

Discussion of Carbon Dioxide and Methane Concentration Spikes from an Airfield near Stillwater, OK and a Carbon Sequestration Site near Farnsworth, TX

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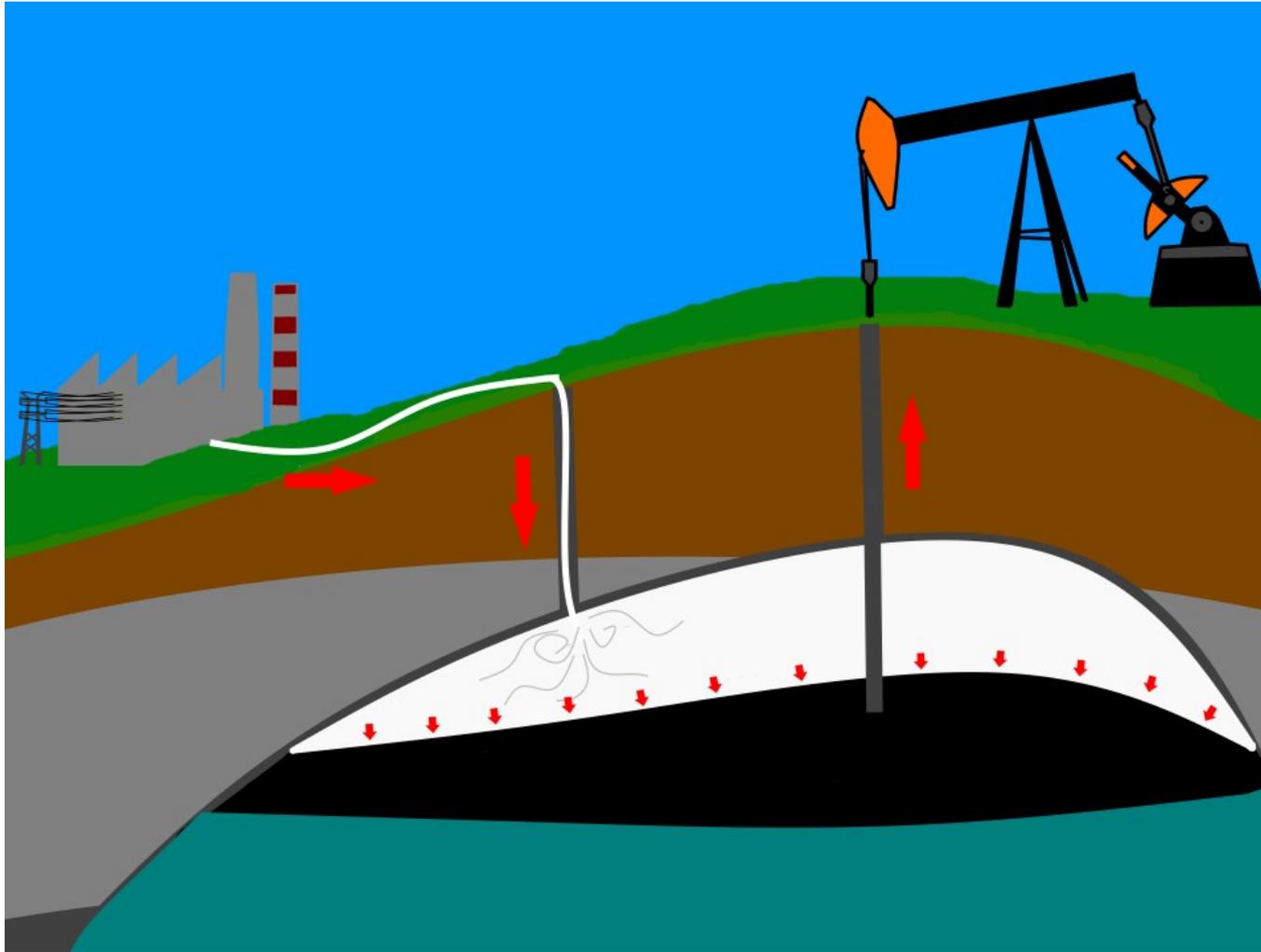
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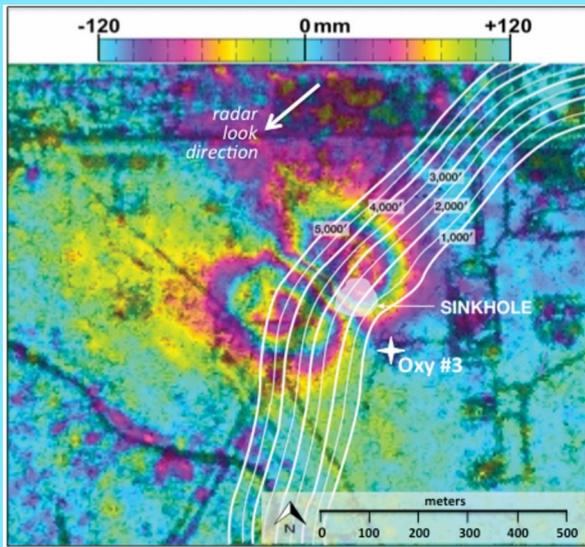
Carbon Sequestration



