

Challenge Case III “Sensor Data QA/QC”: Falling Creek Reservoir, Virginia, USA

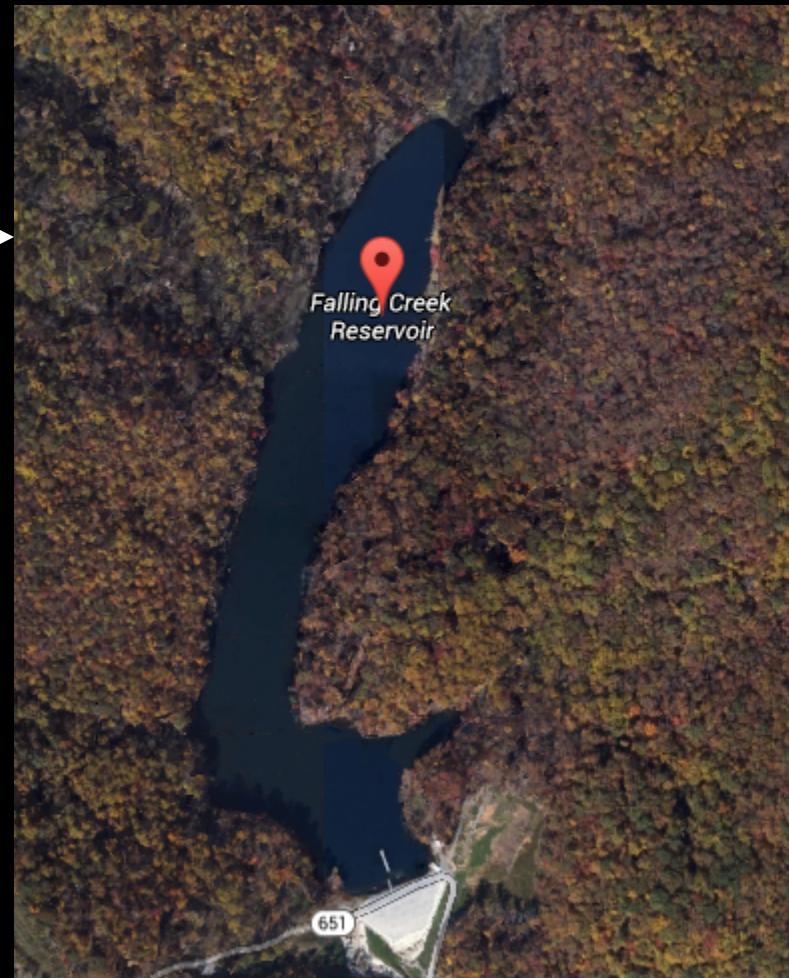


Photo Credit:
C. Carey

Falling Creek Reservoir, Virginia, USA



- Small reservoir: 9.3 m max depth, 0.1 km² surface area
- Eutrophic (poor water quality)
- Drinking water for Roanoke, VA



Temperature & Dissolved Oxygen Sensors

- Dissolved oxygen (DO) is important for many aquatic organisms
- Decreased DO can release nutrients & metals from the sediments → algal blooms and water treatment plant problems, as well as fish kills
- Increased temperature favors toxic cyanobacteria and algal blooms



Importance of High-frequency Data



- Partnership with Global Lake Ecological Observatory Network (GLEON)
 - high-frequency buoys across the globe
 - measure water quality data to help us better predict fine-scale phenomena like algal blooms and make lake management decisions
 - important to have efficient QA/QC and coding of data → lots of data!

Thermistor Data

RBR TR-1050 5.50 012157 (windows: 6.13 - Minimum required: 5.14)
Host time 13/09/04 12:55:18
Logger time 13/09/04 12:56:02
Logging start 13/07/07 10:00:00
Logging end 14/01/01 17:51:58
Sample period 00:05:00
Number of channels = 1, number of samples = 17028, mode: Logging stopped by User
E01%9.4f
Calibration 1: 0.003505591524425
-0.000247980636869
0.000002587291807
-0.000000080944394 Degrees_C
COMMENT: Deployed in FCR by Rick Browne; Retrieved by Kevin Bierlein / Alex Gerling. Jul-sept 2013
Memory type: 3 AT45DB642

	Temp
2013/07/07 10:00:00	23.9099
2013/07/07 10:05:00	23.3920
2013/07/07 10:10:00	22.8504
2013/07/07 10:15:00	23.3505
2013/07/07 10:20:00	23.8605
2013/07/07 10:25:00	24.2272
2013/07/07 10:30:00	24.5315
2013/07/07 10:35:00	24.8463
2013/07/07 10:40:00	25.1740
2013/07/07 10:45:00	25.4925
2013/07/07 10:50:00	25.7812
2013/07/07 10:55:00	26.0589
2013/07/07 11:00:00	26.3133
2013/07/07 11:05:00	26.5365
2013/07/07 11:10:00	26.9417
2013/07/07 11:15:00	26.7384
2013/07/07 11:20:00	23.0188
2013/07/07 11:25:00	22.0603
2013/07/07 11:30:00	21.7644
2013/07/07 11:35:00	22.2149
2013/07/07 11:40:00	24.4402

