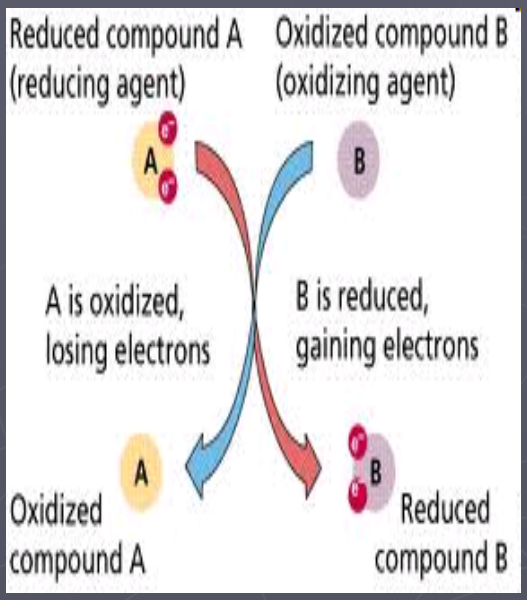
Assessing a Novel Method for Verifying Automated Oxidation-Reduction Potential Data Loggers: Laboratory and Field Tests

Cory Shoemaker, Robert Kröger, and Samuel C. Pierce
Department of Wildlife, Fisheries and Aquaculture
Mississippi State University

Redox Potential (Eh)

- Measure of electron exchange in a system
- Influenced by environmental multiple factors
- Can be used to indicate conditions favorable for denitrification



Eh measurements

- Traditionally use a handheld meter attached to probe and reference electrode
  →numerous limitations
- Continuous Automated Eh Data Loggers (Vorenhout et al. 2004)

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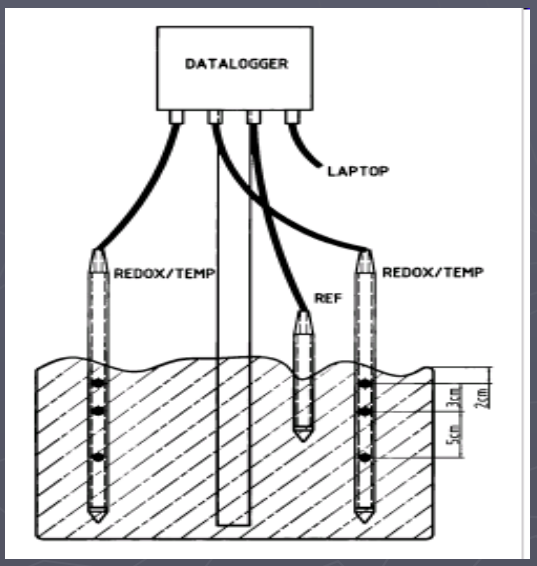