Carbon Sequestration



Bayou Corne, LA - 2014



35 Acre Sinkhole

Preventable
Disaster

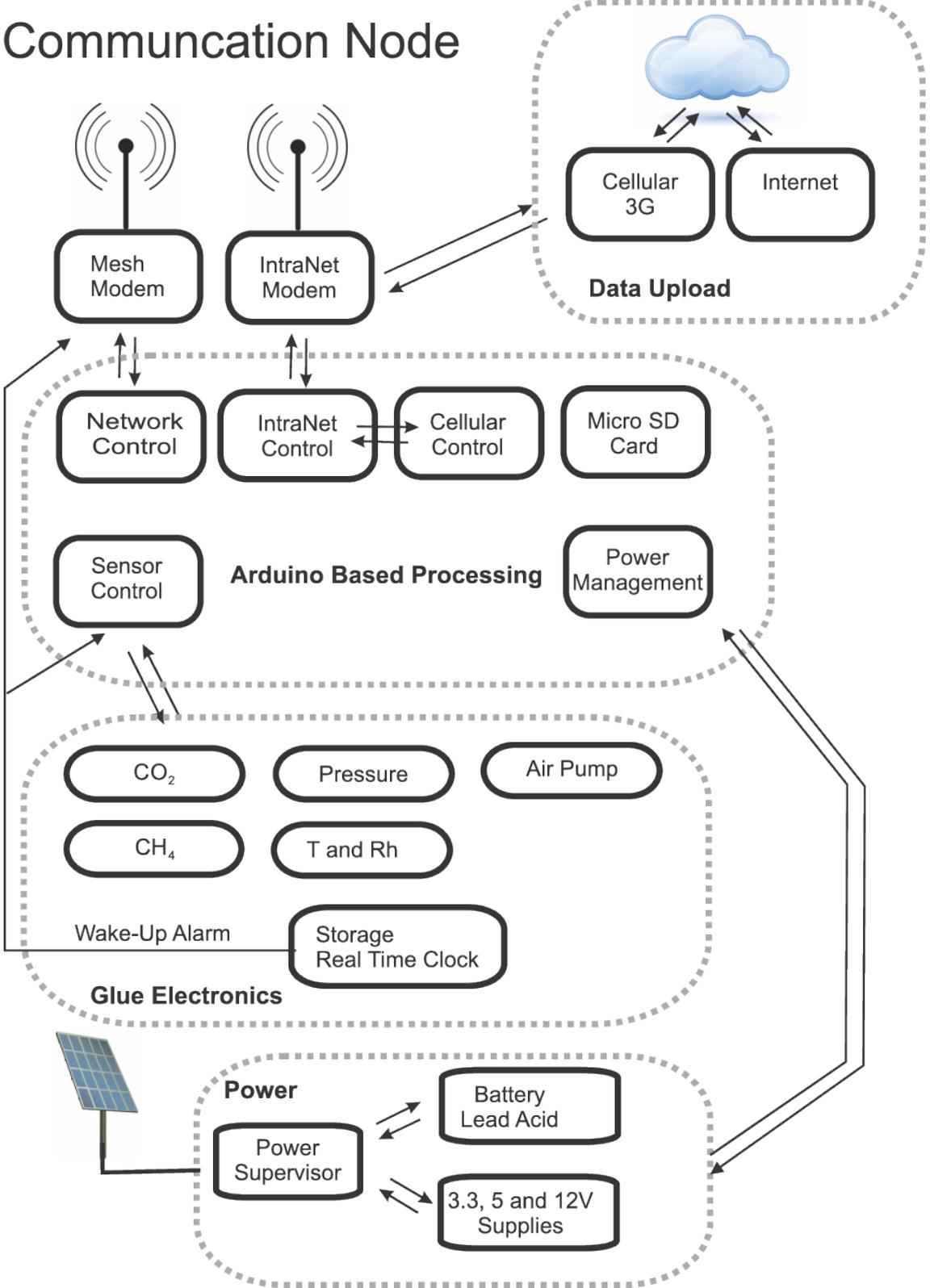
Lake Nyos, Cameroon - 1986



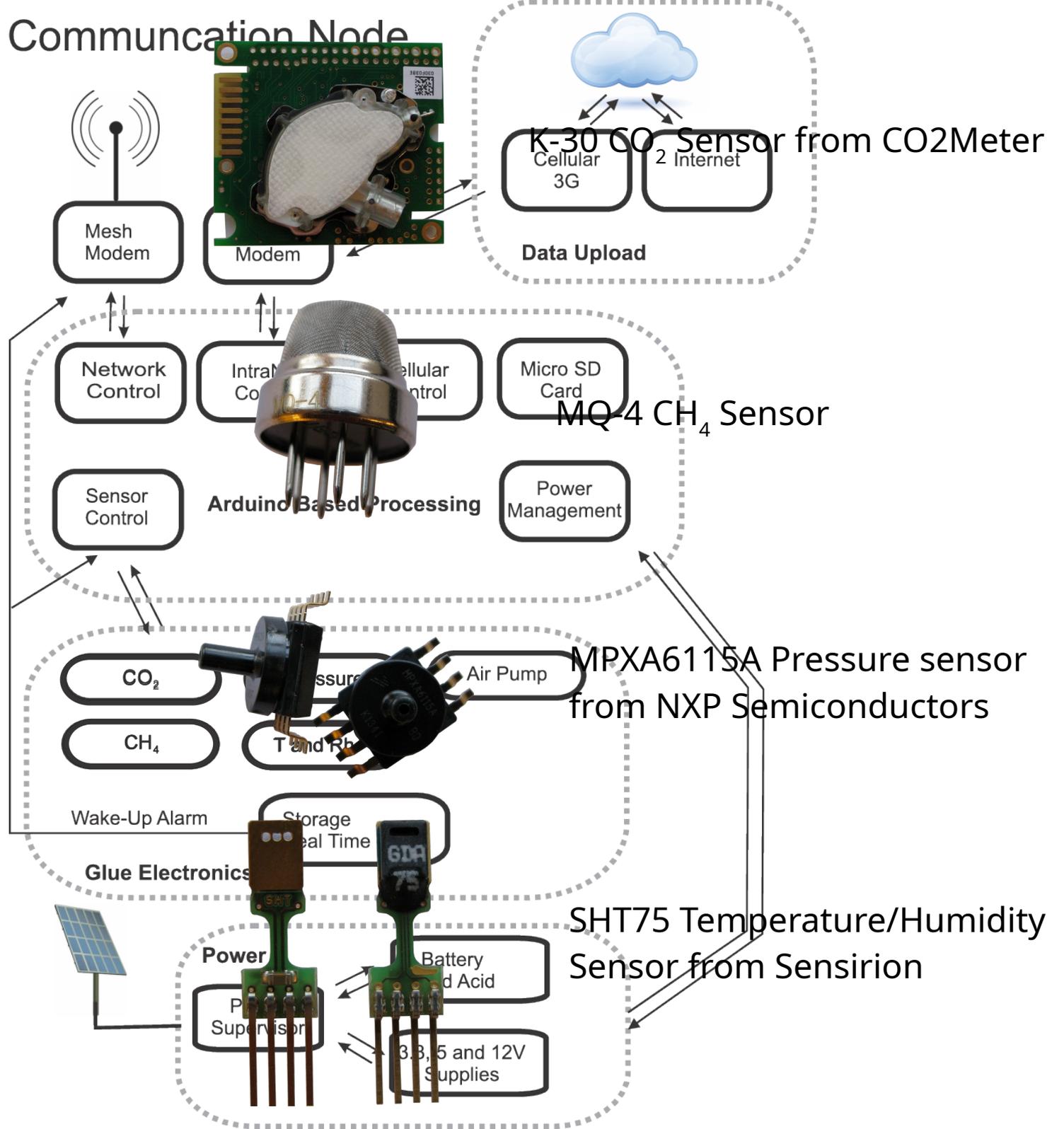
1,700+ Dead in 1km²

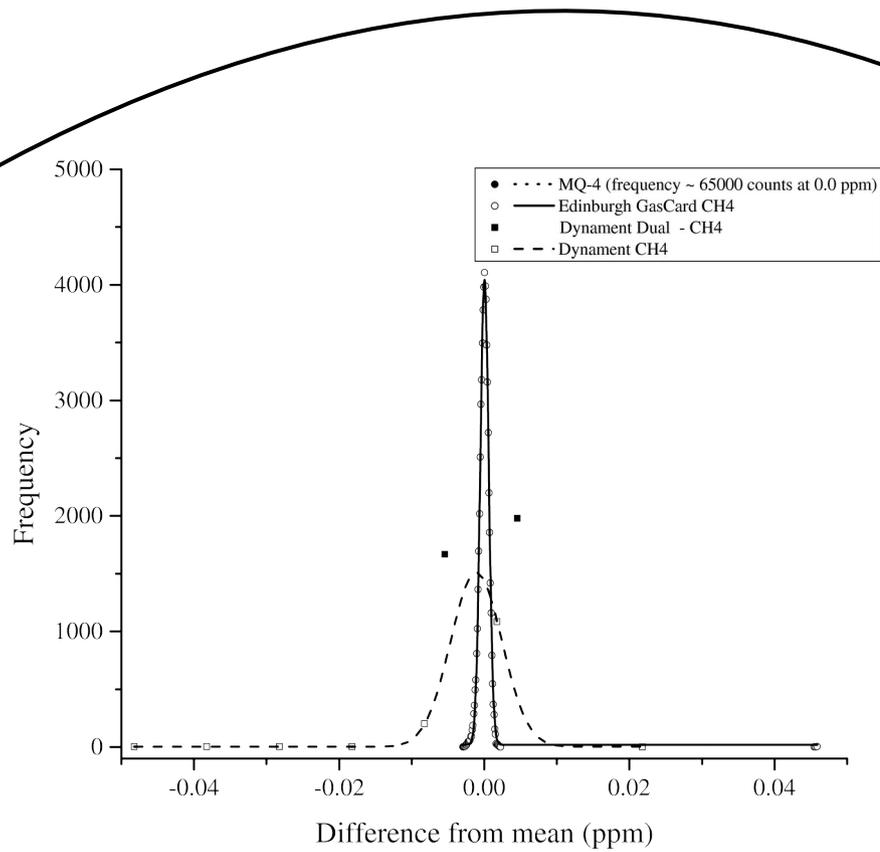
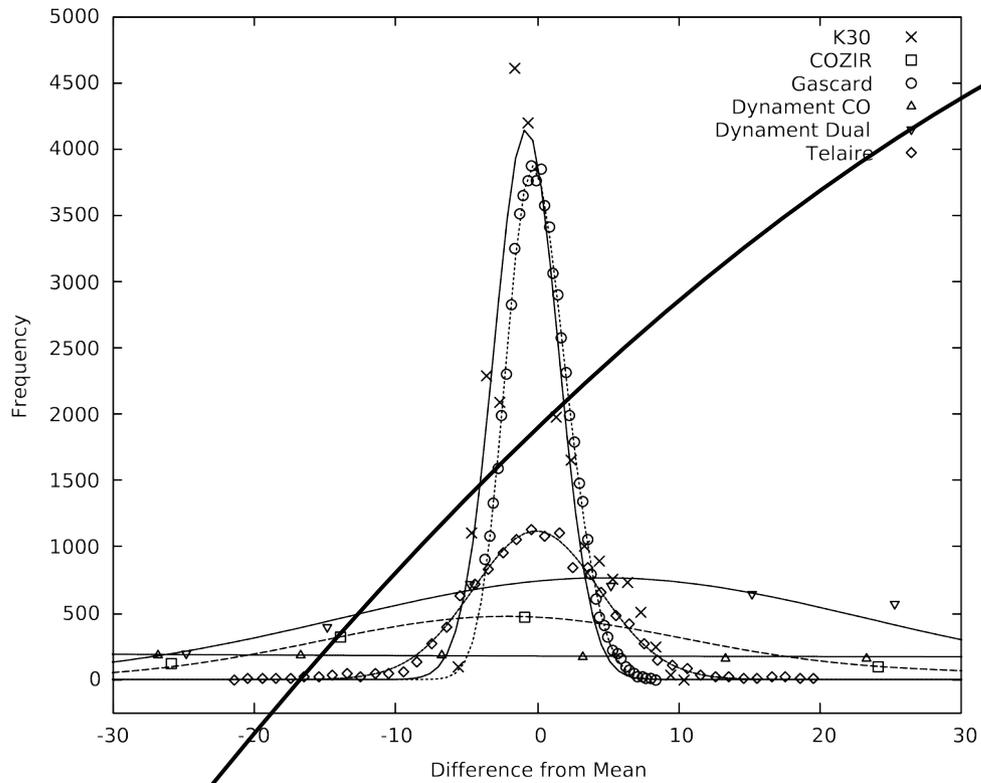


