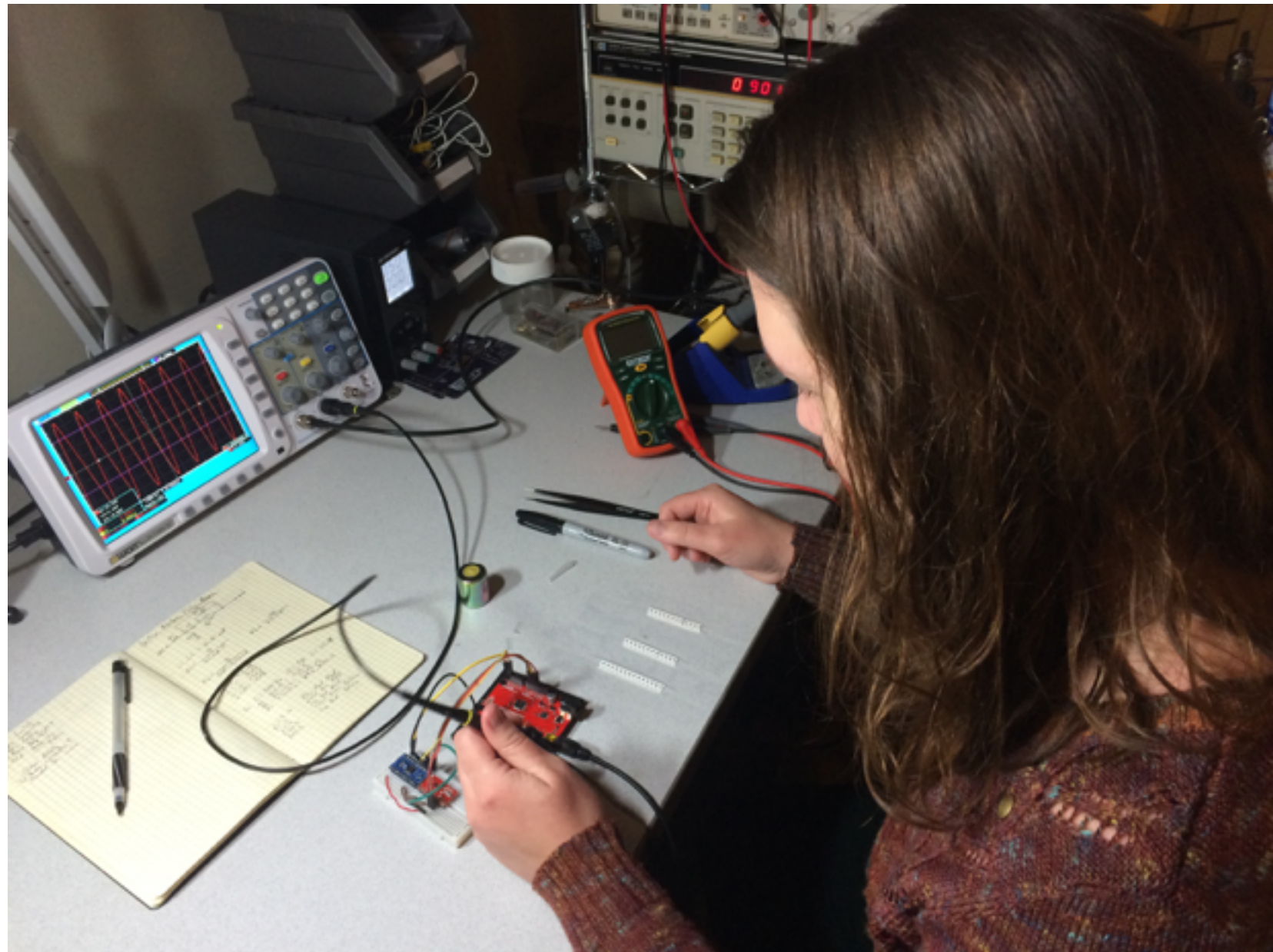


Measuring Gravitational Tides with Arduino

J.R. Leeman
C. Ammon

Department of Geosciences
The Pennsylvania State University

December 16, 2015

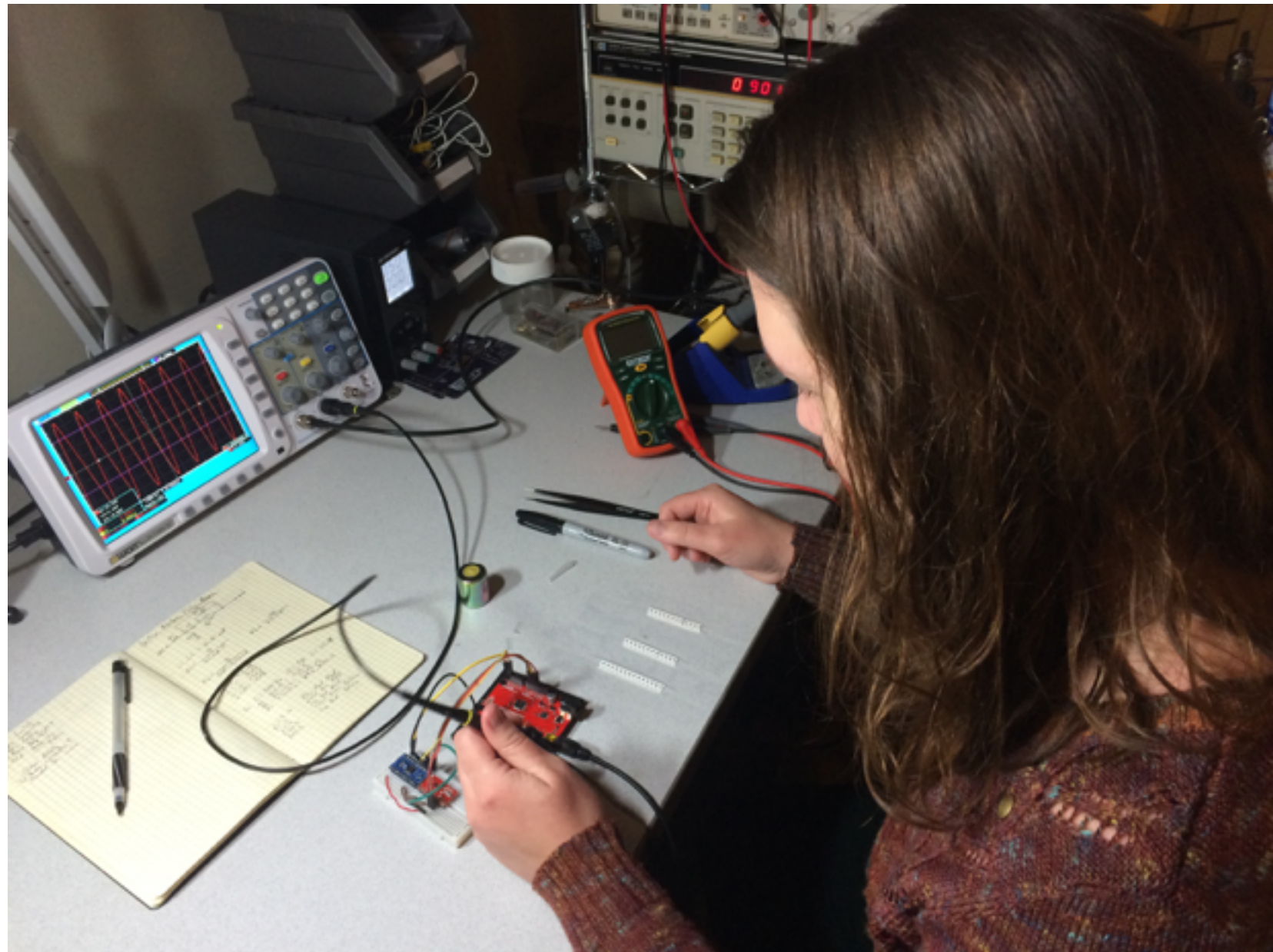


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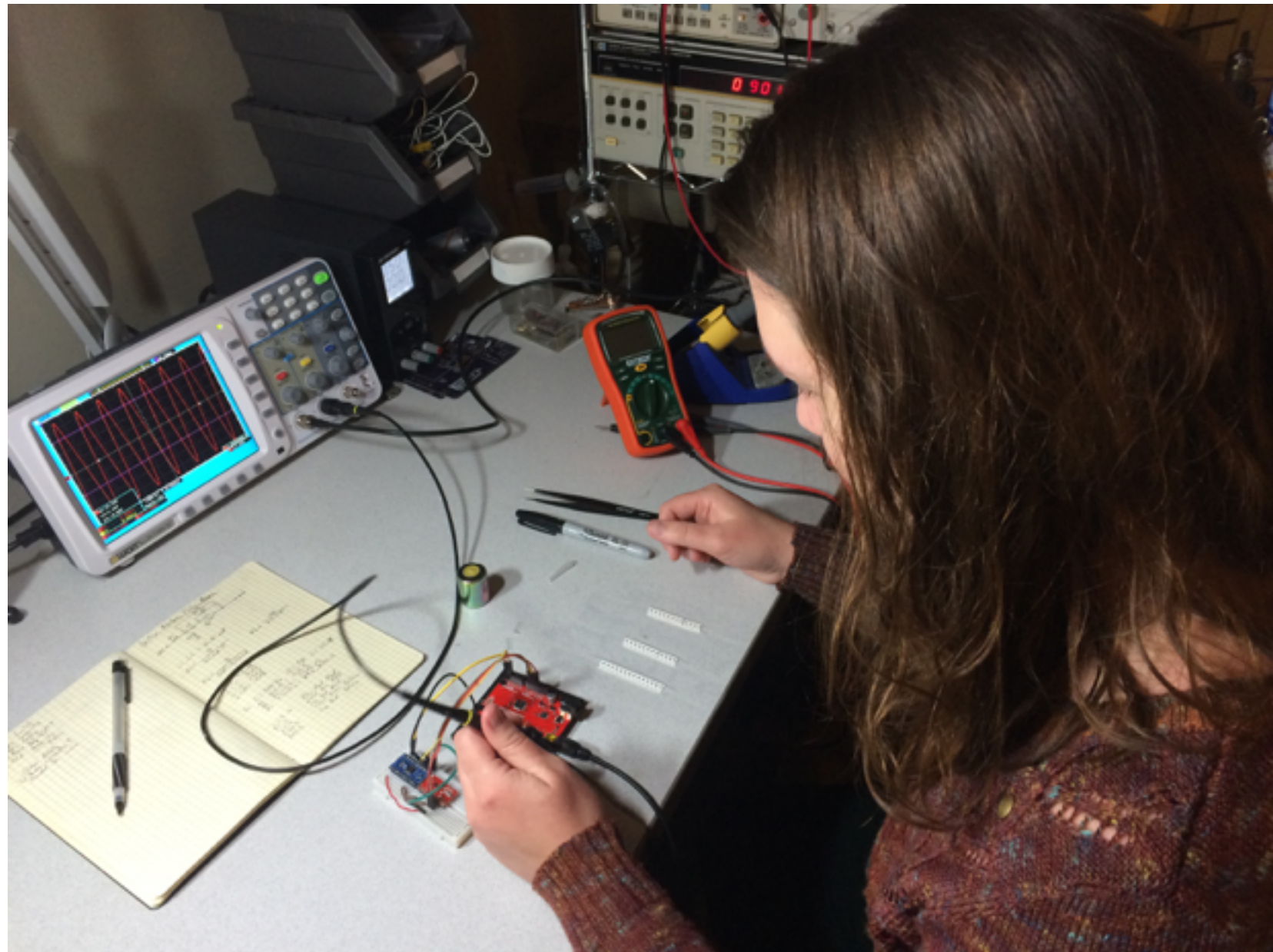