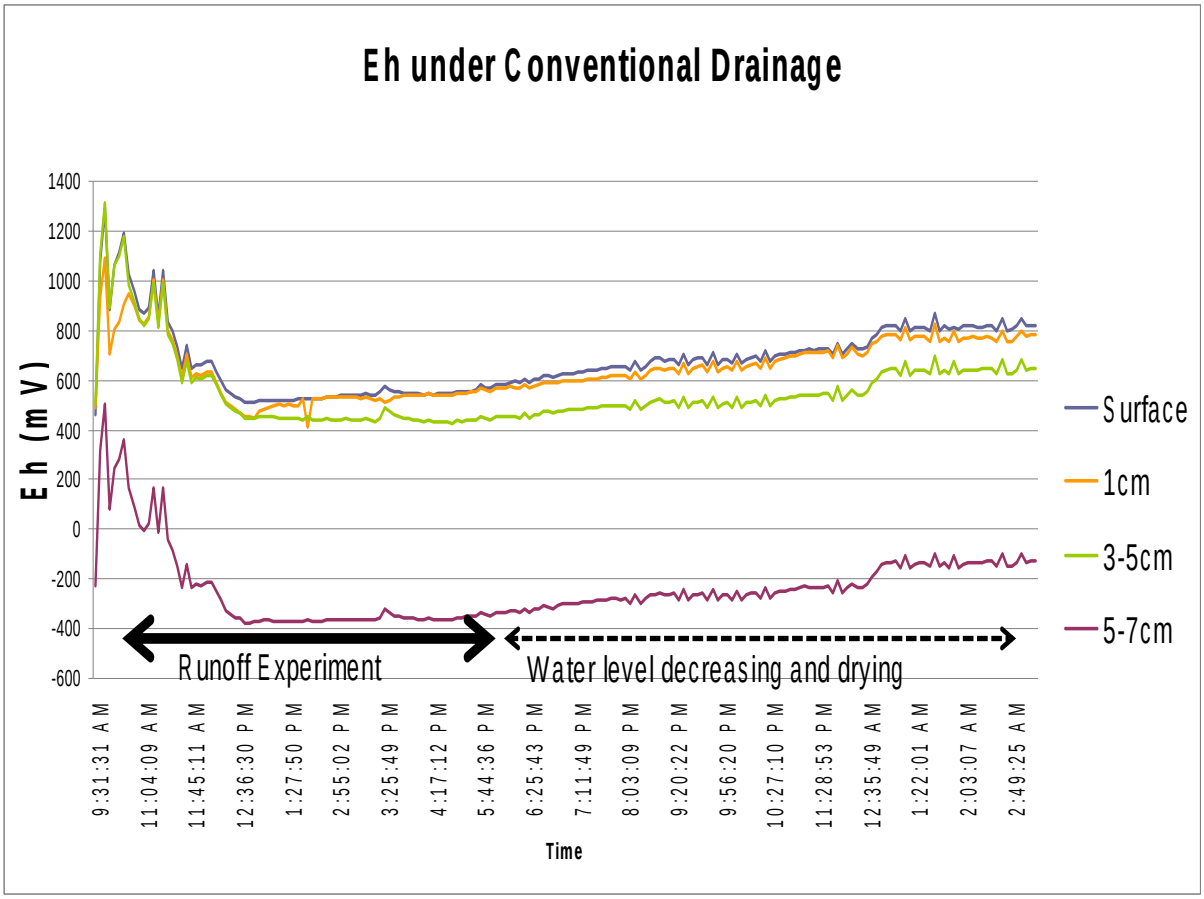
Specifications

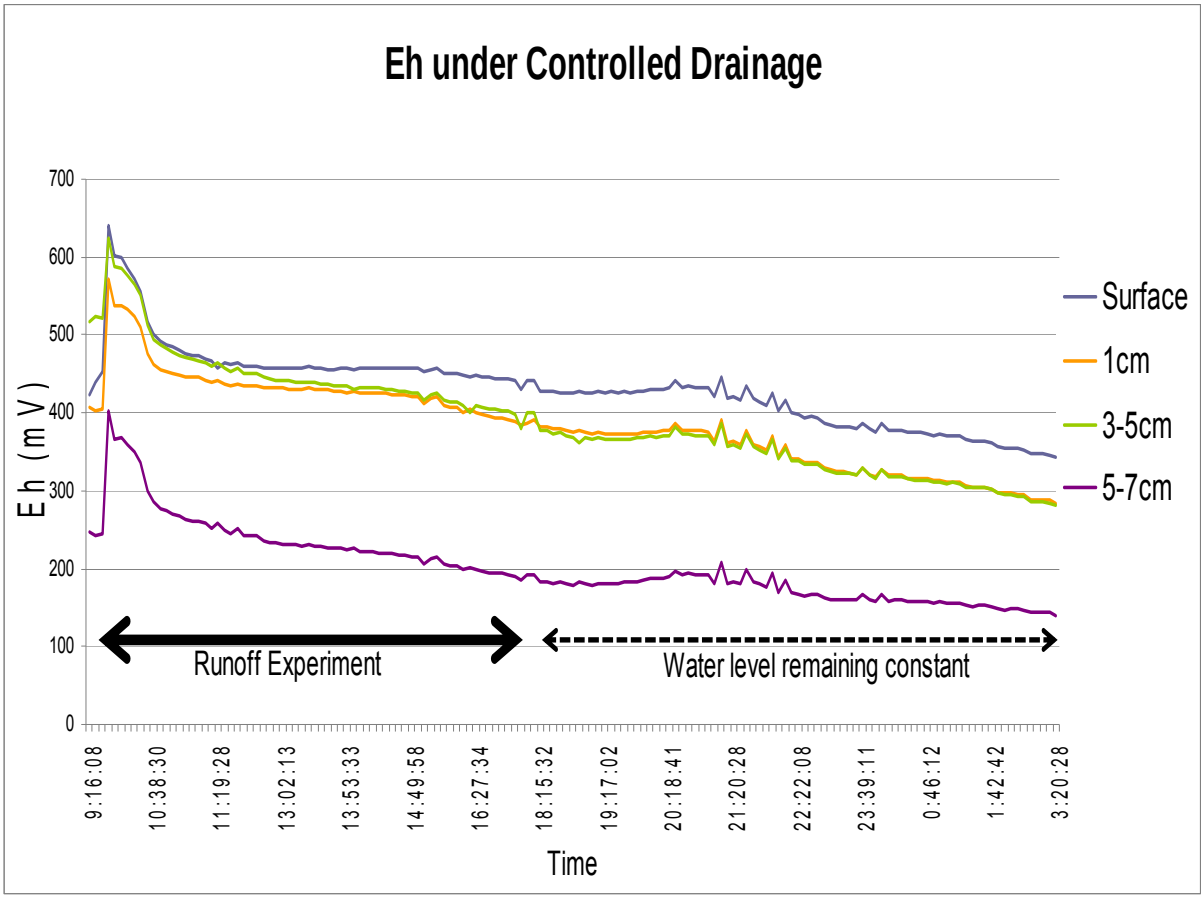
- 4 Soil probes + 1 Reference probe
  - Pt tipped probes connected via Ethernet cords
- Collects Data at 1 or 20 minute polls
- Reference Probes, Single Junction (SJ) vs. LD 15