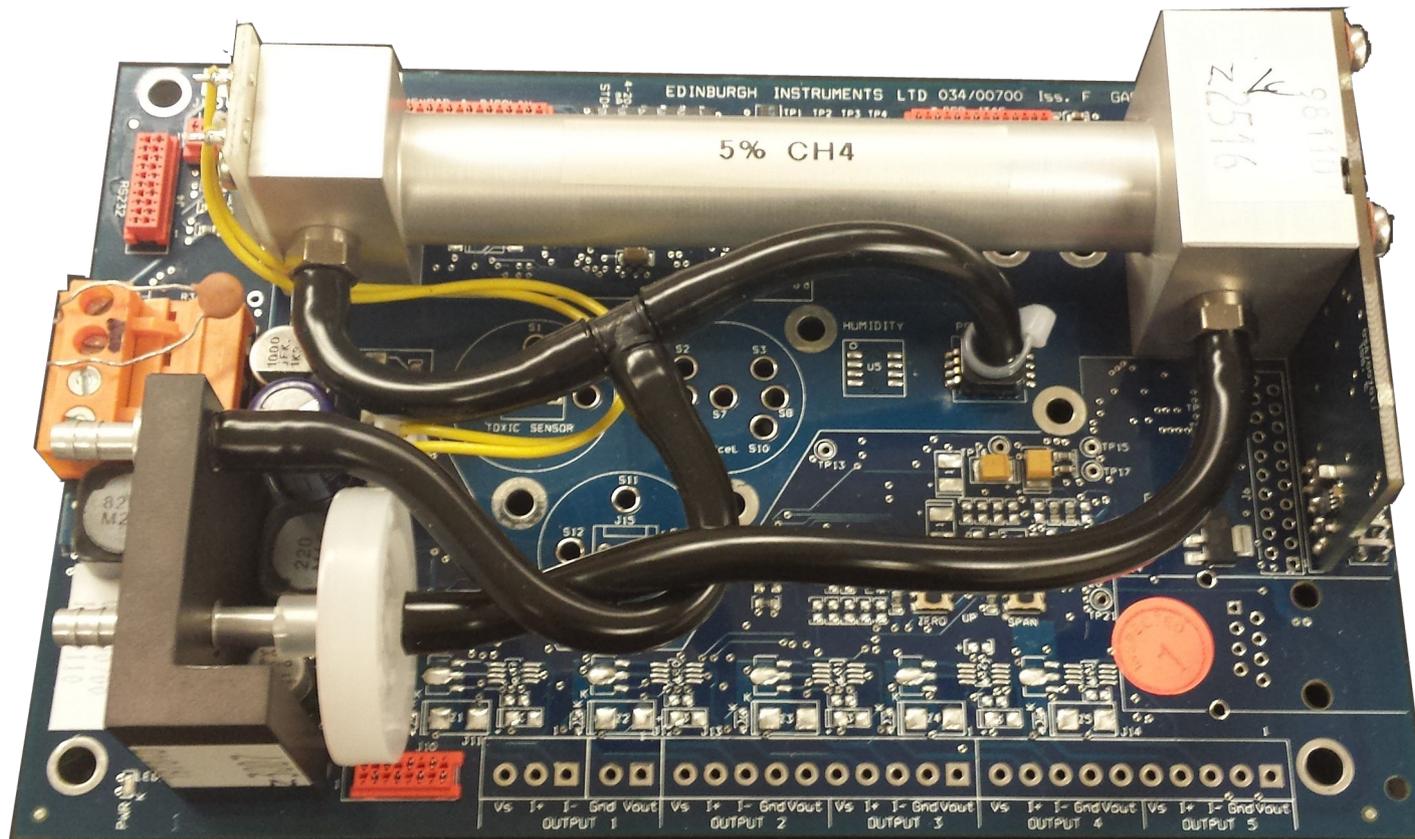
Communcation Node



Communication Node

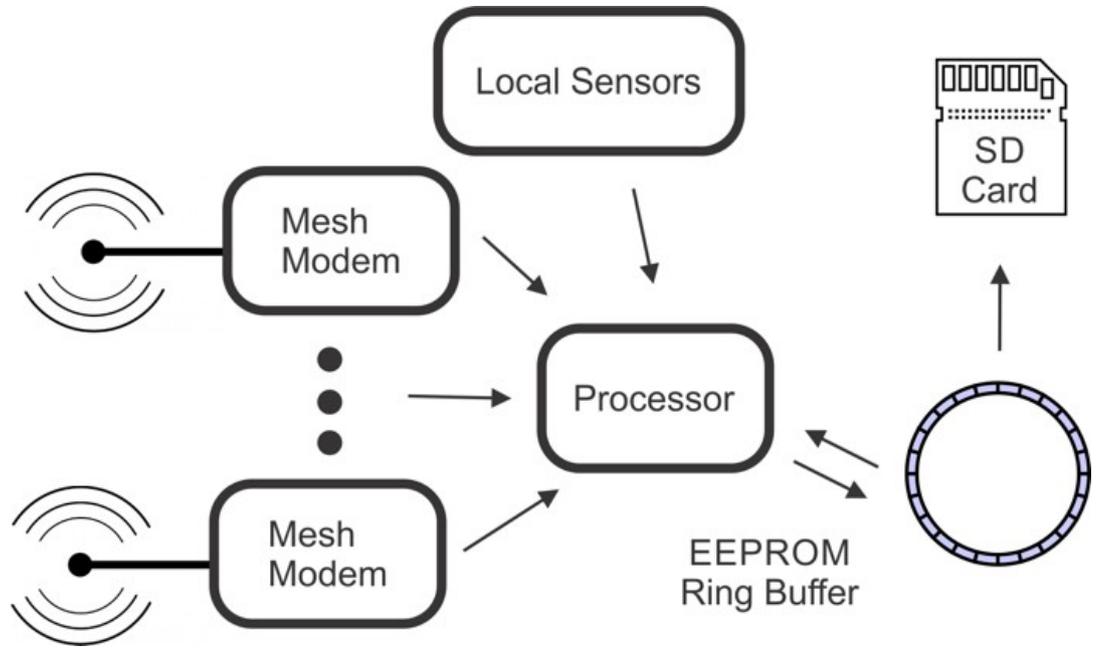
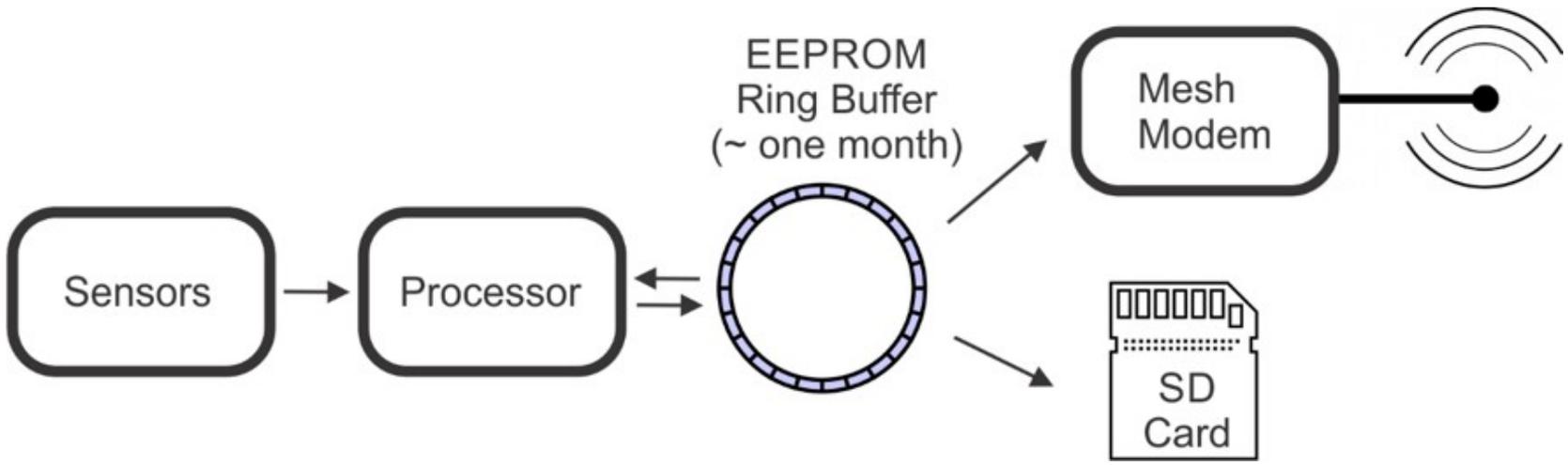




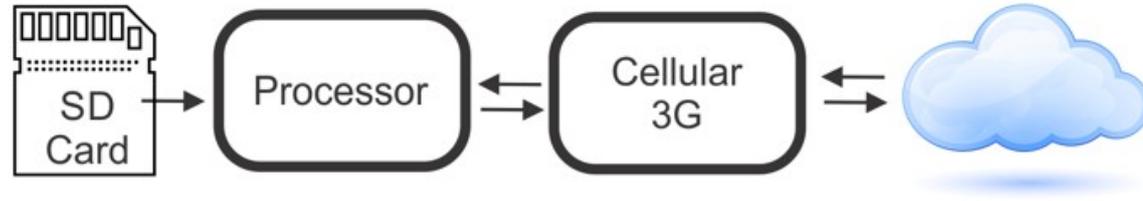


Edinburgh Gascard CH₄ – From Edinburgh Sensors

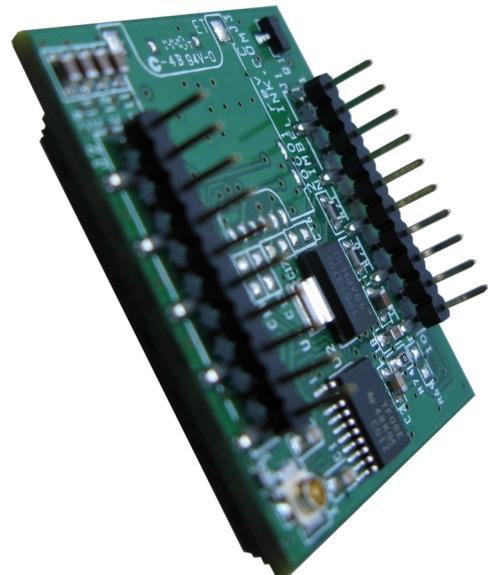
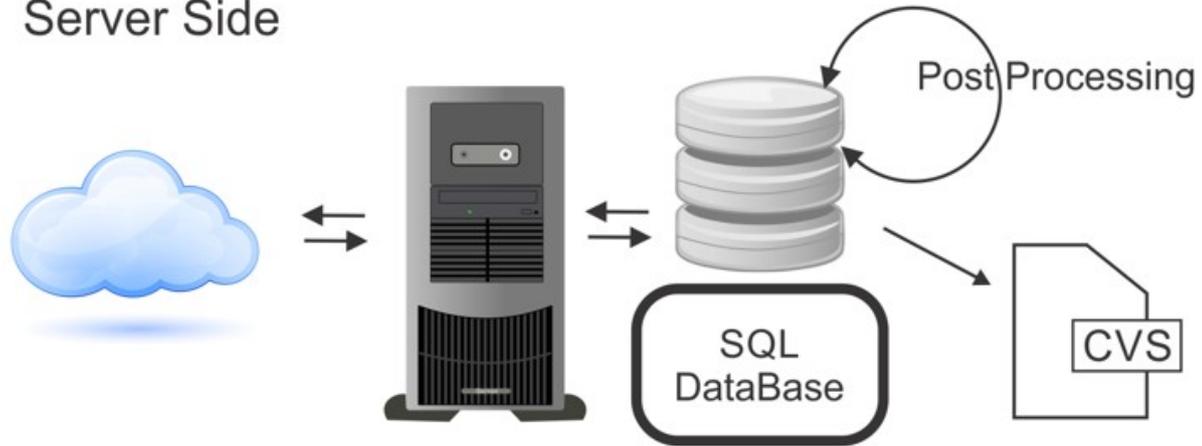
- Long Path Length
- Temperature and Pressure Correction
- Higher Power Consumption
- Requires Flow Regime