Measuring ~~Gravitational Tides~~ with Arduino Everything Else

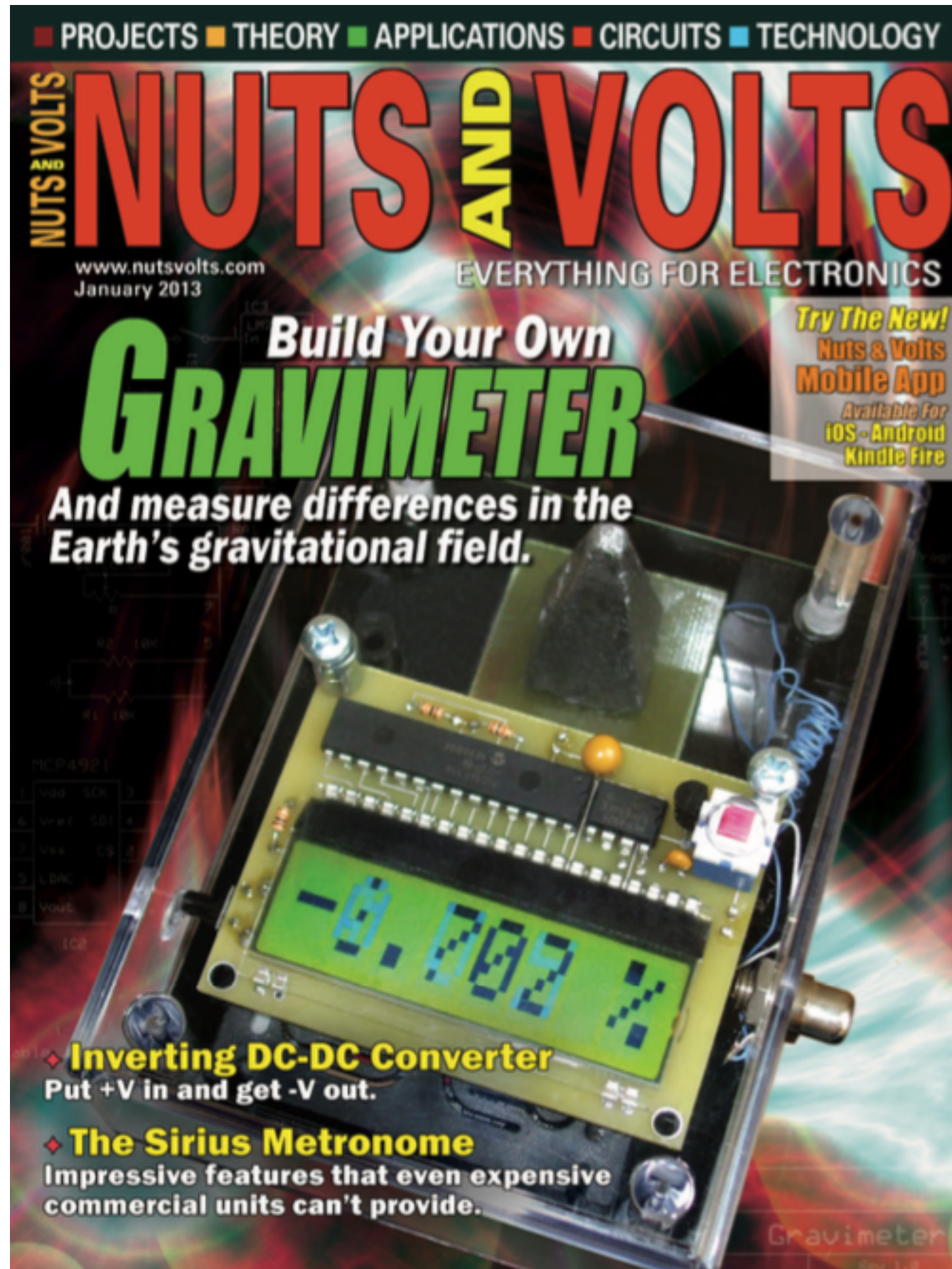
J.R. Leeman
C. Ammon

Department of Geosciences
The Pennsylvania State University

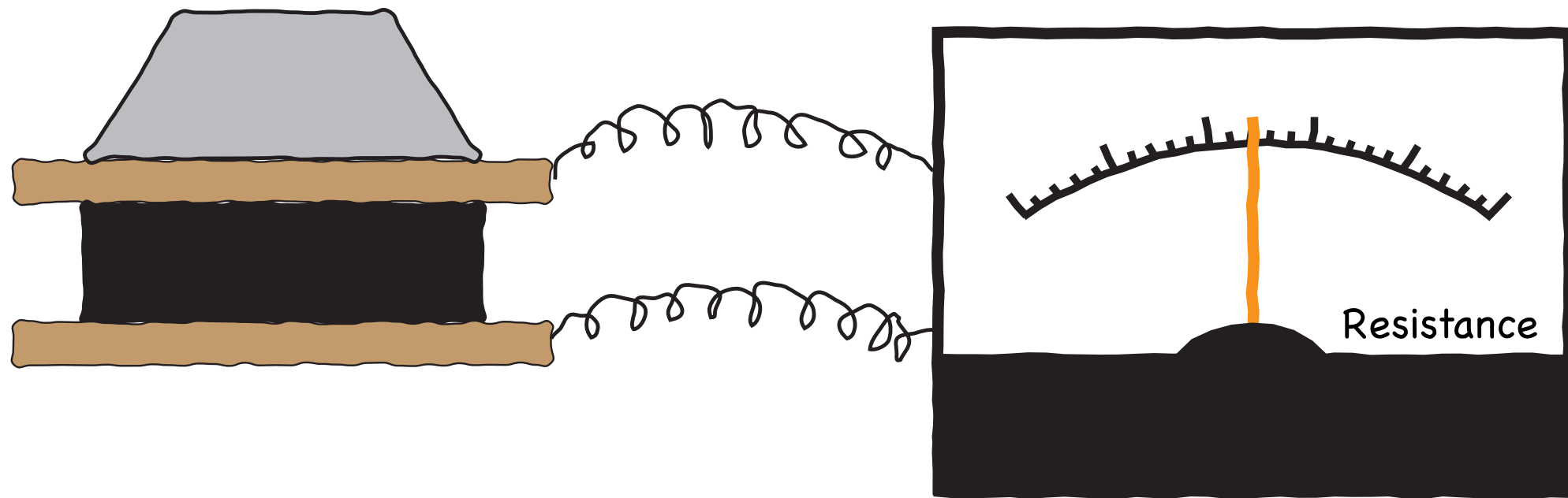
December 16, 2015



Our story starts with a magazine article and kit

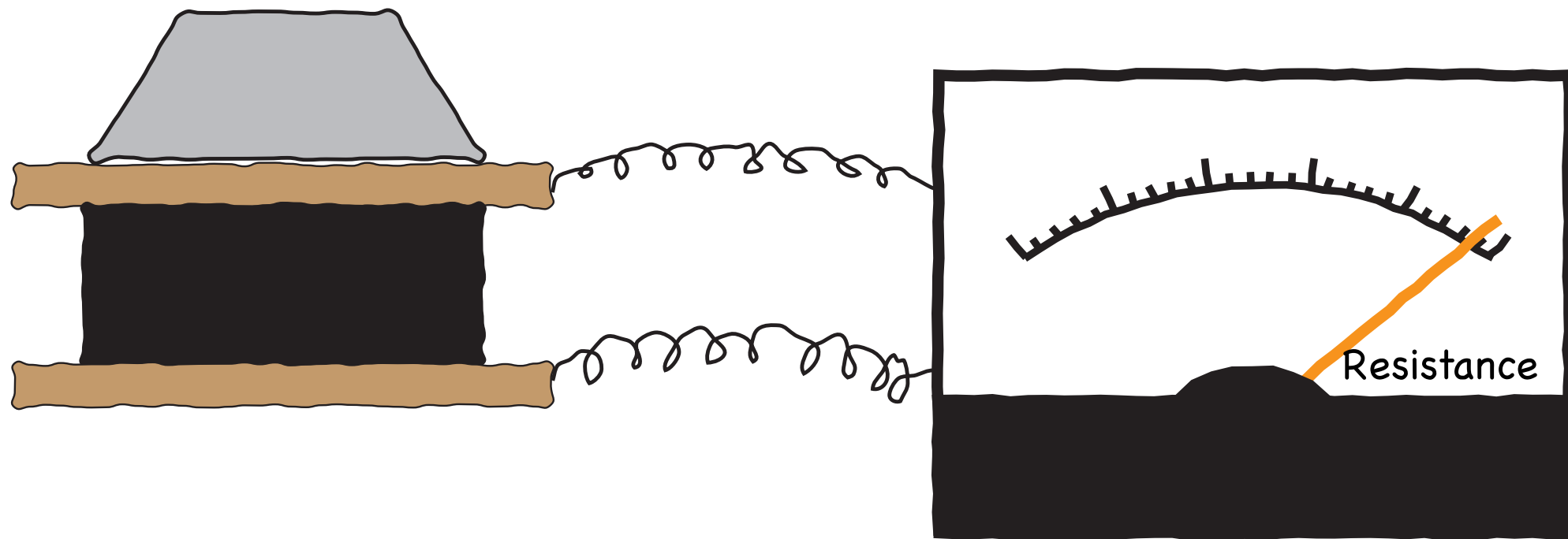