2013/07/07 11:35:00	10.1298
2013/07/07 11:40:00	10.3396
2013/07/07 11:45:00	10.1411
2013/07/07 11:50:00	10.1128
2013/07/07 11:55:00	10.1419
2013/07/07 12:00:00	10.6749
2013/07/07 12:05:00	10.1191
2013/07/07 12:10:00	10.1222
2013/07/07 12:15:00	10.1648
2013/07/07 12:20:00	10.1538
2013/07/07 12:25:00	10.1743
2013/07/07 12:30:00	10.1622
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2013/07/07 12:40:00	10.1676
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2013/07/07 13:00:00	10.1707
2013/07/07 13:05:00	10.1238
2013/07/07 13:10:00	10.1332
2013/07/07 13:15:00	10.1644
2013/07/07 13:20:00	10.1522
2013/07/07 13:25:00	10.1502
2013/07/07 13:30:00	10.1283
2013/07/07 13:35:00	10.1088
2013/07/07 13:40:00	10.1262

8 meters

1 meter
depth

Erroneous Thermistor Data

```
LoggerTime=18-Jun-2013 10:17:26.000
LoggingStartTime=18-Jun-2013 10:17:31.000
LoggingEndTime=31-Dec-2099 00:00:00.000
LoggingsamplingPeriod=00:05:00

Numberofchannels=1
Channel[1].name=Temperature
Channel[1].calibration=0.0035021126 -2.5425068E-4 2.4914075E-6 -7.5050245E-8
Channel[1].units=°C (Degrees_C)
Channel[1].rangingMode=None

Numberofsamples=75541
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Date & Time	temp02
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18-Jun-2013 10:22:31.000	0.3716561198
18-Jun-2013 10:27:31.000	0.3779109120
18-Jun-2013 10:32:31.000	0.3799512982
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18-Jun-2013 10:42:31.000	0.3857279420
18-Jun-2013 10:47:31.000	0.3868045211
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18-Jun-2013 13:07:31.000	0.3671243787

Temperature at 1 m

DO Working Data

DO at 1 m

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"Setup Time (HH:MM:SS) : 09:20:38"
"Starting Date (M/D/YYYY) : 7/14/2014"
"Starting Time (HH:MM:SS) : 08:00:00"
"Stopping Date (M/D/YYYY) : 8/14/2014"
"Stopping Time (HH:MM:SS) : 08:00:00"
"Interval (HH:MM:SS) : 00:15:00"
"Sensor warmup (HH:MM:SS) : 00:00:30"
"Circltr warmup (HH:MM:SS) : 00:00:30"

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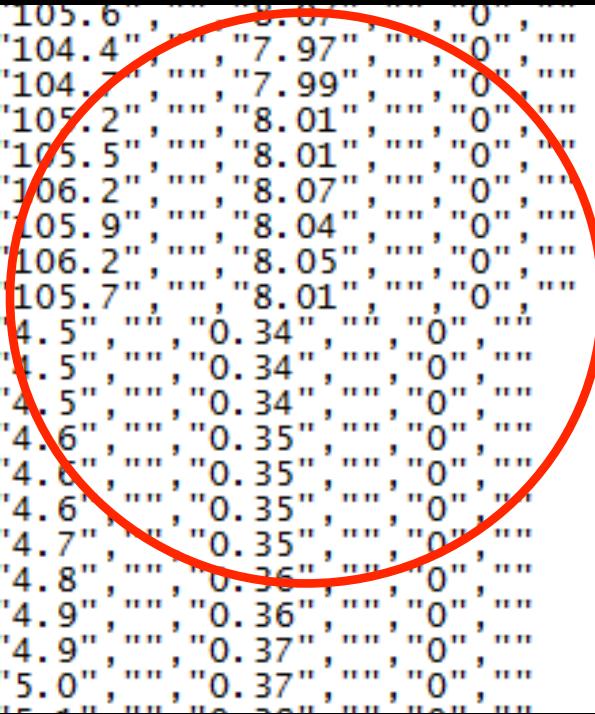
Erroneous DO Data

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Battery died
DO → 0 Volts,
0% internal
battery, DO
crashed

High-frequency Data Issues

- Outliers (e.g., DO >15 mg/L or a negative number)
- Low battery screening
- Consecutive data points
- Drift
 - Algal growth on sensor can result in biofouling, causing an incorrect DO upwards



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QA/QC Activity

- Automate different scripts for QA/QC of data for Falling Creek Reservoir
- 1) Thermistor data at multiple depths
- 2) DO data at multiple depths
- GOAL: create scripts that can process sensor data files, flag outliers and erroneous values, plot the data, and write different .txt files
 - .txt files that removes the outliers and sensor drift
 - .txt files that leaves the raw data but adds flags

A wide-angle photograph of a calm lake under a clear sky. On the left, a wooden pier extends from the shore. In the middle ground, several sailboats are scattered across the water. The foreground is dominated by a large area of green, textured algae or aquatic plants covering the lake bed, which is visible through the clear water.

Questions?