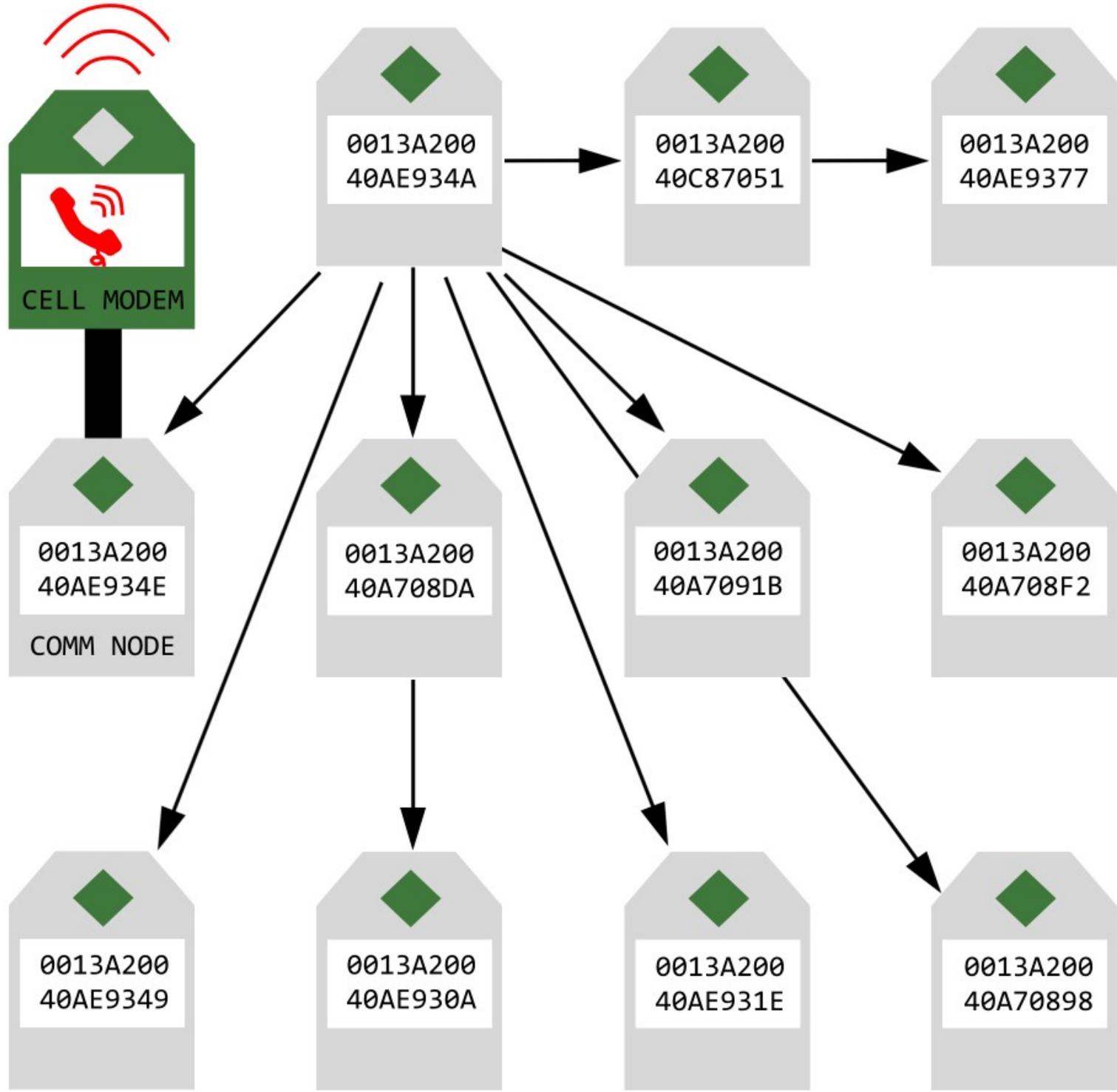


Communication Node

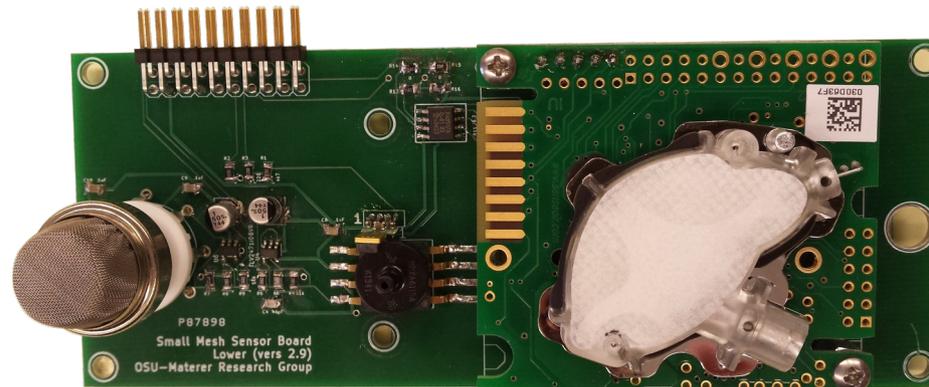
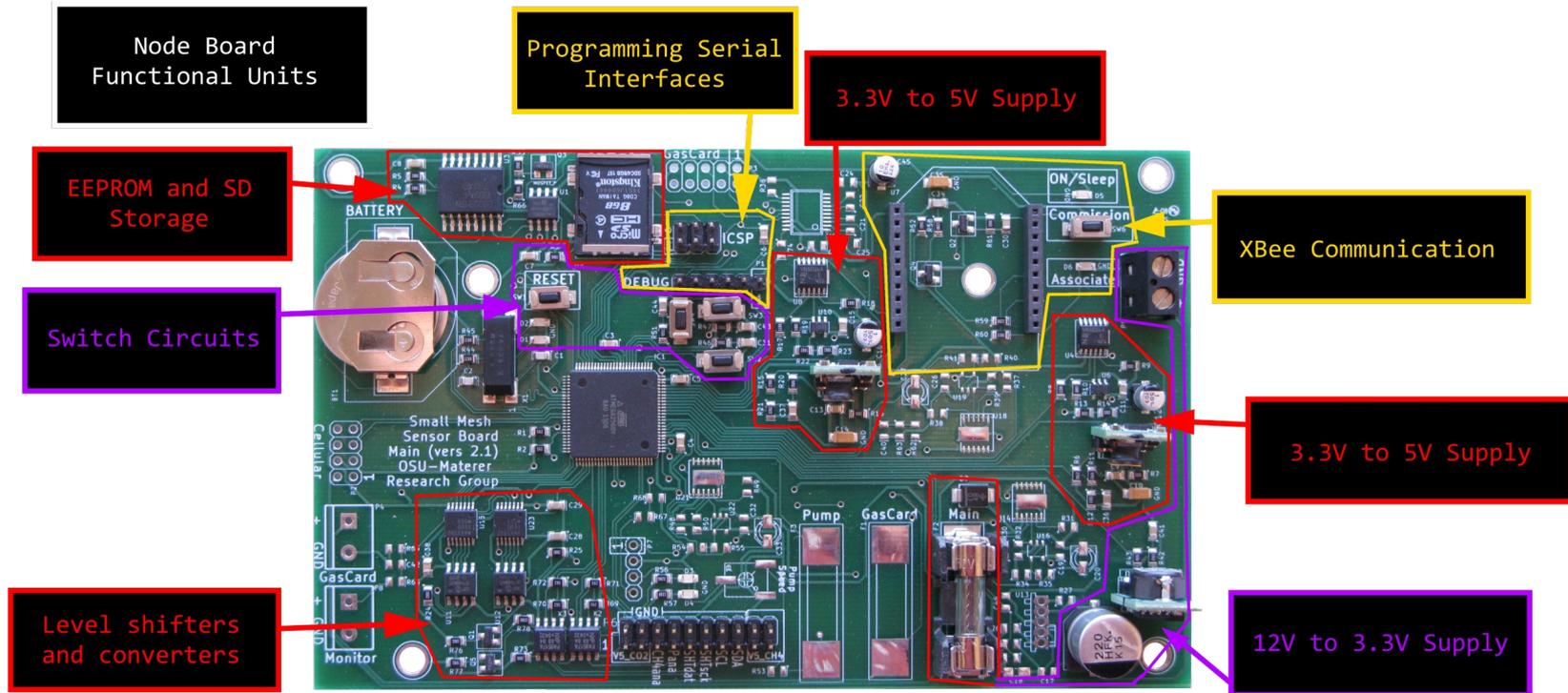