The idea is a simple variable resistor sensitive to the tide



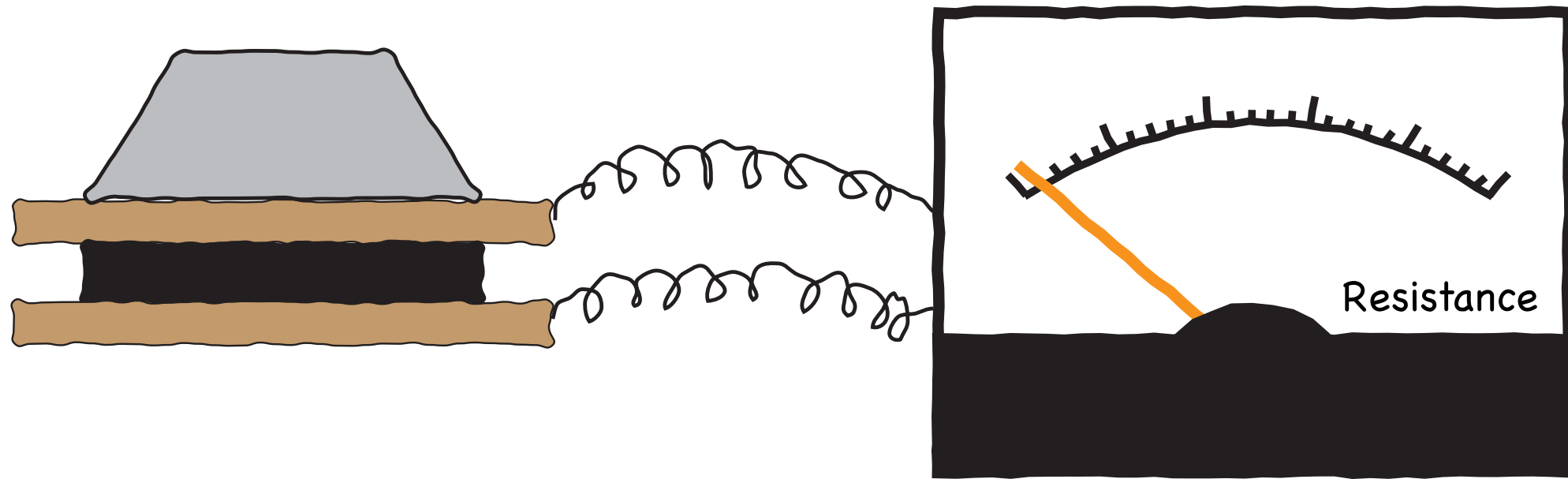
“Average” Gravity

The idea is a simple variable resistor sensitive to the tide



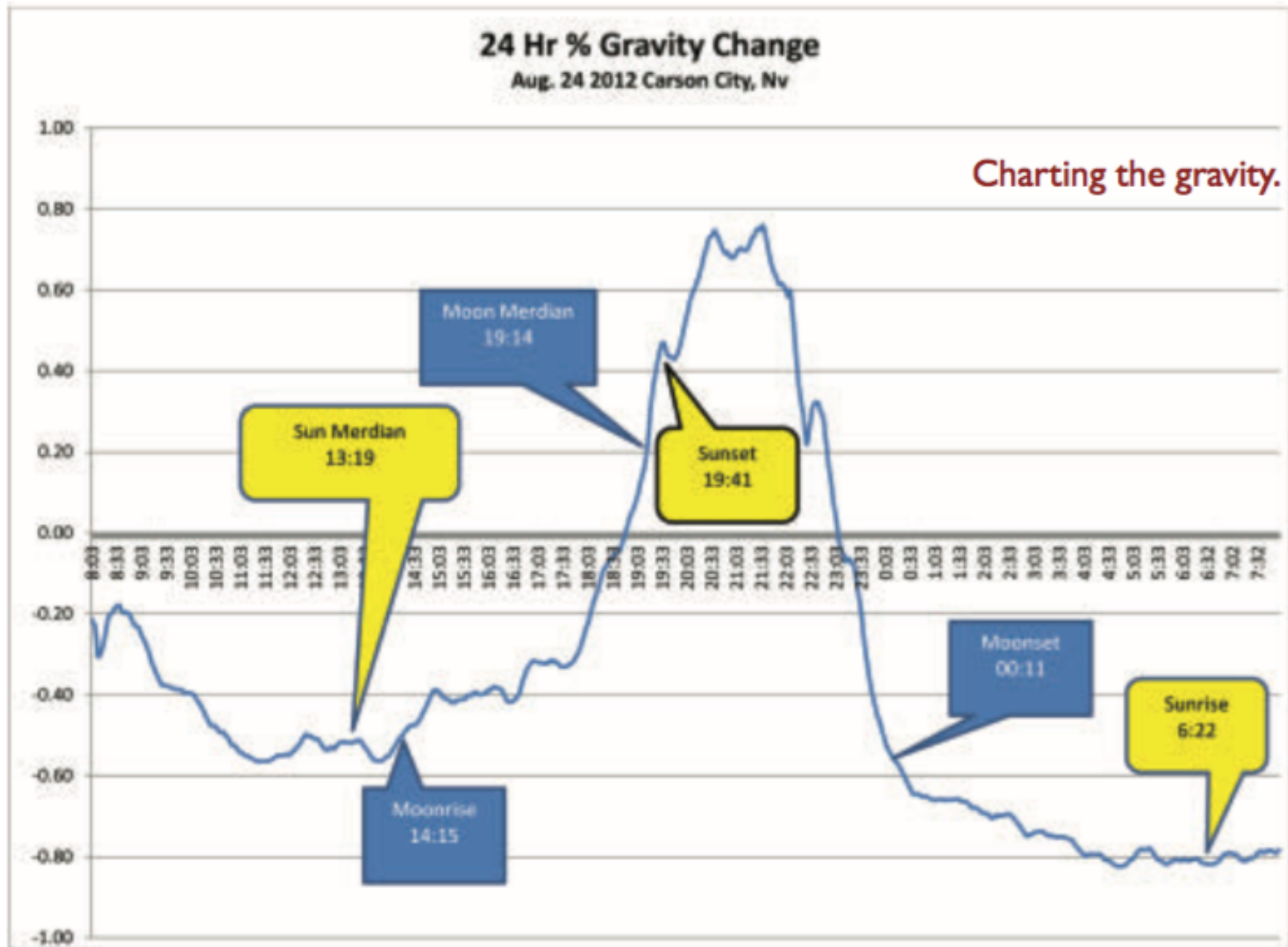
Anomalously Low Gravity

The idea is a simple variable resistor sensitive to the tide

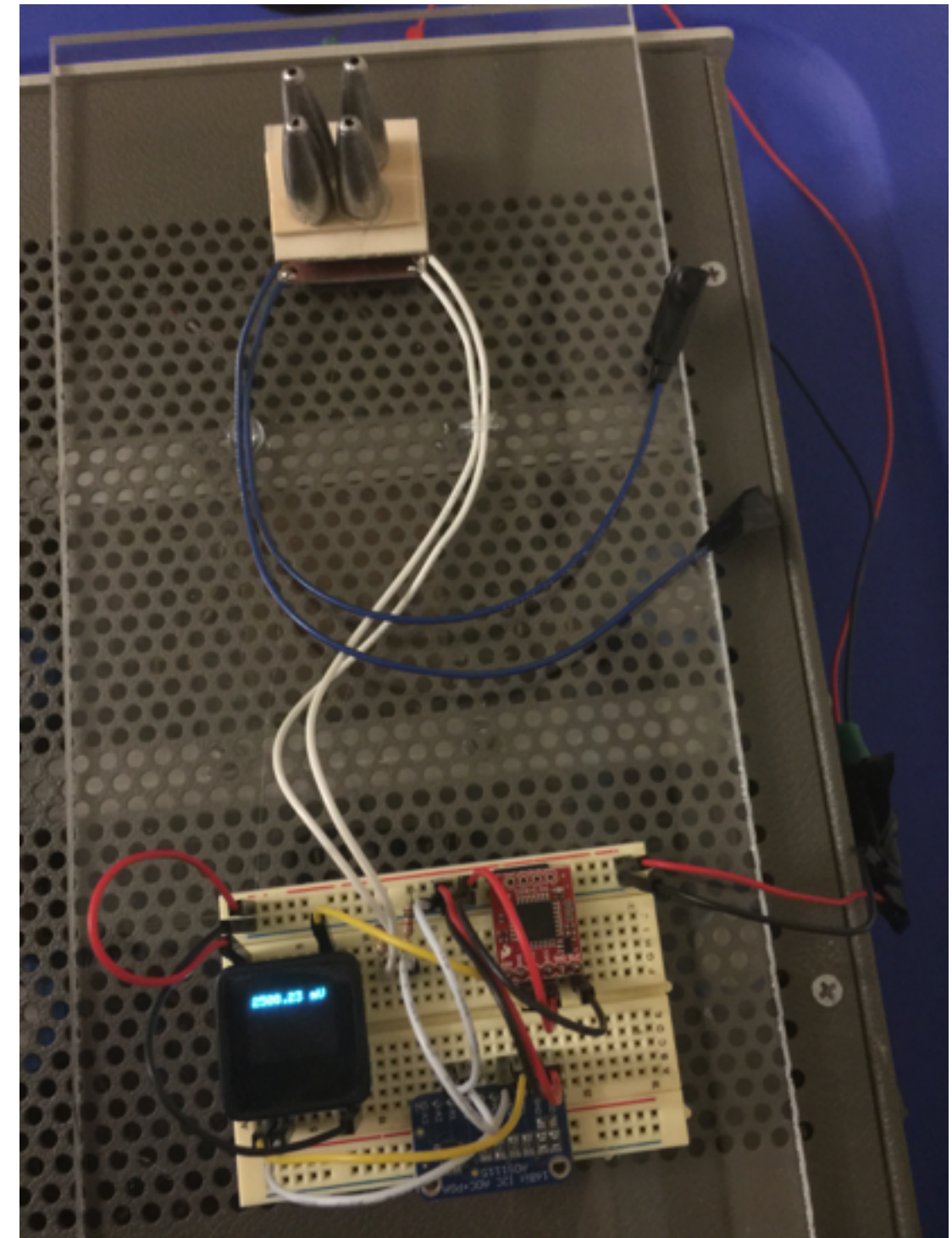
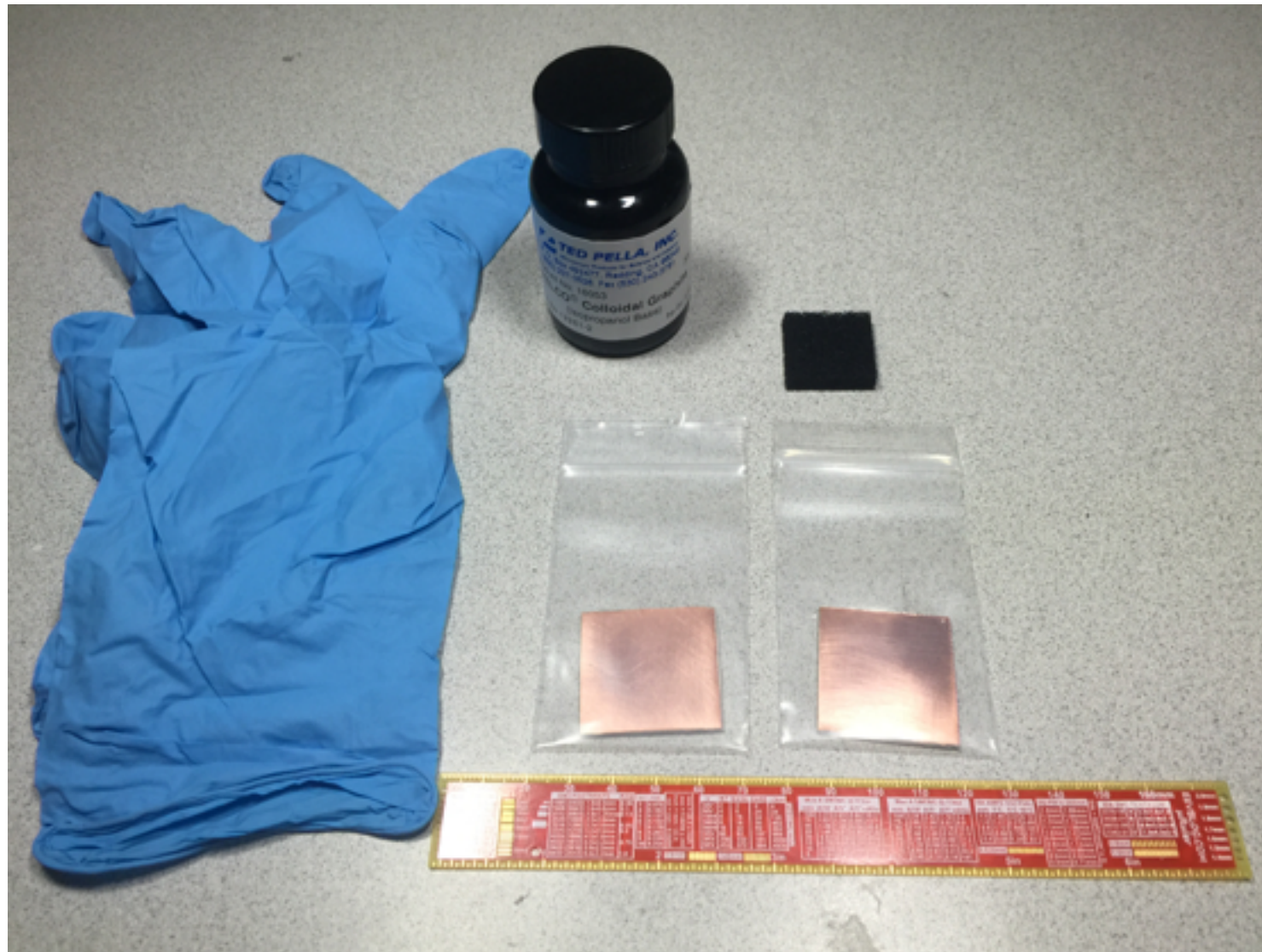


