Flasks are already loaded onto the N₂O line, can use these to illustrate the process (1AO1).

Go over ages in an ice core, reinforcing the difference between a gas age and an ice age. Knowing how we determine this is important – it informs our sample plans, and ultimately dictates the upper limit on the science we can do. This will be the foundation for the data analysis later, so provide a good foundation on the depth/age relationship (1AO3).

Activity 2 – How to determine CH₄ concentrations

Activity Objectives: Participants will...

1. view gas measurements in the GC
2. learn how to calibrate measurements against a standard curve
3. understand and estimate uncertainty

Activity Details: During this 45-minute window, 3 samples will be measured (running as ice-reprocesses so that participants get data quickly). While samples are running, go over the technical components for how the GC makes measurements (**follow Jon's document**) (*make connections to sounds and changes from the GC!*), and what the output we as scientists gather. By this point, 1-2 measurements will be completed. Use these measurements for context of how the calibration against the standard works (2AO1/2AO2).

As data is being gathered, can input it directly into a comparison spreadsheet to past measurements over this time period. This can be used to provide context for our measurements, and to initiate a discussion about the uncertainty in the data (2AO3).

Activity 4 – Wrap Up and Discuss Uncertainty

Activity Objectives: Participants will...

3. compare measurements they've helped make to determine uncertainty
4. plot data on a chronology in order to determine its age and climate context

Activity Details: Smaller groups will join back together to compare results. Each small group completed 3 measurements, with the other group replicating 2 of them. Use the replicate measurements to calculate the uncertainty in our measurement. Plot them using the chronology discussed in Activity 3. Discuss the data, what we can see, and how data/chronological uncertainty can influence our interpretation.

Session Outcomes

Participants will gain insight into the fully laboratory process behind making a gas measurement, from sample storage and preparation through to the final data point. They will understand standard calibrations, how to convert from a technical value to meaningful climate data with an associated age, and what uncertainties are impactful. Participants will have real-world data to drive discussions of anthropogenic climate change in later activities.

Distribution of participants

2 groups of 8, each broken into two concurrent groups

- 4 groups total with 2 groups running in each session
- 4 people per sub-group

Group Schedule

Group 1a and 1b: 1:00 – 2:45 pm

Group 1a 1:00 – 1:45; Activity 1 - Lab Tour and Sample prep

Group 1b 1:00 – 1:45; Activity 2 – How to determine CH₄ concentrations

Group 1a: 1:45 – 2:30; Activity 2 – How to determine CH₄ concentrations

Group 1b: 1:45 – 2:30; Activity 1 - Lab Tour and Sample prep

Group 1: 2:30-2:45; Final Questions and Transition to Louise and Bill's activity

Group 2a and 2b: 3:00 – 3:45 pm

Group 2a 3:00 – 3:45; Activity 1 - Lab Tour and Sample prep

Group 2b 3:00 – 3:45; Activity 2 – How to determine CH₄ concentrations

Group 2a: 3:45 – 3:30; Activity 2 – How to determine CH₄ concentrations

Group 2b: 3:45 – 3:30; Activity 1 - Lab Tour and Sample prep

Group 2: 3:30-3:45; Final Questions and Transition to Louise and Bill's activity

Session Handouts