Server Side

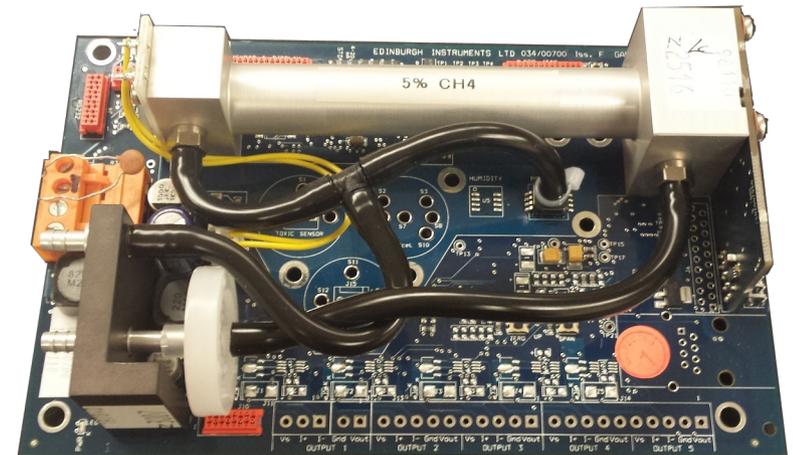
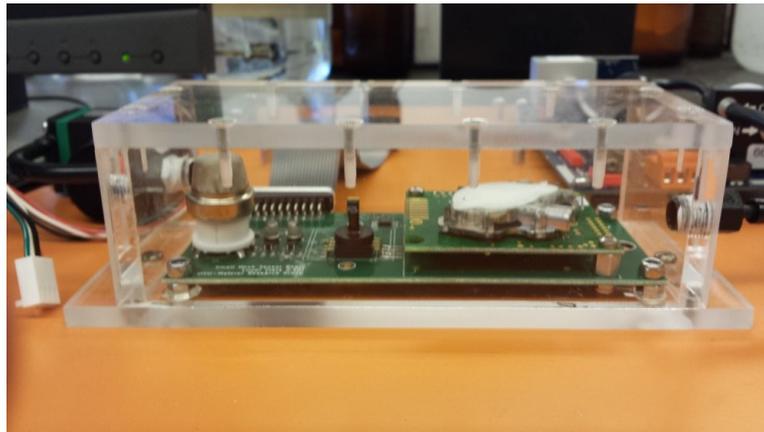
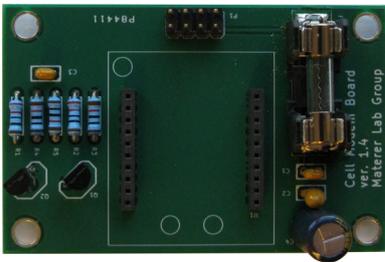
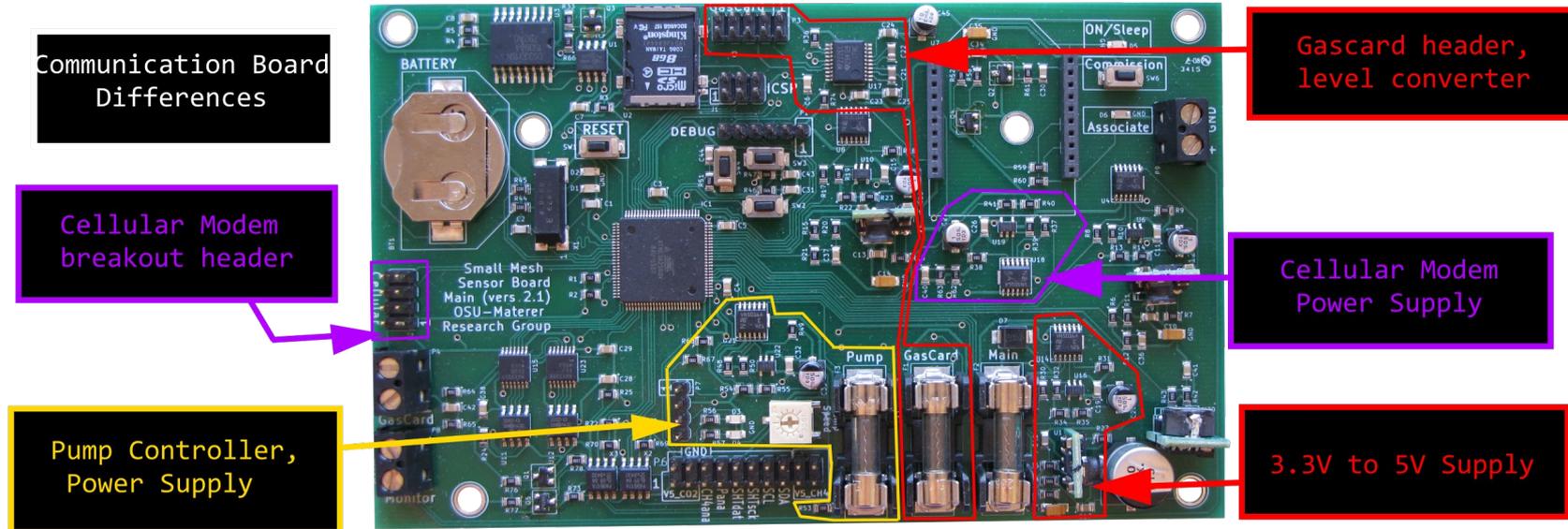


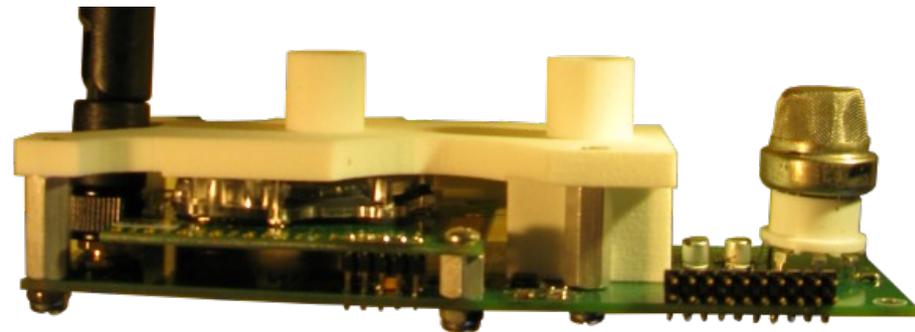
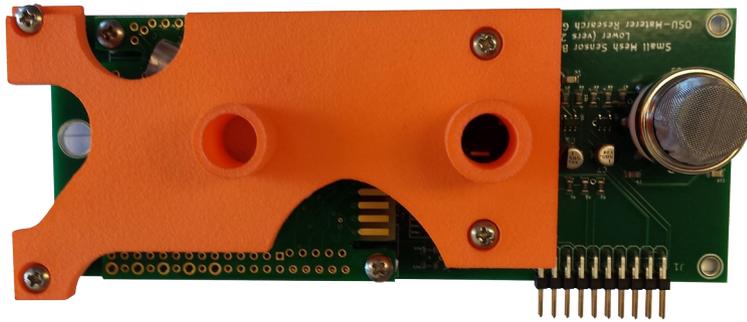
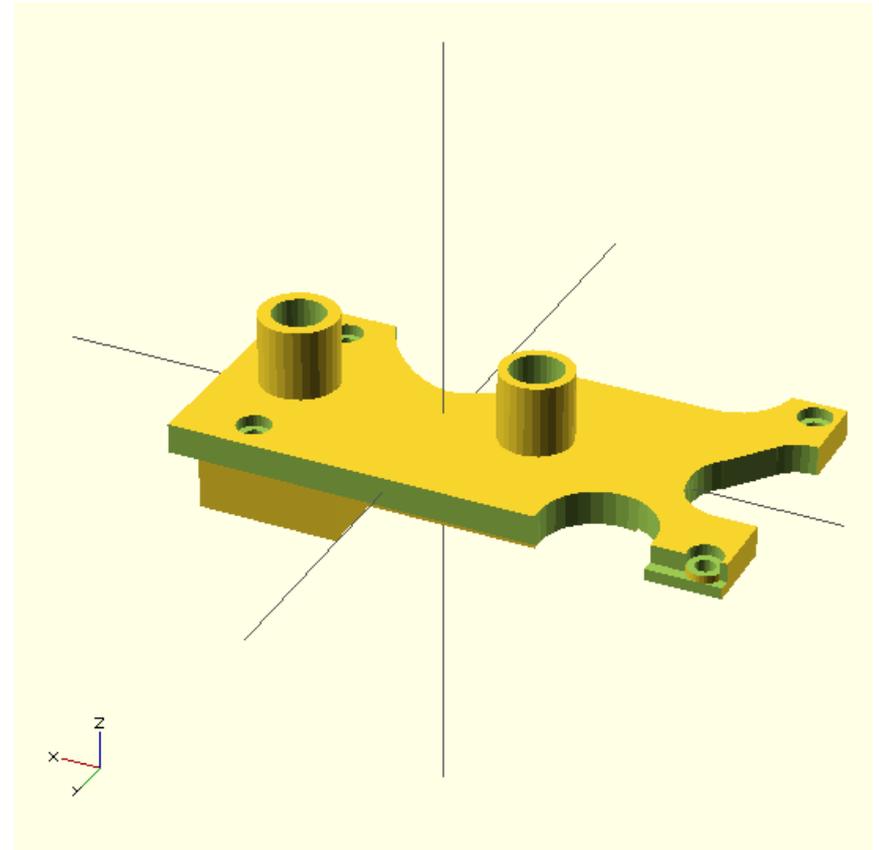


Sensor Node Boards



Communication Node Boards

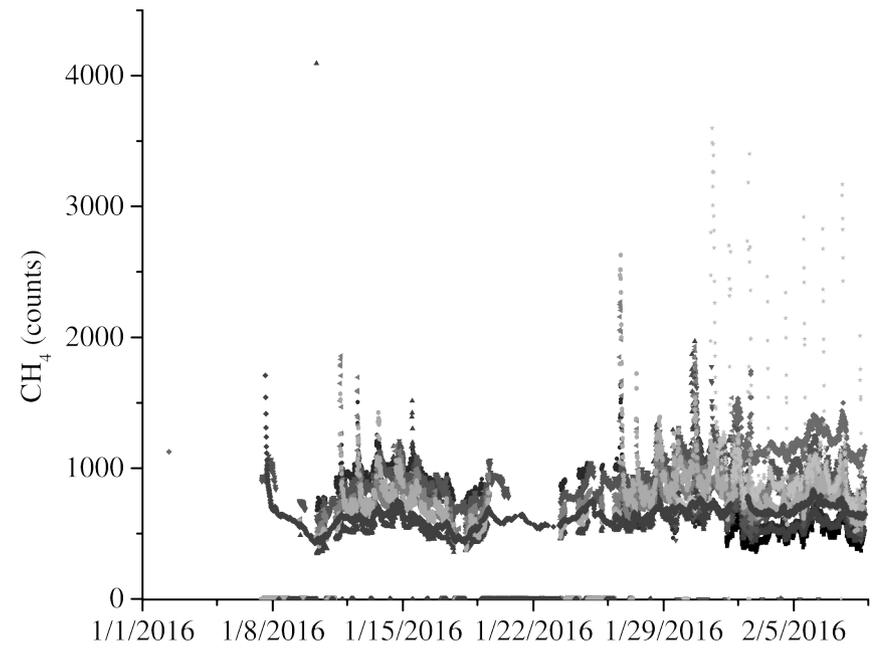
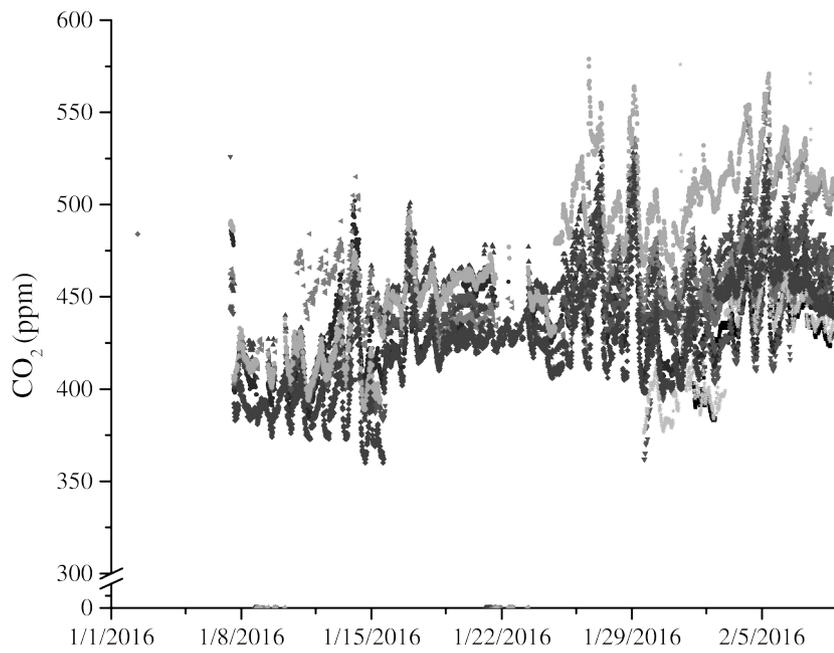