Anomalously High Gravity

The author of the article even showed some data



Alright! Let's build one and be very careful



We need to use a model to verify that we see what we expect

Formulas for Computing the Tidal Accelerations Due to the Moon and the Sun¹

I. M. LONGMAN

*Institute of Geophysics, University of California
Los Angeles, California*

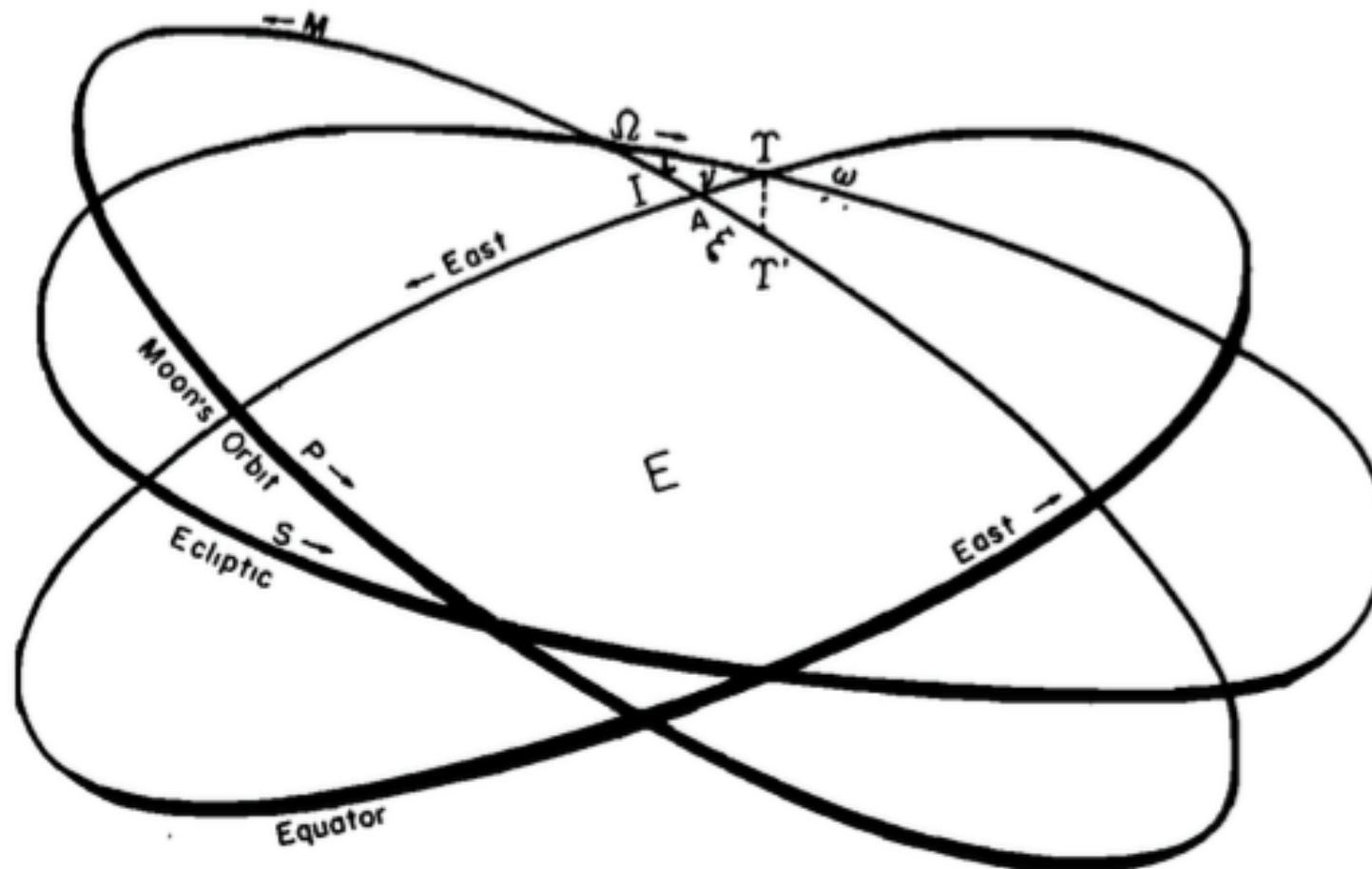
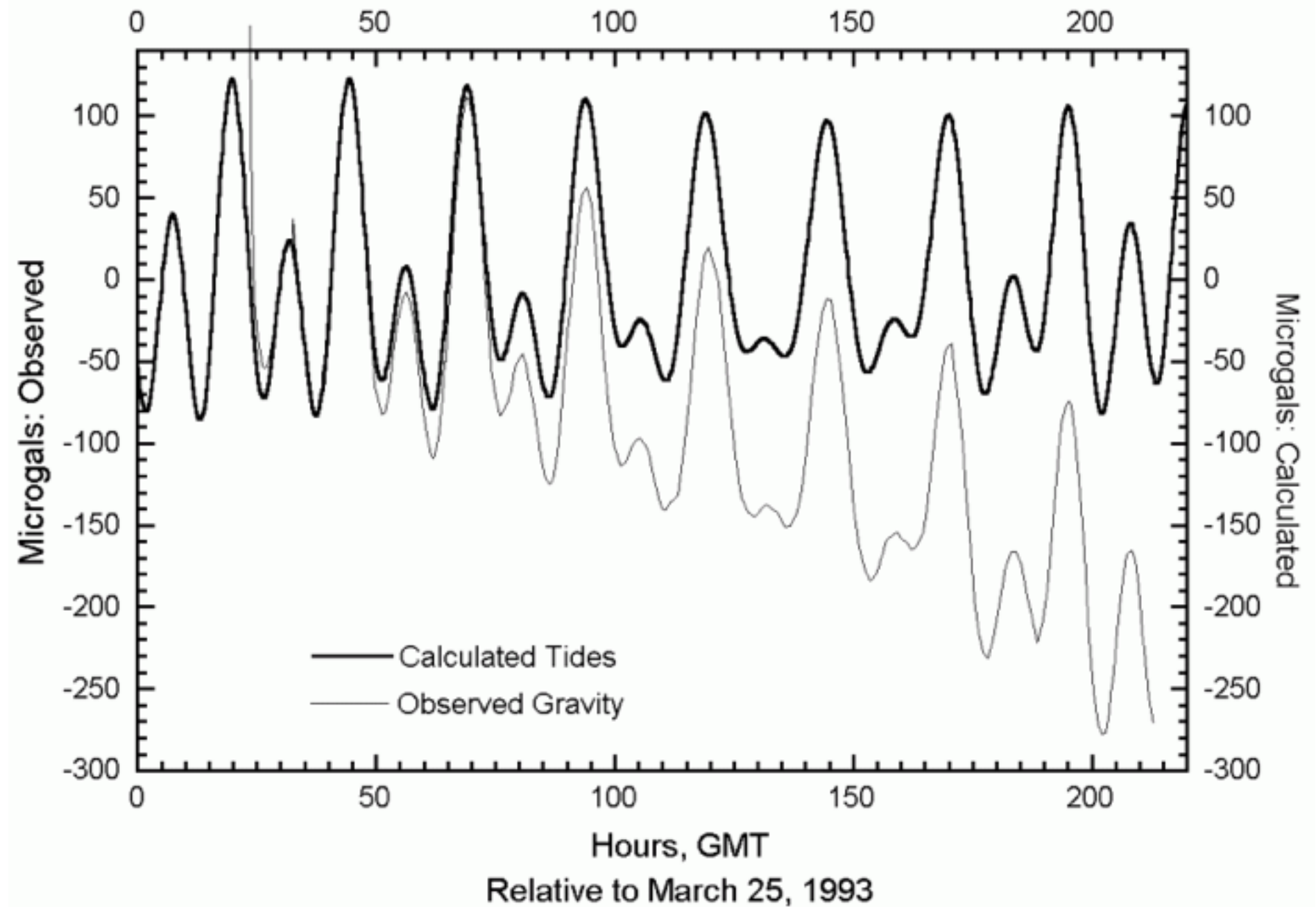


FIG. 1—Orbital parameters.