Reference Probes

Standard Single Junction Reference

LD15 Reference


Eh under Conventional Drainage
Eh (mV)
1400
1200
1000
800
600
400
200
0
-200
-400
-600
Runoff Experiment
Water level decreasing and drying
9:31:31 AM
11:04:09 AM
11:45:11 AM
12:36:30 PM
1:27:50 PM
2:55:02 PM
3:25:49 PM
4:17:12 PM
5:44:36 PM
6:25:43 PM
7:11:49 PM
8:03:09 PM
9:20:22 PM
9:56:20 PM
10:27:10 PM
11:28:53 PM
12:35:49 AM
1:22:01 AM
2:03:07 AM
2:49:25 AM
Time
Surface
1cm
3-5cm
5-7cm

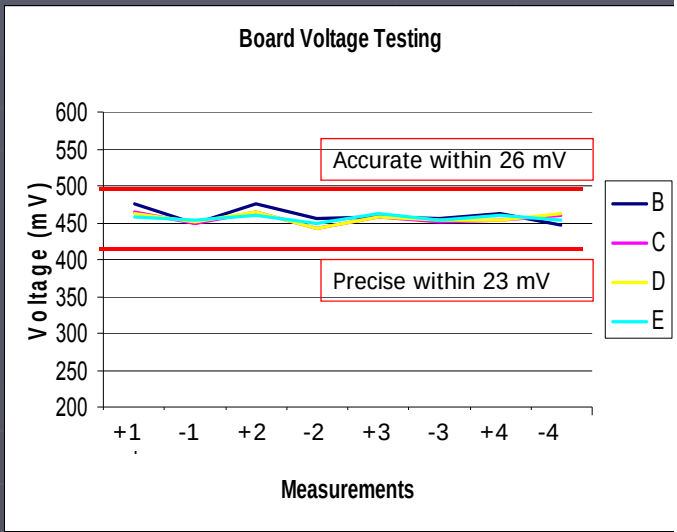

Eh under Controlled Drainage
Eh (mV)
700
600
500
400
300
200
100
0
Runoff Experiment
Water level remaining constant
9:16:08
10:38:30
11:19:28
13:02:13
13:53:33
14:49:58
16:27:34
18:15:32
19:17:02
20:18:41
21:20:28
22:22:08
23:39:11
0:46:12
1:42:42
3:20:28
Time
Surface
1cm
3-5cm
5-7cm

Significance

- Controlled Drainage can be used to reduce nutrient loads to downstream receiving systems (Kröger et al. 2010)
- Eh is an effective indicator of biogeochemical reactions occurring in the soil, such as denitrification (Kunickis et al. 2010)
- Automated Data Loggers have the potential to be used for easy classification of systems by nutrient reducing capacity both spatially and temporally

Verification Processes

- Board Voltage
- Board + Probe
- Single Junction Ref.
- LD 15 Ref.
- Standard Eh
- LD 15 Eh
- Pilot, Non-vegetated
- Pilot Vegetated



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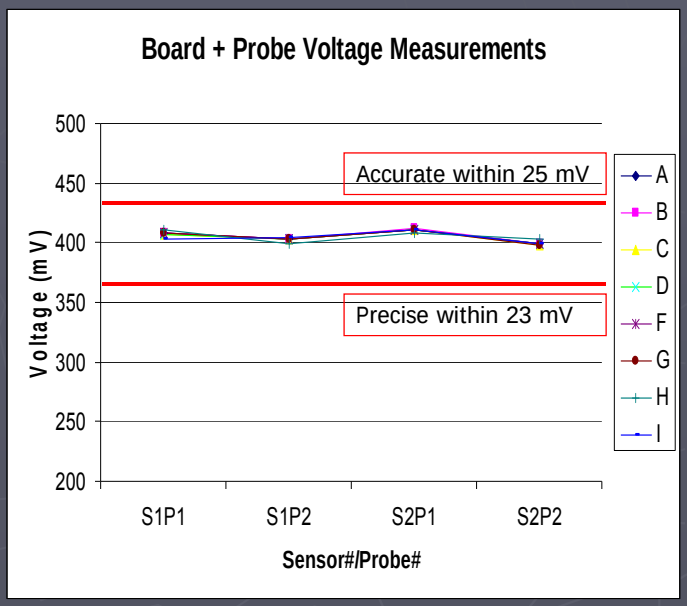