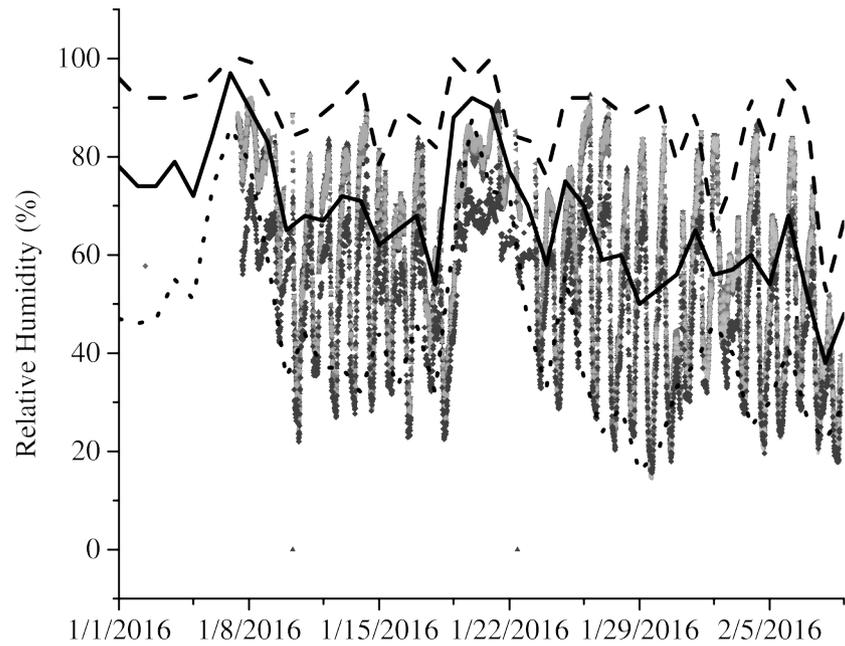
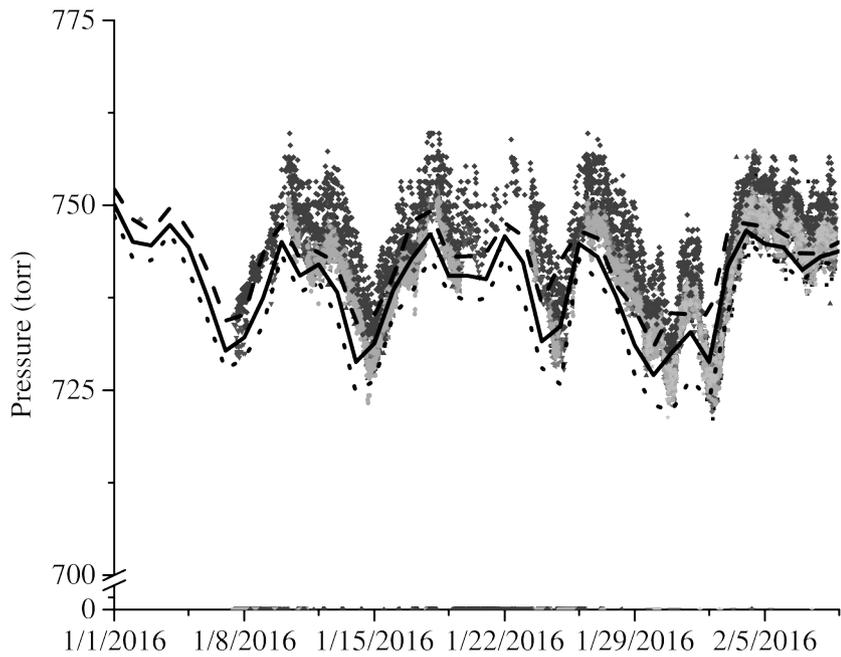




Proving Grounds – North of OSU

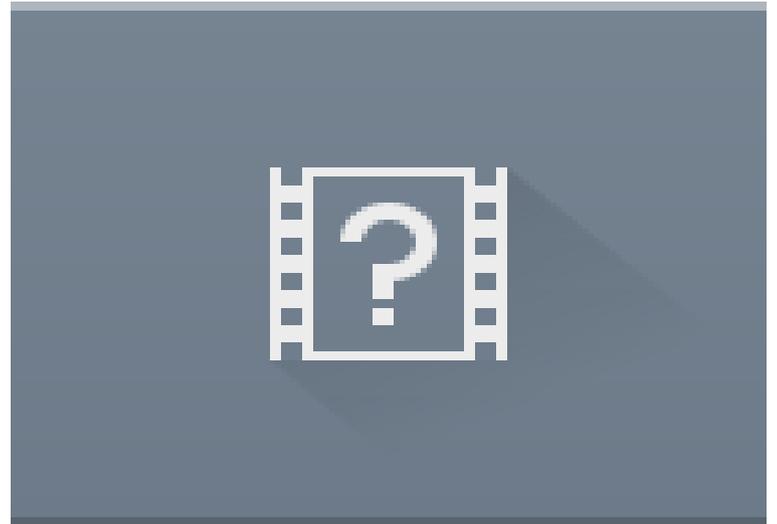
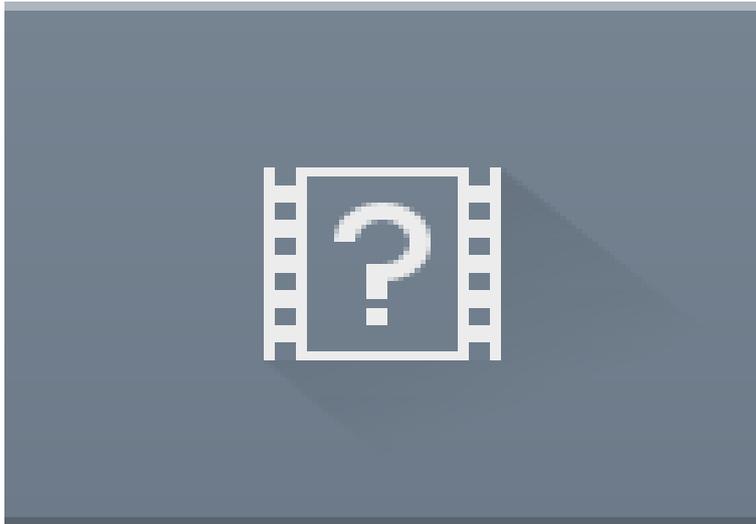