We know the model works and matches expensive instruments



Jud Ahern (OU)





I decided to write a Python module to help analyze the data


 **jrleeman / LongmanTide**


Unwatch ▾ 1



Gravitational tide computation based on Longman 1959 — Edit


 **18** commits

 **1** branch







 **0** releases

 **1** contributor

 Branch: **master** ▾ **LongmanTide** / + 

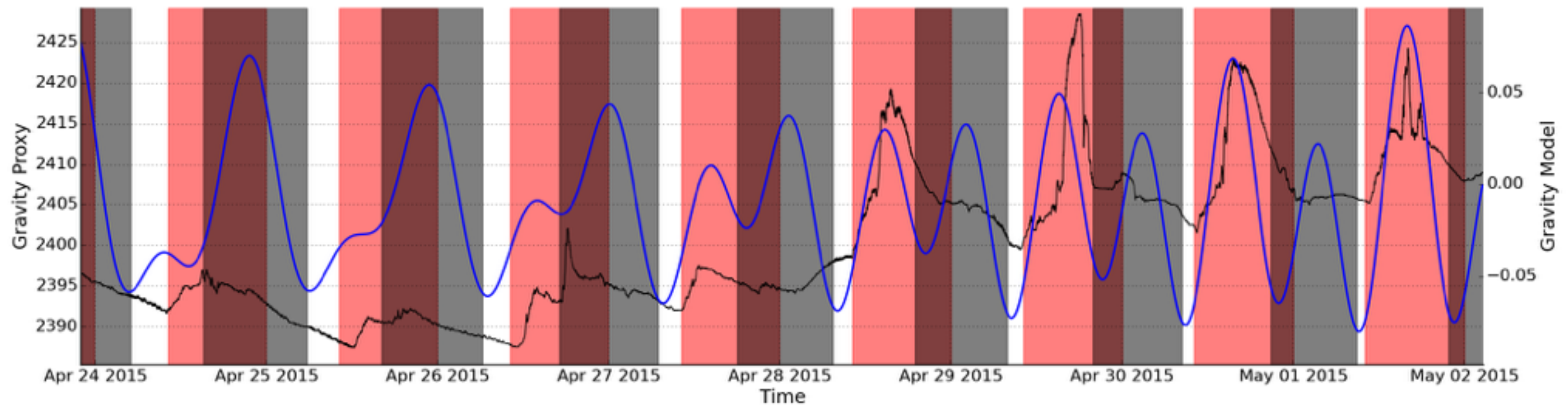
 **jrleeman** Remove redundant example

Latest commit c54eb75 on Jul 3

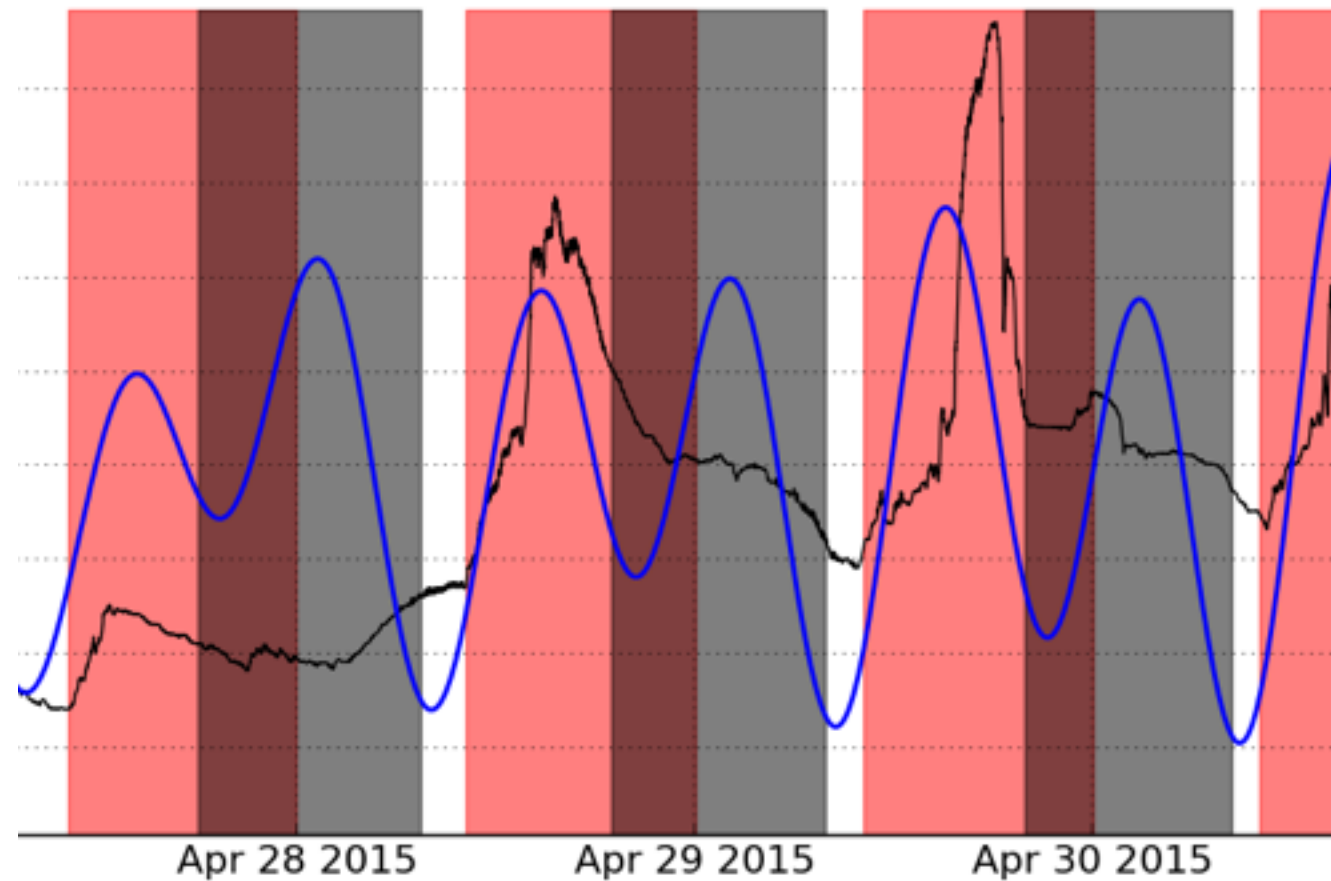
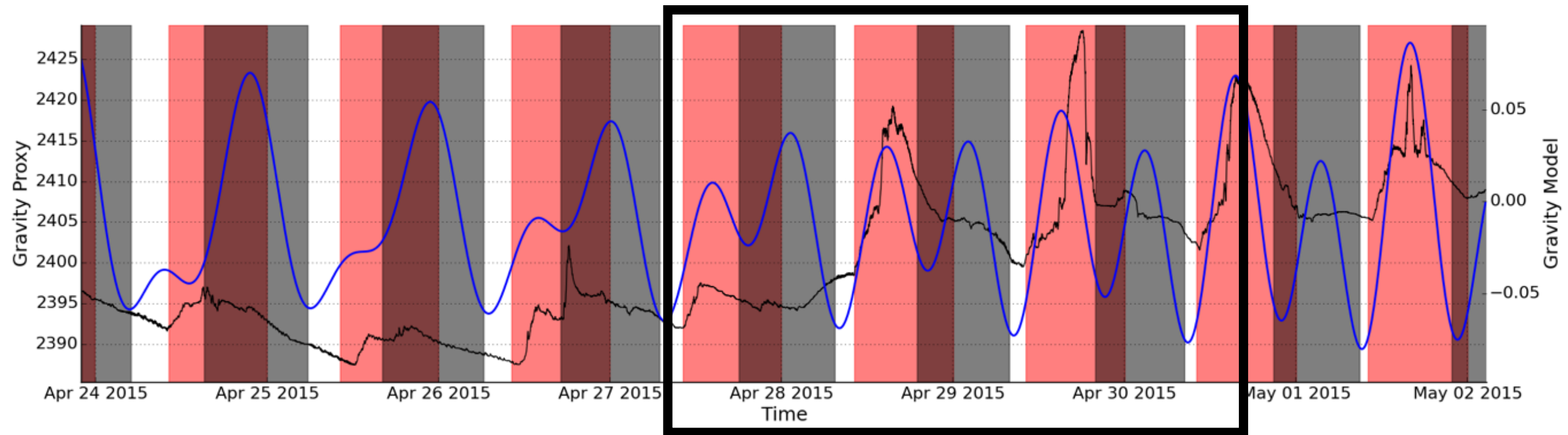
 examples	Remove redundant example	4 months ago
 longmantide	Restructure and split examples	4 months ago
 tests	Add test to verify function	4 months ago
 .gitignore	Initial commit	6 months ago
 README.md	Update examples	6 months ago
 setup.py	Restructure and split examples	4 months ago

github.com/jrleeman/longmantide

Ok, let's look at our data compared to the model



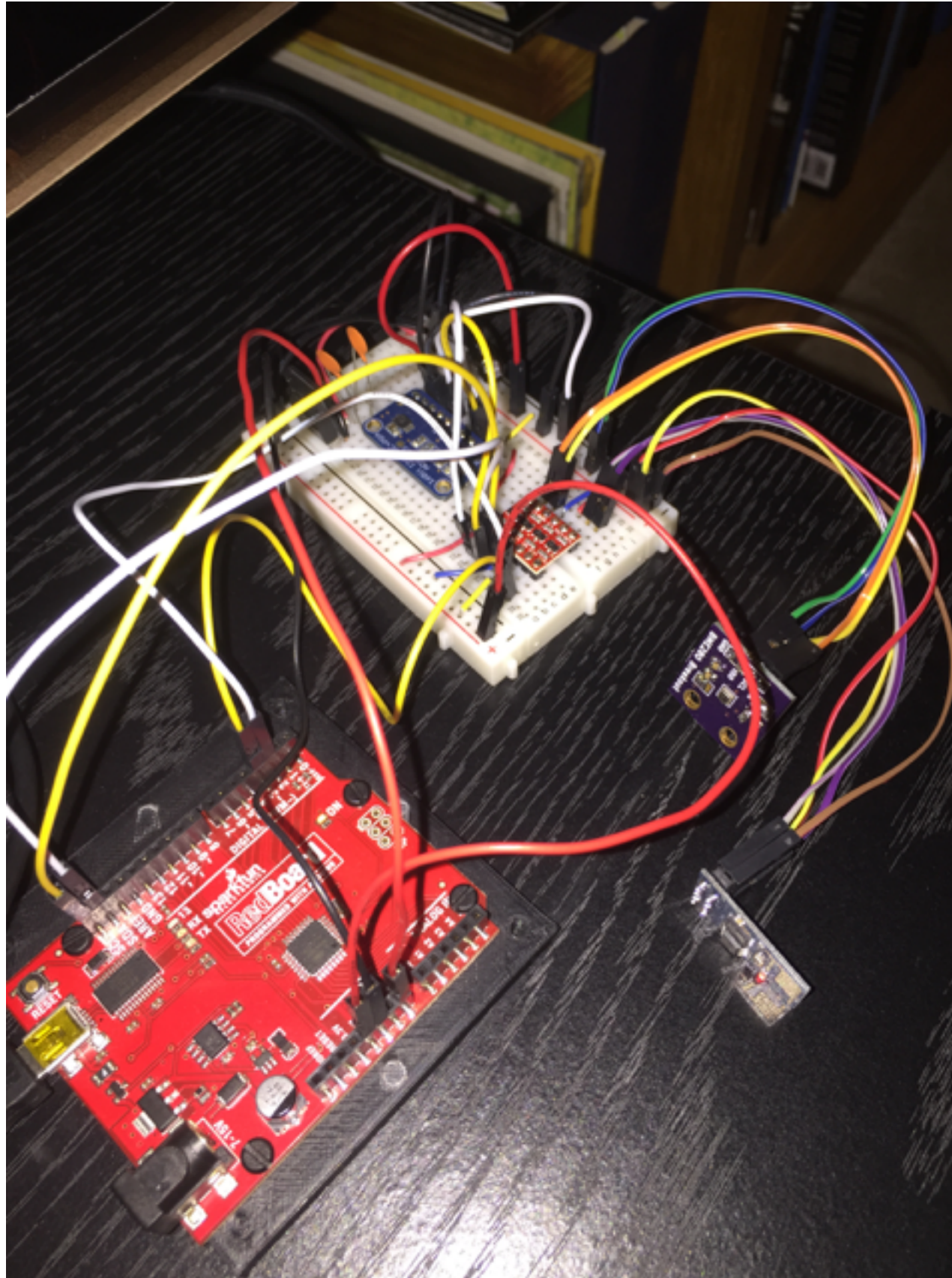
Ok, let's look at our data compared to the model