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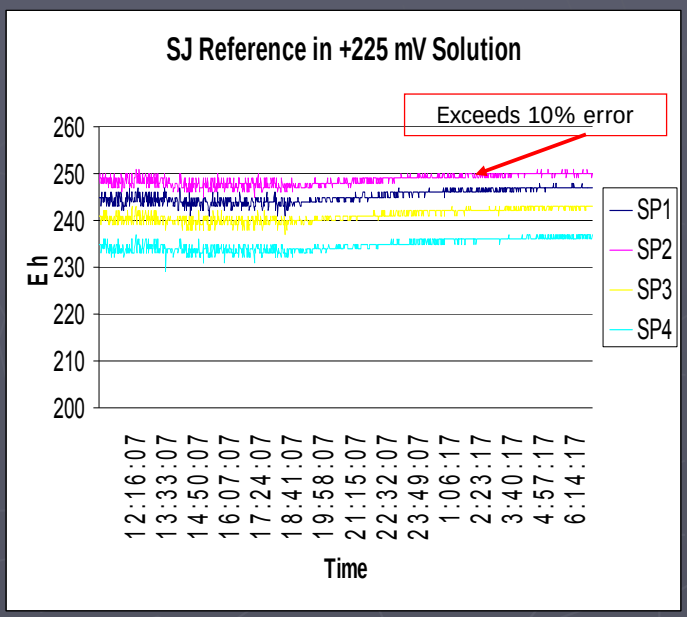

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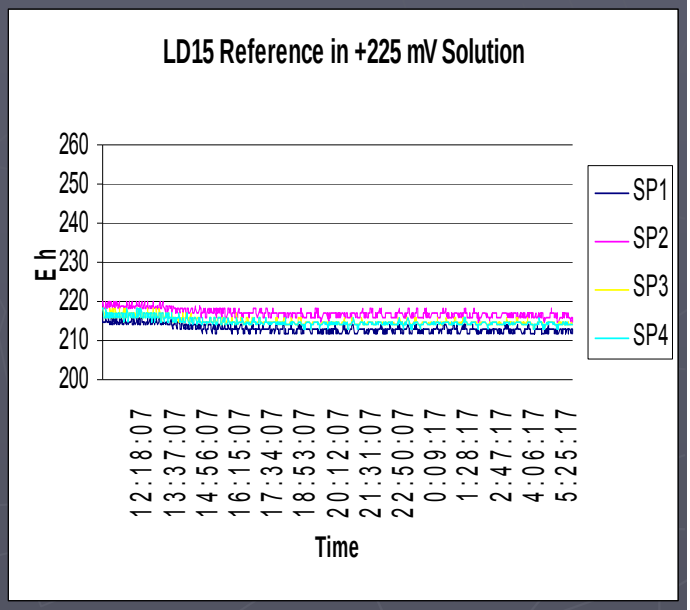

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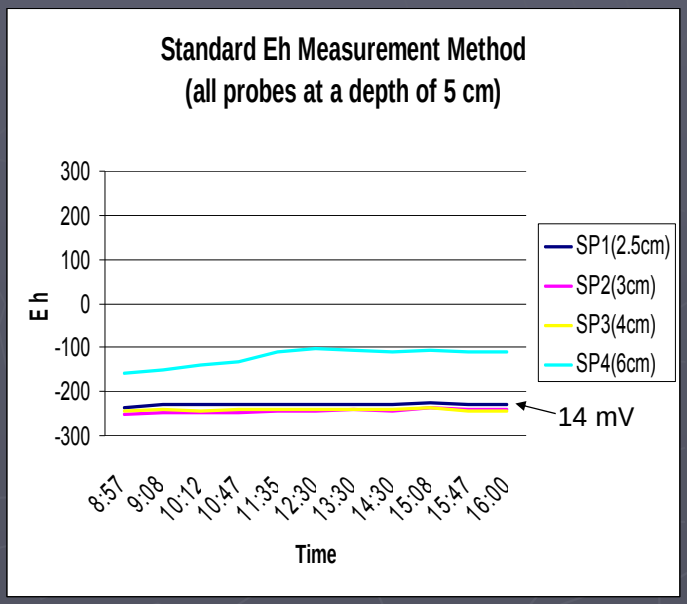