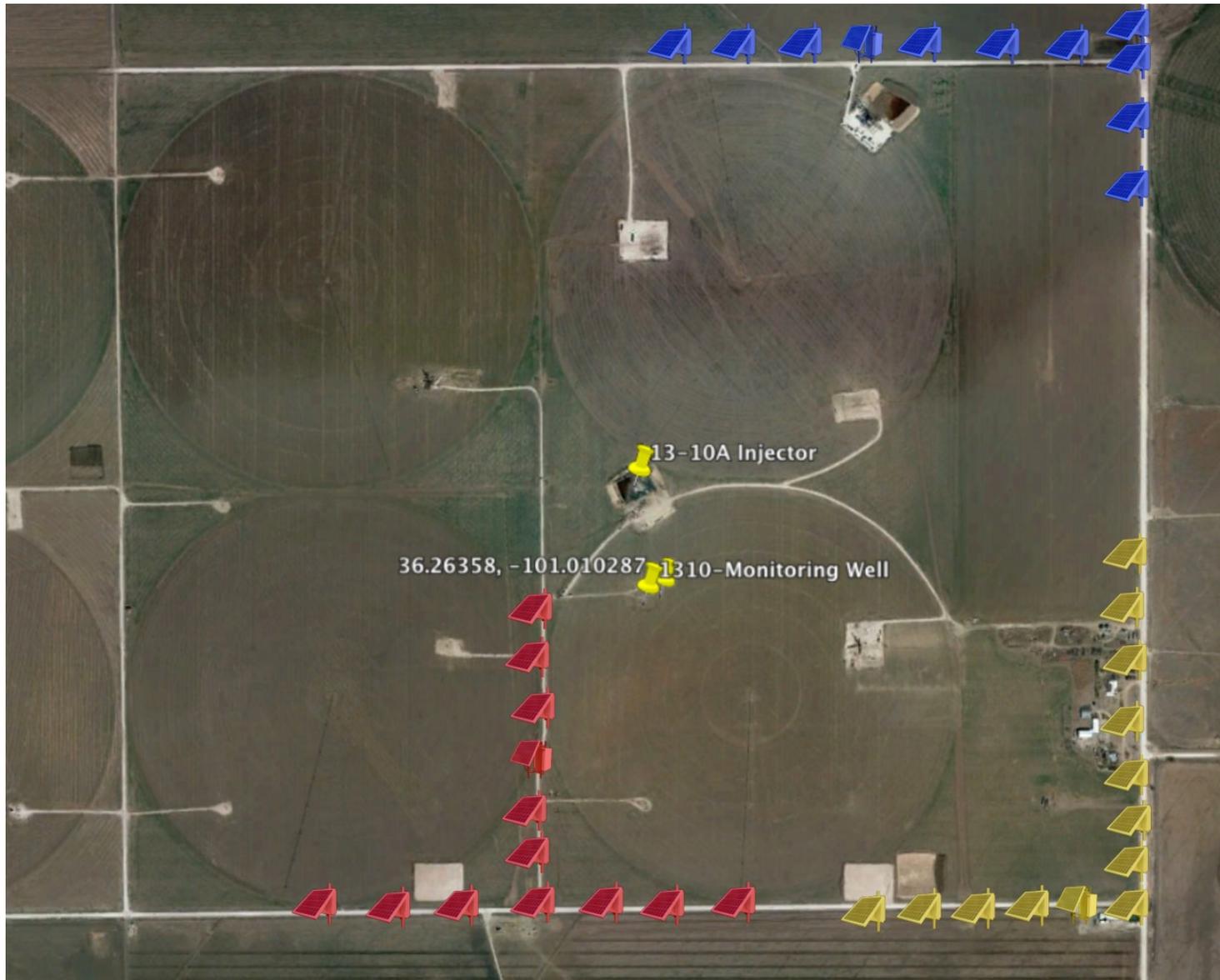
Unmanned Aircraft Flight Station



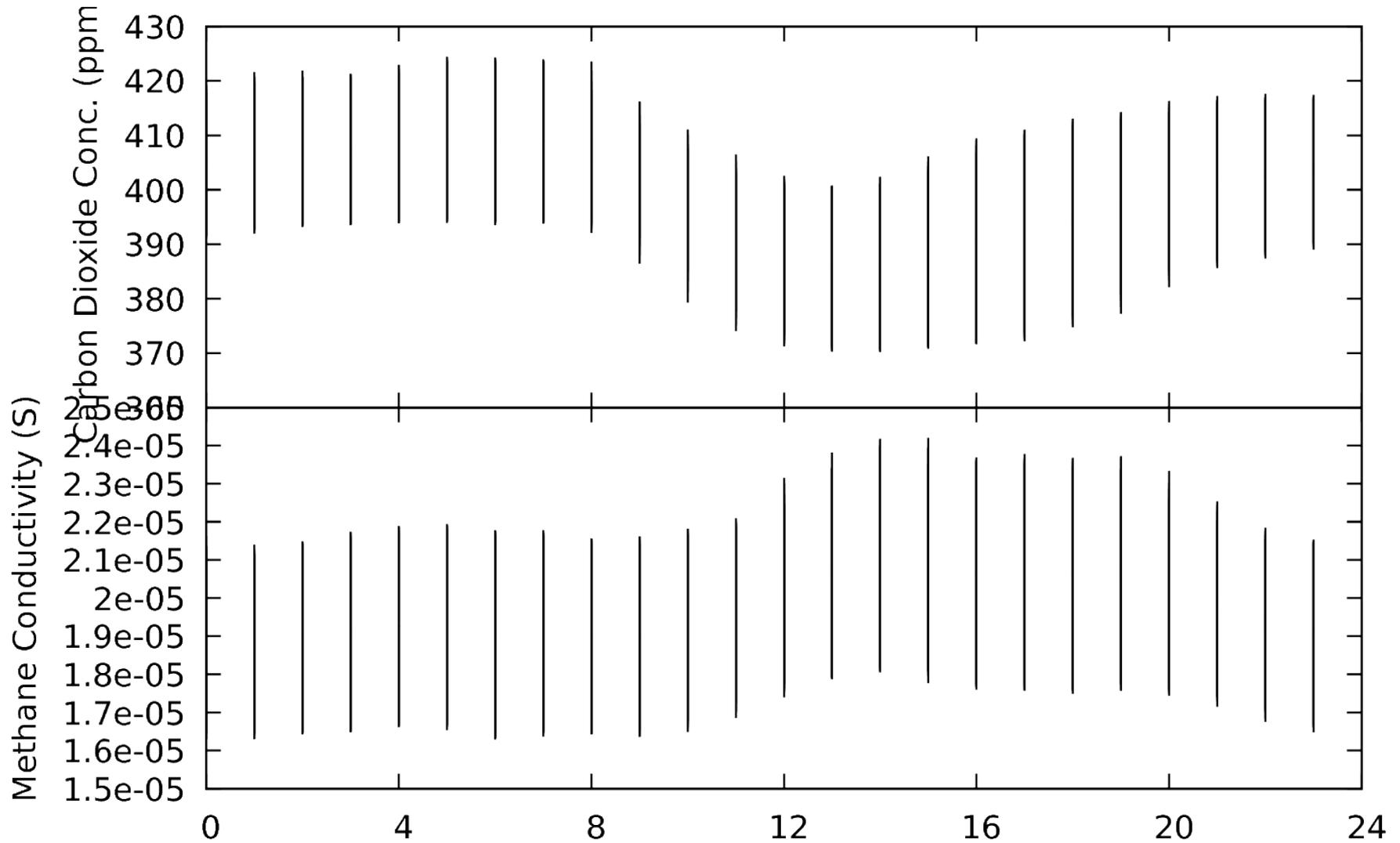


1s in video = 8.33hr data
@ 100 fps

CO₂ Enhanced Oil Recovery Pilot Well in the Anadarko Basin near Farnsworth, TX



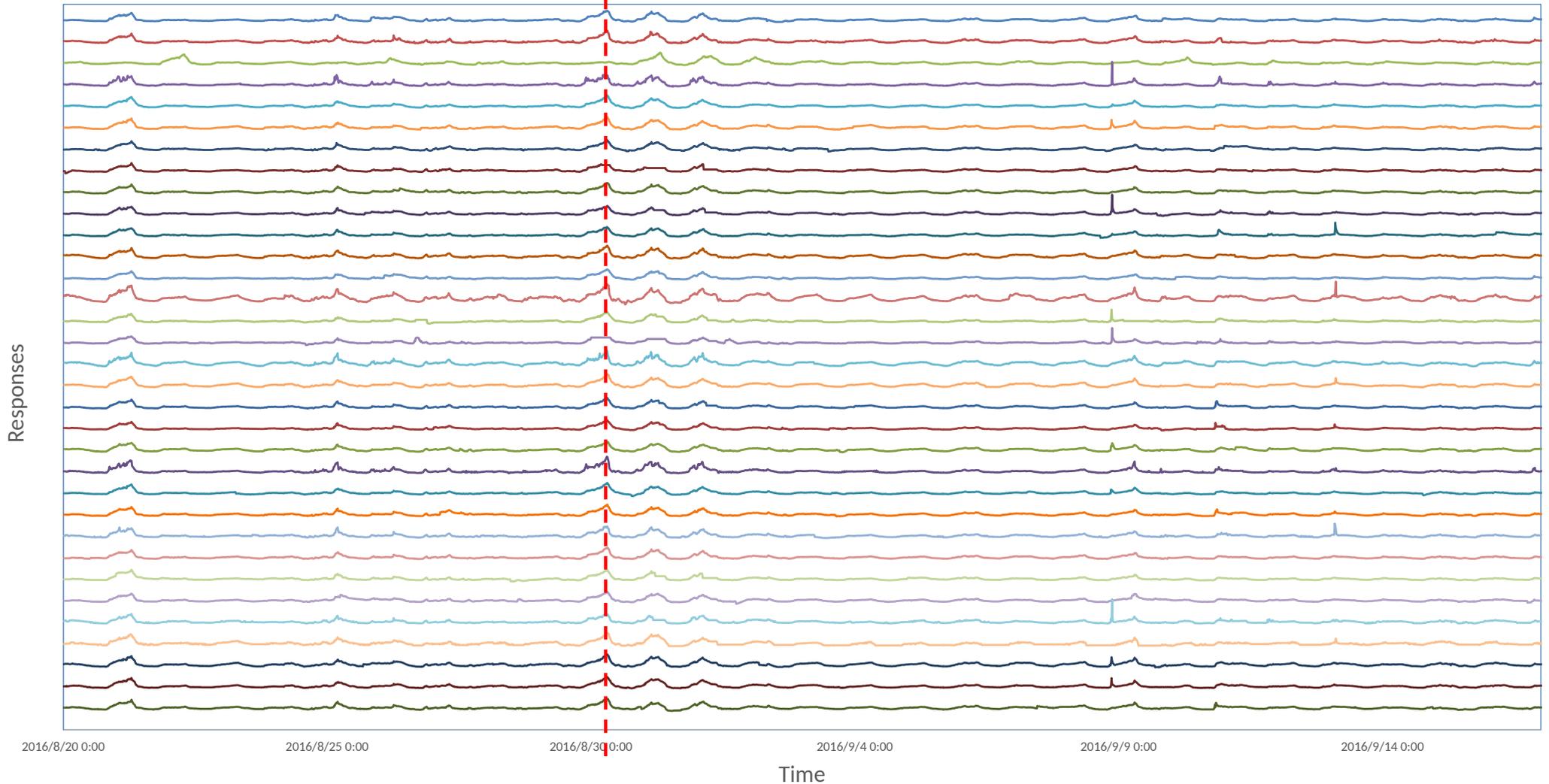
Daily Gas Concentration Cycle



CO₂ Sensor Response

Peak occur at the same time for all the sensors

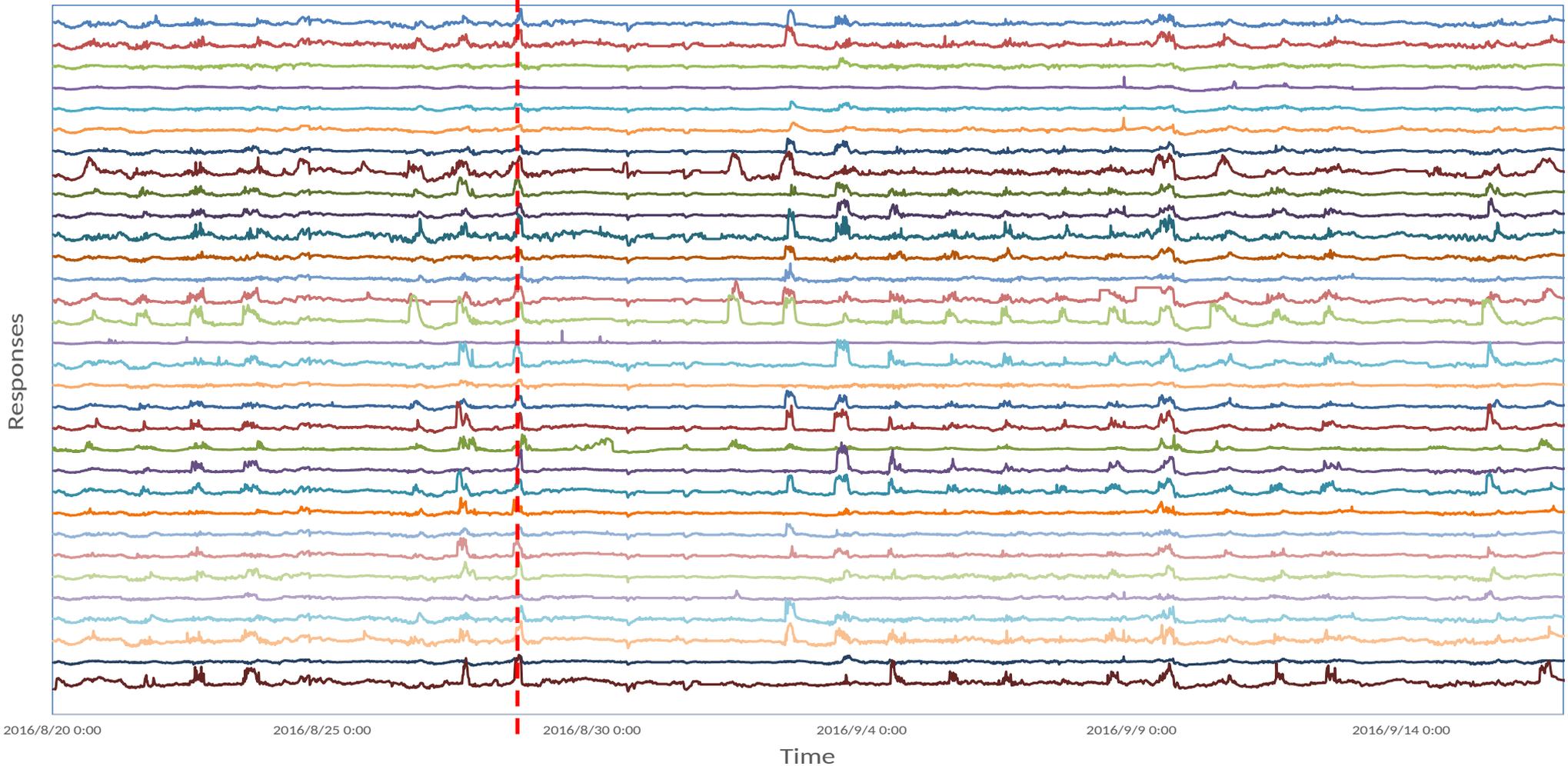
Responses from All Sensors



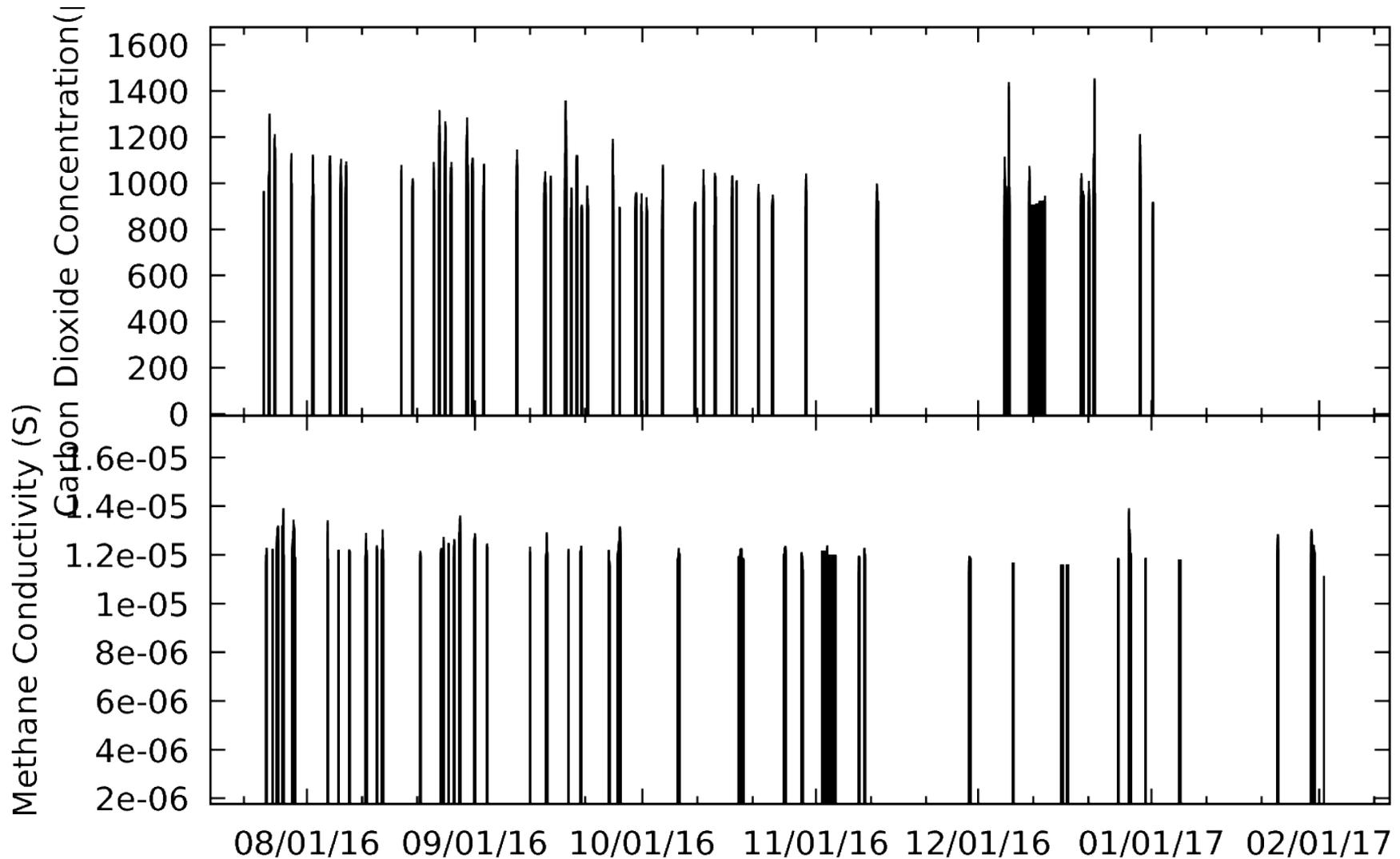
CH₄ Sensor Response

Peak occur at the same time for all the sensors

Responses from All Sensors



Events: Greater than 2σ



Conclusions/Future Directions