Turns out, it wasn't consistent. Time to build it better



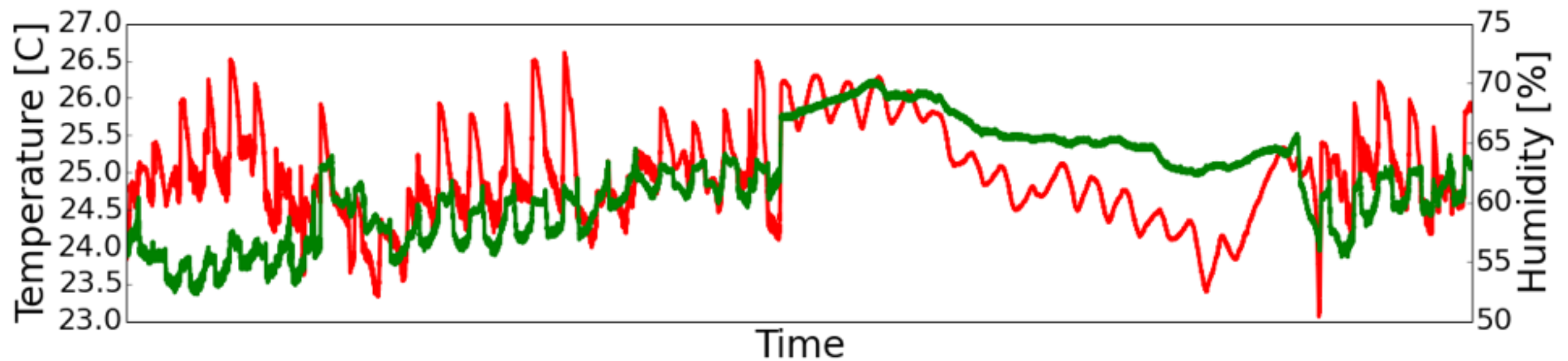
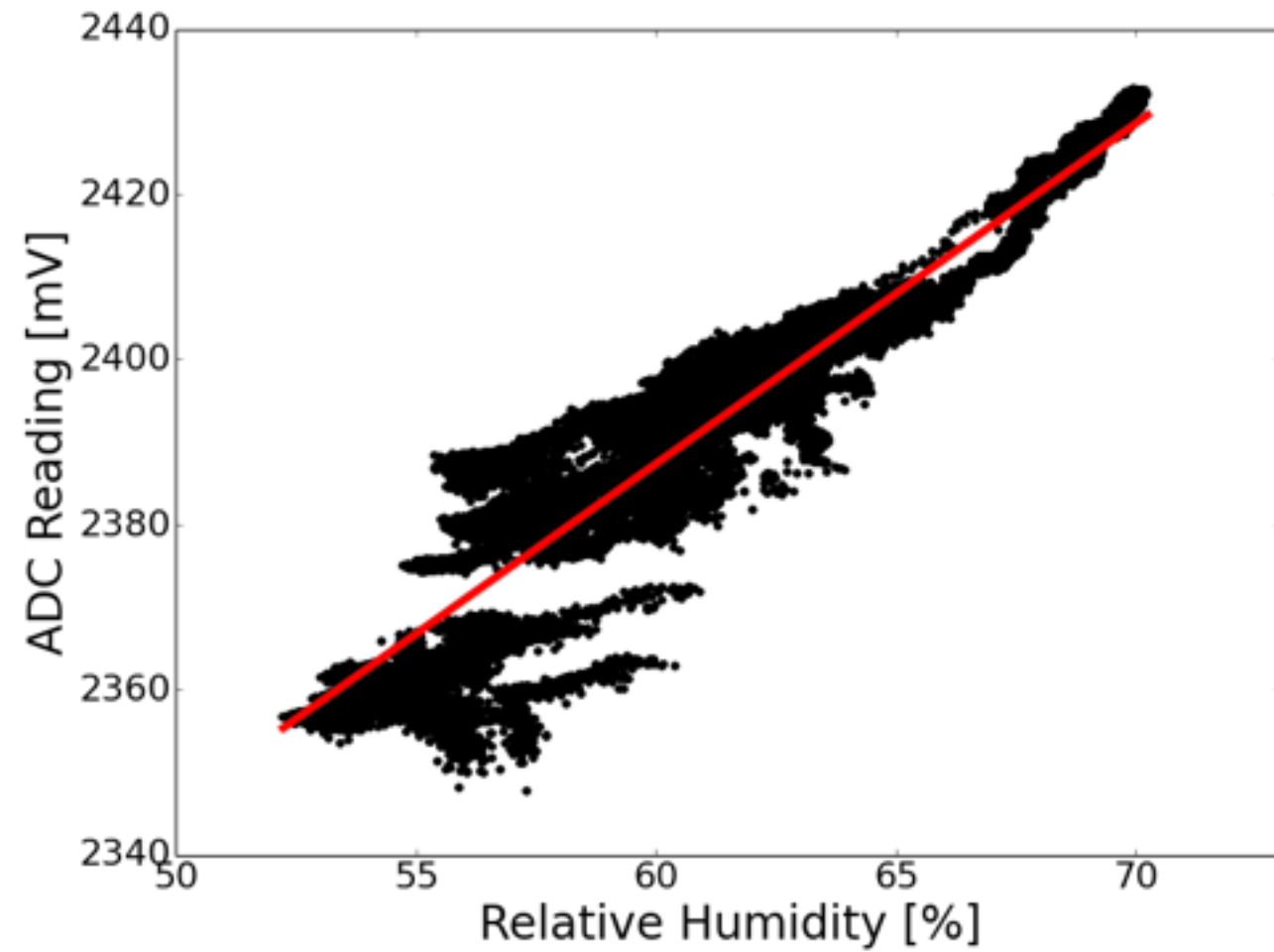
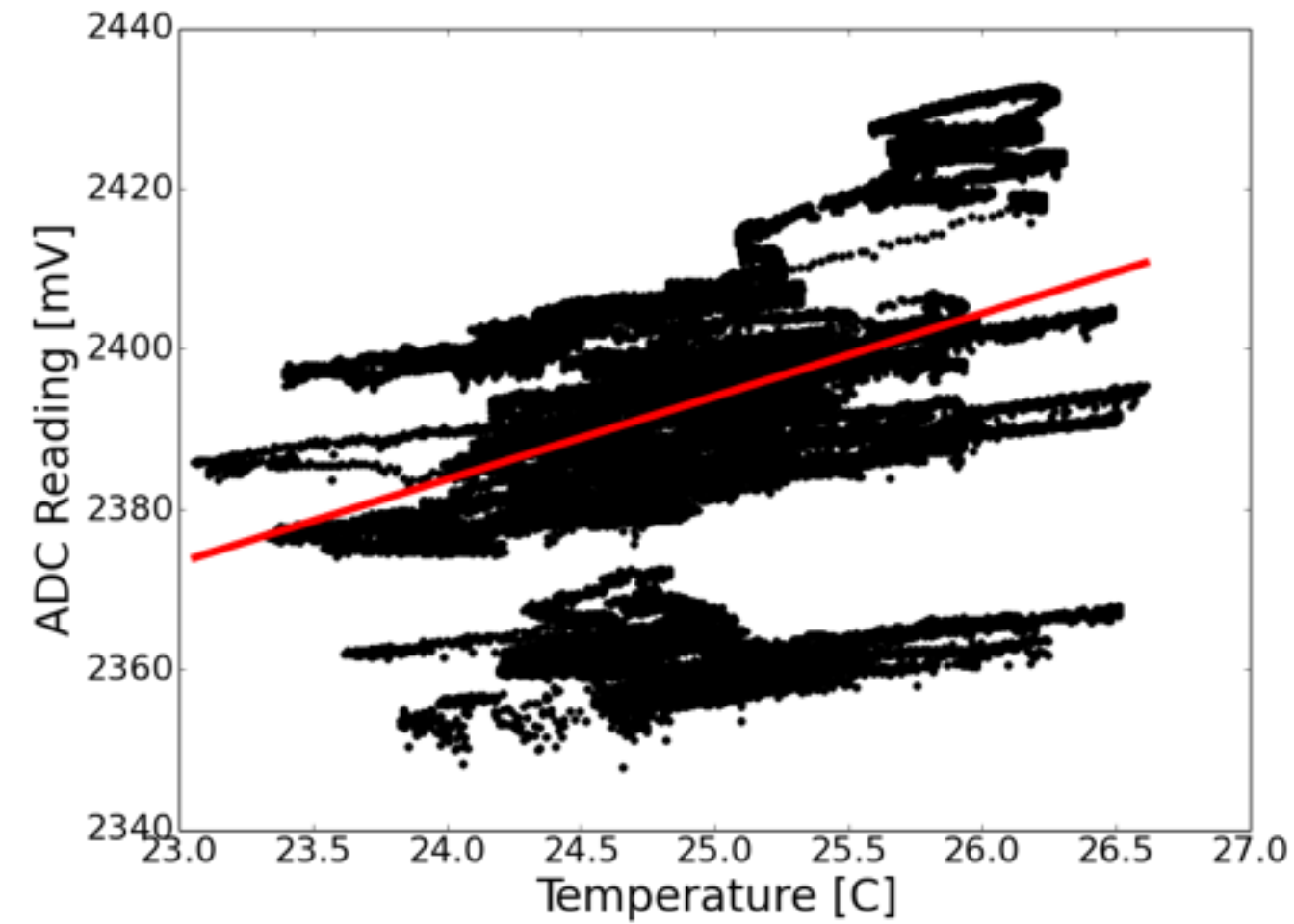
Turns out, it wasn't consistent. Time to build it better