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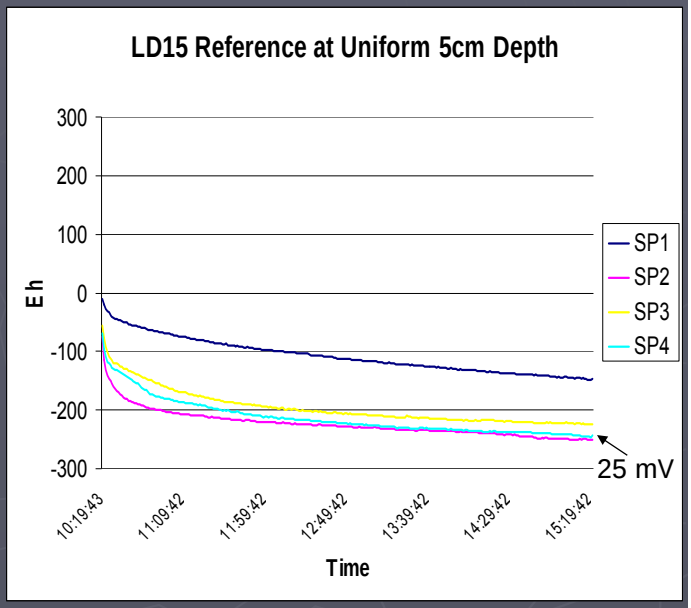

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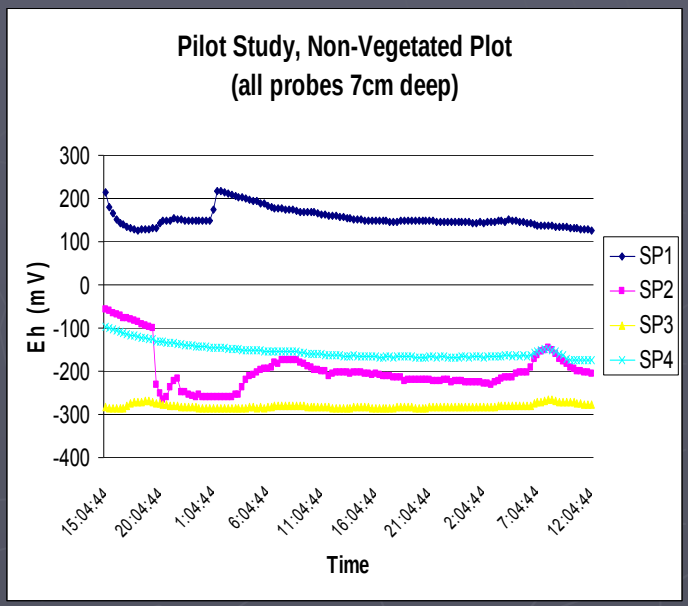

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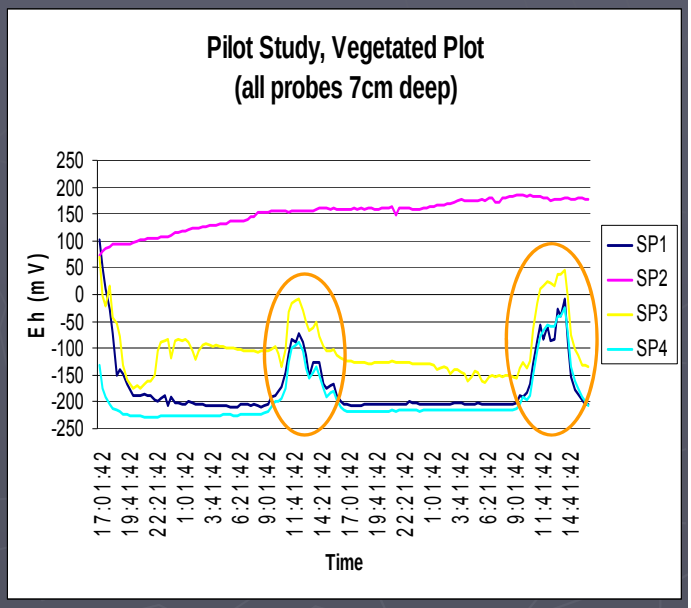

Conclusions

- Continuous Automated Data loggers are accurate, precise and can be used to discern Eh trends in soil
- LD 15 probes are a viable alternative to standard single junction probes

Acknowledgements

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- MSU Electrical Engineering Students
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