1. Scope and Application

1.1 Covers how to install Eosense soil gas flux chambers (XXX) and connect them to multiplexer (part number) and a Picarro G2508 (Santa Clara, USA) gas analyzer.

1.2 Orginally, this SOP was developed for greenhouse gas emissions from strawberry fields in NorCal, has been been modified as new projects come on line that rely on these instruments.

2. Summary of Method

2.1 This SOP describes how to 1) set up the Picarro, Multiplexer, Dynamic Soil Chambers, and Vacuum Pump.

Contents

3. Acknowledgements

We thank the work of Isaac Medina, Neha Vaingankar, and Baily Lai who worked with the instrutment early on and developed early versions of the SOP.

4. Definitions

4.1 Picarro 2508...

4.2 EosAC soil flux chambers (Eosense Inc, Dartmouth, Canada) coupled an

4.3 eosMX-P multiplexer (Eosense Inc, Dartmouth, Canada)

4.4 Vacuum pump.

5. Biases and Interferences

5.1 Biases and interferences can come from...

5.2 Calibration gases

6. Health and Safety

6.1 Describe the risk...

Safety and Personnnel Protective Equipment

7. Personnel & Training Responsibilities

Researchers training to use the Eosense chambers and Picarro analyzer include the following components:

Researchers using this SOP should be trained for the following SOPs:

- SOP03 Field Work
- SOP04 Electrical Power in the Field

Unanswered Picarro Questions

7.1 Set up tool / Data Logger setup: what is difference between dry and regular and timed Data columns

7.2 What is etalon temp (part of sensors in data source)

7.3 We need an SOP for calibration, including parts to order

Table 1: EosAC soil flux chambers (Eosense Inc, Dartmouth, Canada)

Chamber S?N	Filed ID # (2015-16)
1001501	
1001502	5
1001503	2
1001504	3
1001505	4
1001506	
1001507	1
1001508	
1001509	
1001510	
1001511	
1001512	

7.4 Recommendations for car-mounting? Is okay to stack the multiplexer on top?

7.5 Is there are way to turn on computer without turning on the gas analyzer and vacuum?

7.6 What files do we need to send to marc for him to reprocess them.

7.7 N2O is very noisy. Is there a way to reduce the noise?

Picarro Data Source/ sensors: allows you to see all sensor readings on picaro controller: zoom in/out= right and left mouse click

Forunner Multiplexer Questions

7.8 In the chamber data processor what does (L) or (E) mean in displaying fluxes for graphs?... for example Flux CO2 (L) or Flux CO2 (E)

7.9 In options for measurements chart in the data processor what is dead band range and what is chamber offset?

7.10 Are we supposed to measure chamber offset for each of the chambers we set out? (distance between bottom of chamber and soil due to collar)

8. Required Materials and Apparati

8.1 Picarro G2508 S/N 2143-JFAADS2048

8.2 Eosense (Forerunner) Multiplexer S/N ??

8.3 Chambers with Cables and Teflon Tubing (X meters in length)

8.4 In addition, we have identified the following customer support contacts:

- Picarro Tech support: Melissa, 408-962-3978
- Scott (408-962-3987)
- Karrin Alstad Applications — get calibration stuff from her. 408-962-3991

8.5 Eosense (East Coast Time Zone)

9. Reagents and Standards

9.1 Standards..[**?**].

9.2 Driorite

10. Estimated Time

10.1 Setting up the Picarro can take between 1-1 1/2 hours depending on your experience. Depending on the ambient temperature, the Picarro can take 30 minutes to reach operating temperatures. To be effecient, start the Picarro as soon as possible.

11. Sampling Design

11.1 The cable and gas tubing is XX meter.

11.2 If the generator is used, place the it downwind at a minium of 100 feet.

12. Set Up

12.1 Connect recirculation pump to Analyzer VACUUM port using the convoluted metal hose. Hand tighten and use wrench to seal connection.

12.2 Connect multiplexer to Picarro through USB ports on Picarro (does not matter which port used)

- See Picarro Figure 1 for USB port identification

12.3 Connect monitor, mouse, and keyboard to Picarro via the remaining USB ports (note: there are two extra USB ports on the front of the Picarro)

12.4 Connect blue monitor plug to Picarro and monitor power plug to outlet.

12.5 Ensure all machines are in the off position (the circle signifies off position)

12.6 Connect power plugs for CRDS, multiplexer, and recirculation pump

12.7 Connect recirculation pump to multiplexer

- Connect control and data ports on the back of the recirculation pump to the Picarro ensuring white triangles are facing up on the back of the pump
- Insert other cable end of these connections into any USB port on the Picarro

12.8 Connect clear tubes to an inlet port on the recirculation pump, connect other end to the inlet on the front of the multiplexer

- Inlet on multiplexer on right (labeled)
- Inlet on vacuum (on left – clear tube)

12.9 Repeat process for the outlet tubes

- Outlet on Picarro
- Outlet on vacuum (on right – silver tube)

12.10 Attach clear tube inlet of Picarro to labeled outlet on multiplexer

12.11 Attach one end of power/data cable to the COMM port in the pump and the other end to the matching COMM port on the multiplexer

Picarro Start Up Procedure

12.12 Keep ambient/outside temperature below 35°C

12.13 Power on recirculation pump and Picarro **Never turn off recirculation pump when Picarro is on**

12.14 Boot up sequence initializes CRDS software and analyzer

12.15 Next turn on multiplexer. Ensure that multiplexer is on before connecting tubing between it and the analyzer.

12.16 On the monitor start the Multiplexer System (a quick link is located on the Desktop)

12.17 Warming up for 30 minutes – System Alarm will be red until the Piccarro the system is heated.

12.18 Picarro is ready when the system alarm is no longer red.

Typical Begining Temperatures

12.19 Cavity Pressure (Torr) ppm - 565.135

12.20 Cavity Temperature (C) ppm - 30.570

12.21 Warm Box Temp (C) ppm - 30.286

Selection the Proper Location for Instruments

12.22 asfasd saddfasdf sd asfd sdf

Installing Chamber Rings

12.23 Install rings in soil at sampling locations.

12.24 Make sure no plant material can get caught below ring, between ring and chamber and between chamber top and seal. Remove all leaves and fruit that might get caught. Tuck cut plastic in plant so that it can be used to replace hole when finished.