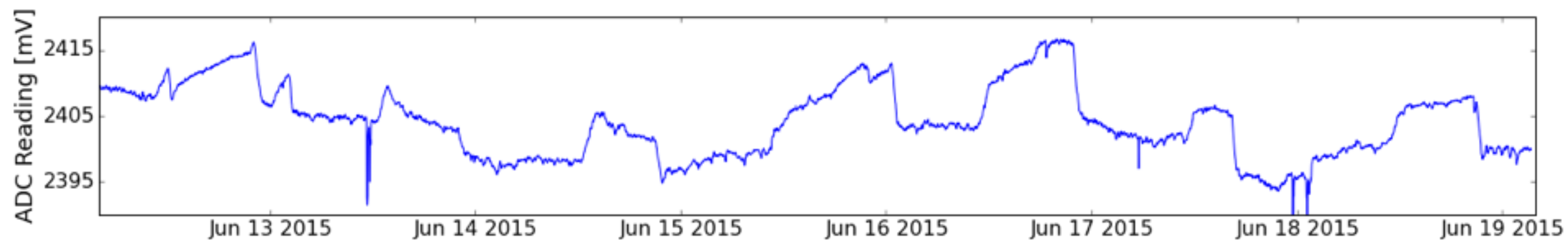


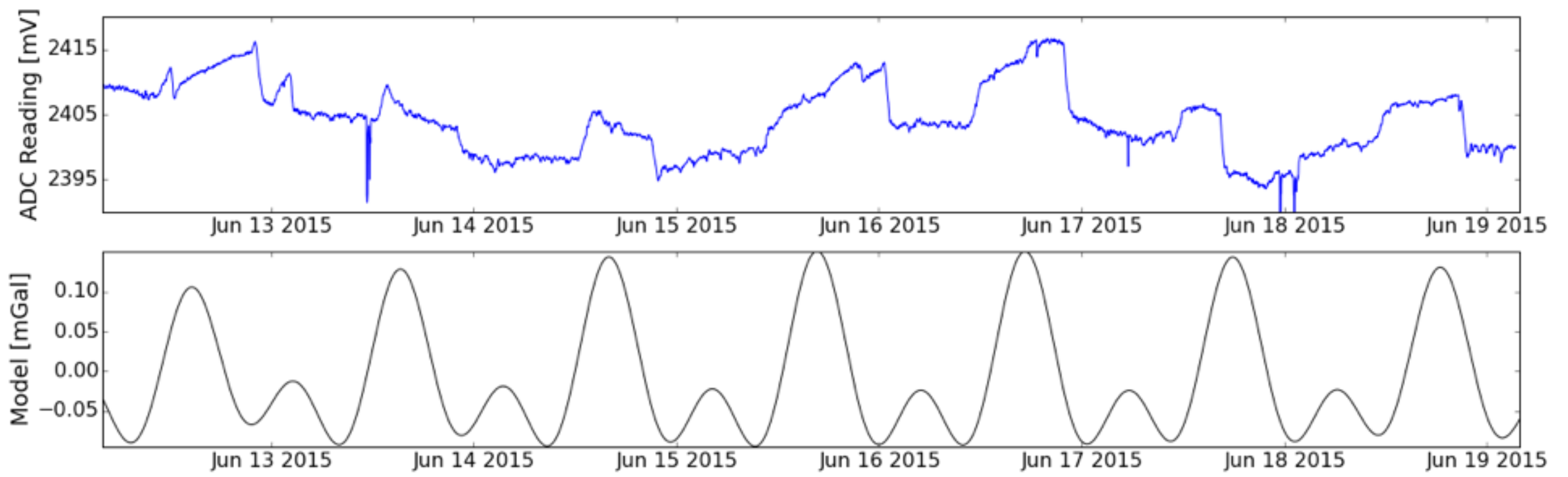
Turns out, it wasn't consistent. Time to build it better

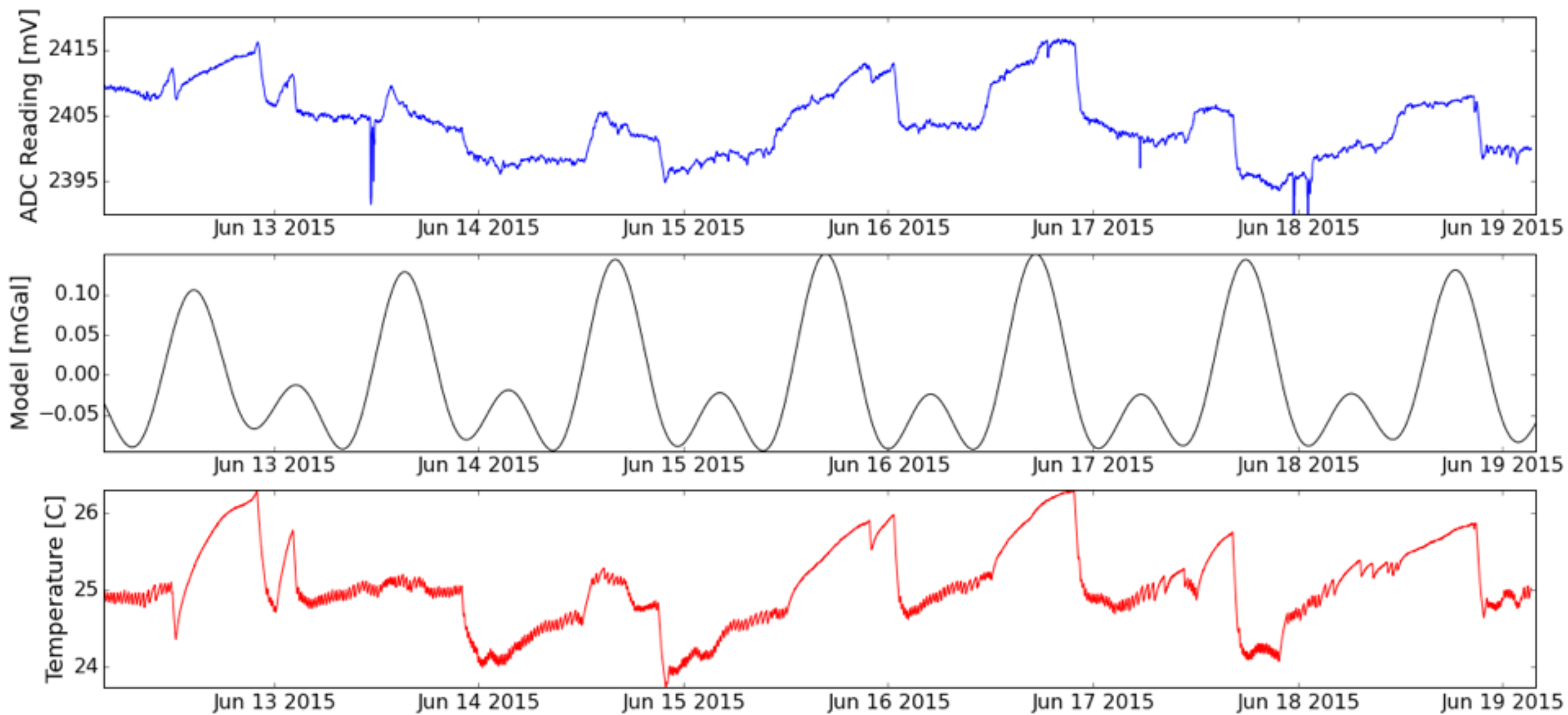


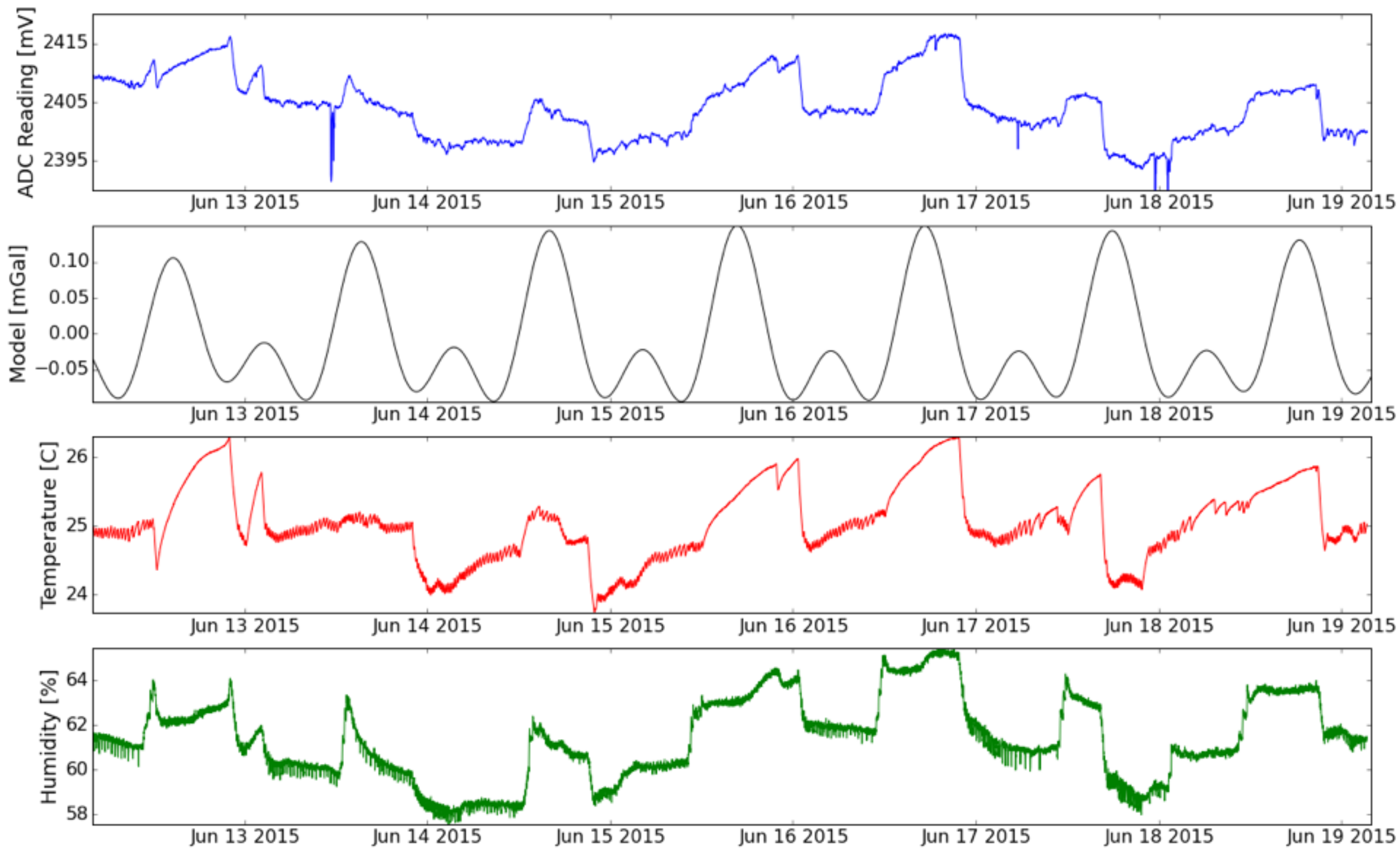
Sensors are strongly correlated with temperature and humidity