- Networked sensor arrays can monitor large areas of land effectively for changes in gas concentration.
- Microseepage events can be detected by the sensor array, and these are currently being compared against known releases.
- Controlled release tests of gas in the UAS airfield are planned to observe how the network behaves during a significant release.
- Devices are being applied to other applications for remote monitoring.

Acknowledgements

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Questions?



Current Options

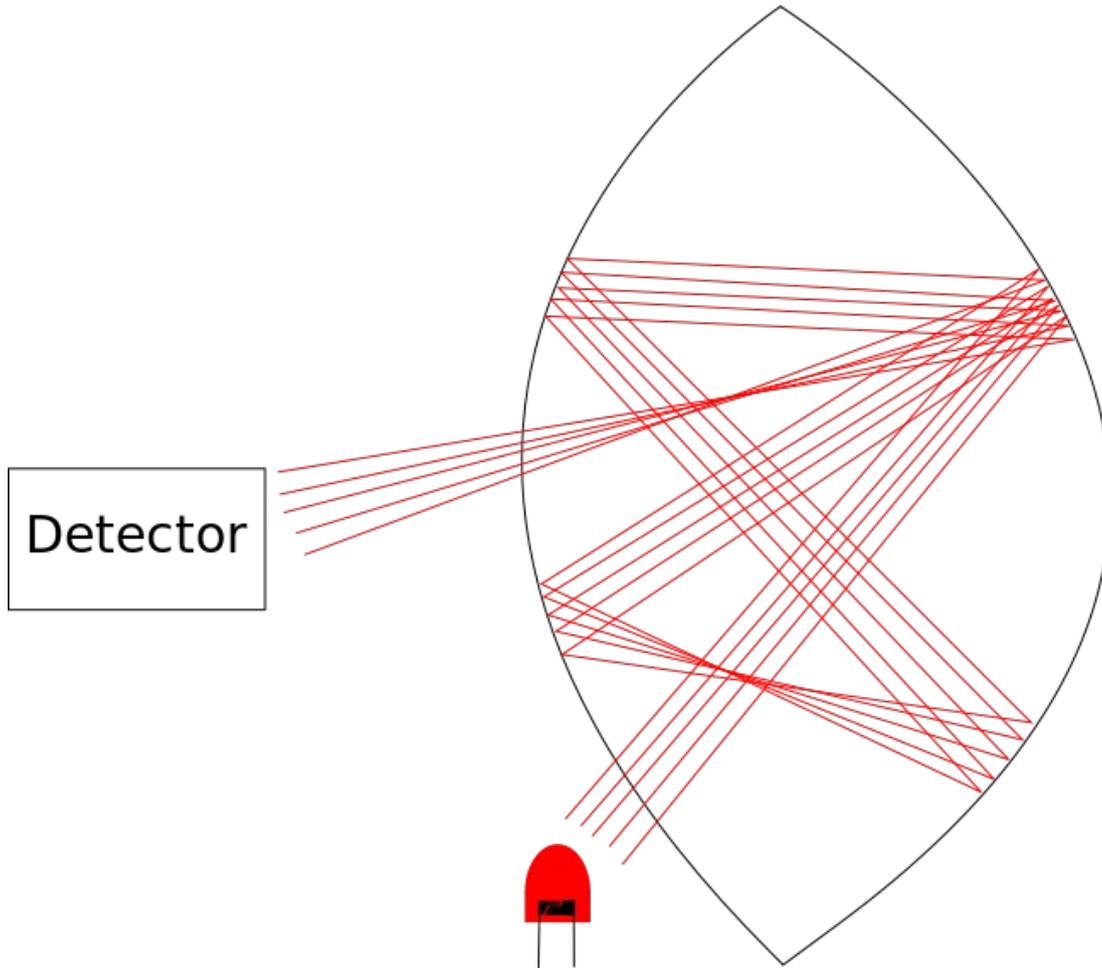
LIDAR

Eddy Covariance

Gas Tracers (e.g. SF₆)

Single Sensors

K-30 FTIR Optical Sensor



$$A = \epsilon bc$$

CH₄ Optical Sensor