Place Chambers on Rings

12.25 Place chambers onto bases, pressing ring down to get a good seal. Try to avoid disturbing the chamber after it has been installed.

12.26 Connect all hoses while Picarro is warming up. –place tubing along the bed (dont let them get into the furrow)

12.27 After all chambers have opened up, do a second check for foliage that might get in the way

Data Collection (when alarm is green)

12.28 Check Picarro Conditions

12.29 Ambient should be below 35°C. (DAS – if DAS goes up to 45°, should be turned off or cooled – Use fan to cool air around the Picarro.

12.30 Check for typical atmospheric concentrations:

- N2O 0.3 ppm
- CH4 2.4 ppm
- C2O 300-600 ppm

- NH3?
- H2O 1-5%

straw 5 chamber ??? names?

Full 12

Full 12 minus #4

()

Running the Multiplexer Software

12.31 Uncheck default cycle on monitor

12.32 Load Cycle in User Data Folder.

12.33 Multiplexer will initialize - Cycling through Stage (1 to 12)

12.34 Check chambers to ensure good seals

12.35 Check fuel every two hours, top off each time – be careful to avoid spilling. Be sure to release pressure before putting nozzle into filler throat. Open valve for gas when nozzle is inserted nearly into generator filler throat. Press green button for 3-5 sec intervals, checking between filling to determine if the gas at at or near the red line. Try to get at least 3 cycles minimum . ideal is 2 cycles before irrigation, 2 cycles during irrigation and 2 cycles after.

Shut-Down Procedure

12.36 After at least two cycles after irrigation, begin retrieving chambers after each one has completed measurements (starting at 1 usually).

12.37 Cap all sets of tubes with glove and tape.

12.38 Carefully coil each set of tubes and wires to limit twisting and scratching of teflon. Zip/velcro together and stack in order 1-5 on the ground.

12.39 Remove chambers from sampling location

12.40 Separate based from chamber and repackage them into boxes.

12.41 When final chamber measurement has been completed, "end" ? sampling cycle

12.42 Connect spare chamber to channel X and refresh chamber...

12.43 select "Desciccate" method and run dry air through Picarro for 10 minutes.

12.44 shut down.

12.45 CRDS Date Viewer - Shut down Picarro — Select option "turn off analyzer and prepare for shipping]

12.46 After Picarro shuts down, manually switch off the instruments in the following order:

1. 1. Multiplexer
2. 2. Picarro
3. 3. Recirculation Pump
4. 4. Power Strip

13. Data Analysis and Calculations

14. QC/QA Criteria

15. Trouble Shooting

How to read data from Picarro (must be emailed) The Chamber Data Processor program is expecting to find all of the relevant

files in its own folder. You can freely move these out between sites, but as they contain information about the chamber sequencing, when you are processing a certain date range, you will need to have to correct FRMonitor logs present (the program will start its search with log 0000 and go until it cannot find the next in the sequence). The path for raw analyzer data should always be the same, and should look like:

You can set this from the Data menu in the Chamber Data Processor (Data-¿ Analyzer Data Path).

Days with unexpected data: These days (159 and 175 or June 8th and June 24th) appear to contain valid chamber measurements. The Julian Day metric is pulled directly from the raw analyzer data and there don't appear to be any cases where a measurement got moved from the proper day. I would check to see if the system and/or local time on the analyzer have been changed, as this could potentially cause problems. You could also compare the processed measurements against your field notes to see if there is an obvious time period with missing data that seems to match with these days.

Days that should have more data: I noticed several errors in the FRMonitor logs that you uploaded. I've fixed these files and attached them to this email. Back up the older versions and try using these instead: I noticed several additional measurements appear once I had updated them. As for where these errors came from, the log files suggest that, at some points at least, chambers were disconnected from the Multiplexer while it was actively running a measurement cycle? If so, I would strongly advise against this, as it can cause the Chamber Data Processor to overlook measurements (especially if the chamber was closed when it was removed). Also, are you using the 1.6.0 or 1.6.2 version of the FRMonitor software? Make sure to use the newer version to schedule measurements.

Days where some chambers are missing: I saw several days where Chambers 1 and/or 2 do not appear to be sending any data. This indicates either a communication issue between the Multiplexer and Analyzer, or that the chambers were not connected during this time period. Has the FRMonitor software been recognizing all of the connected chambers on start-up? If not, then they will not record data (even if they open and close). The System Info button will show you a break down of chamber-specific events, including successfully logged measurements and communication problems. Disconnecting and reconnecting chambers during a measurement cycle can also cause these errors.

16. References

16.1 APHA, AWWA. WEF. (2012) Standard Methods for examination of water and wastewater. 22nd American Public Health Association (Eds.). Washington. 1360 pp. (2014).