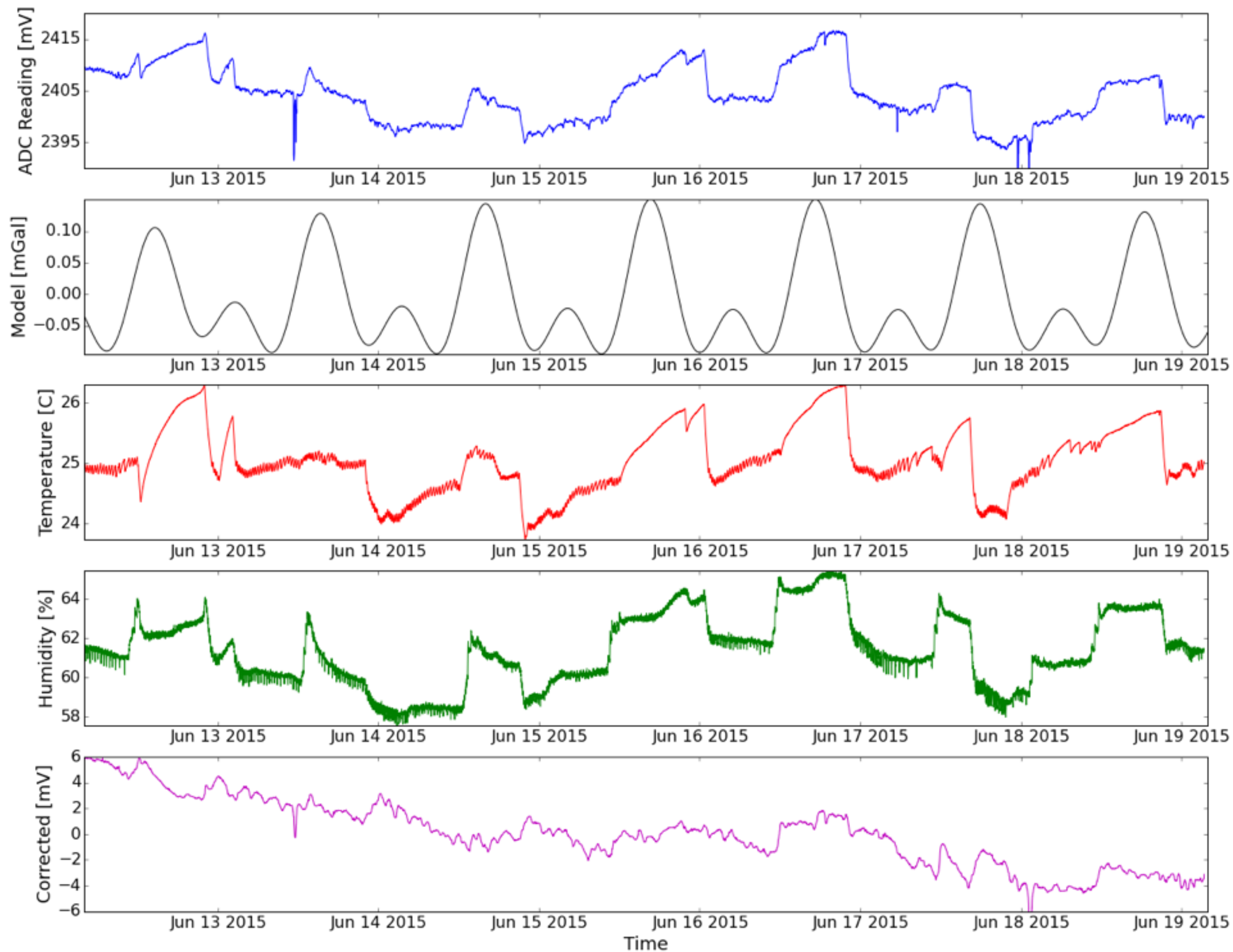




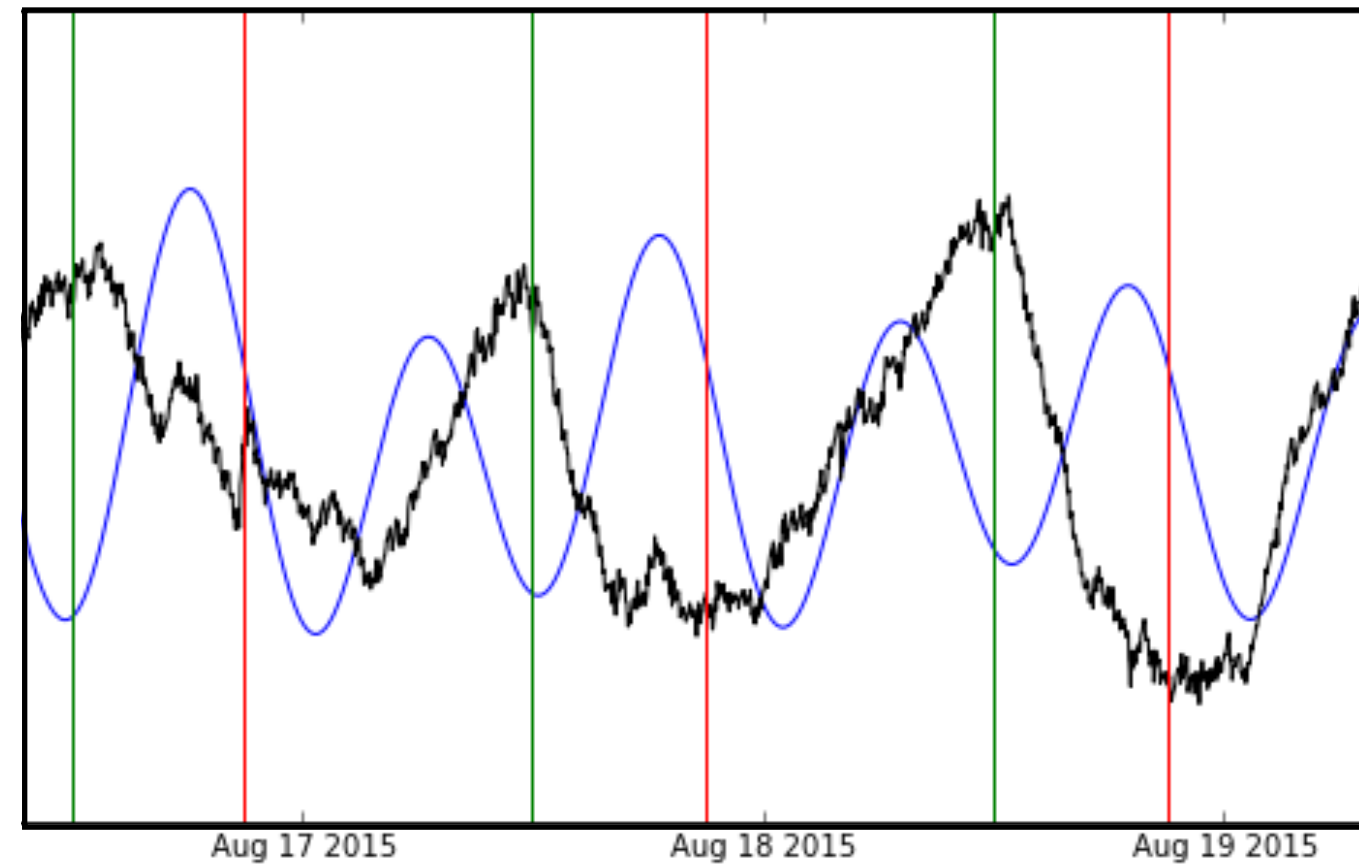
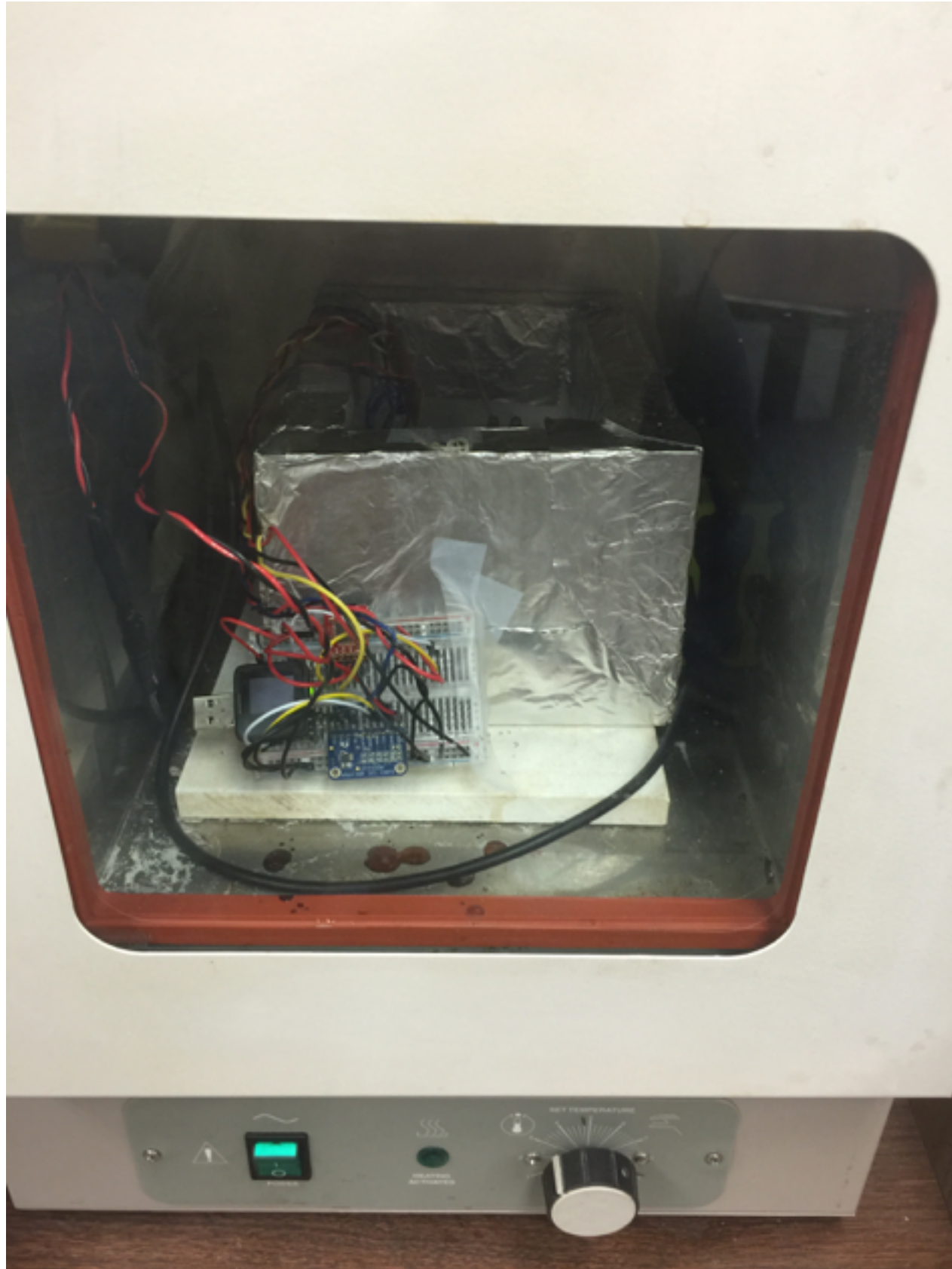




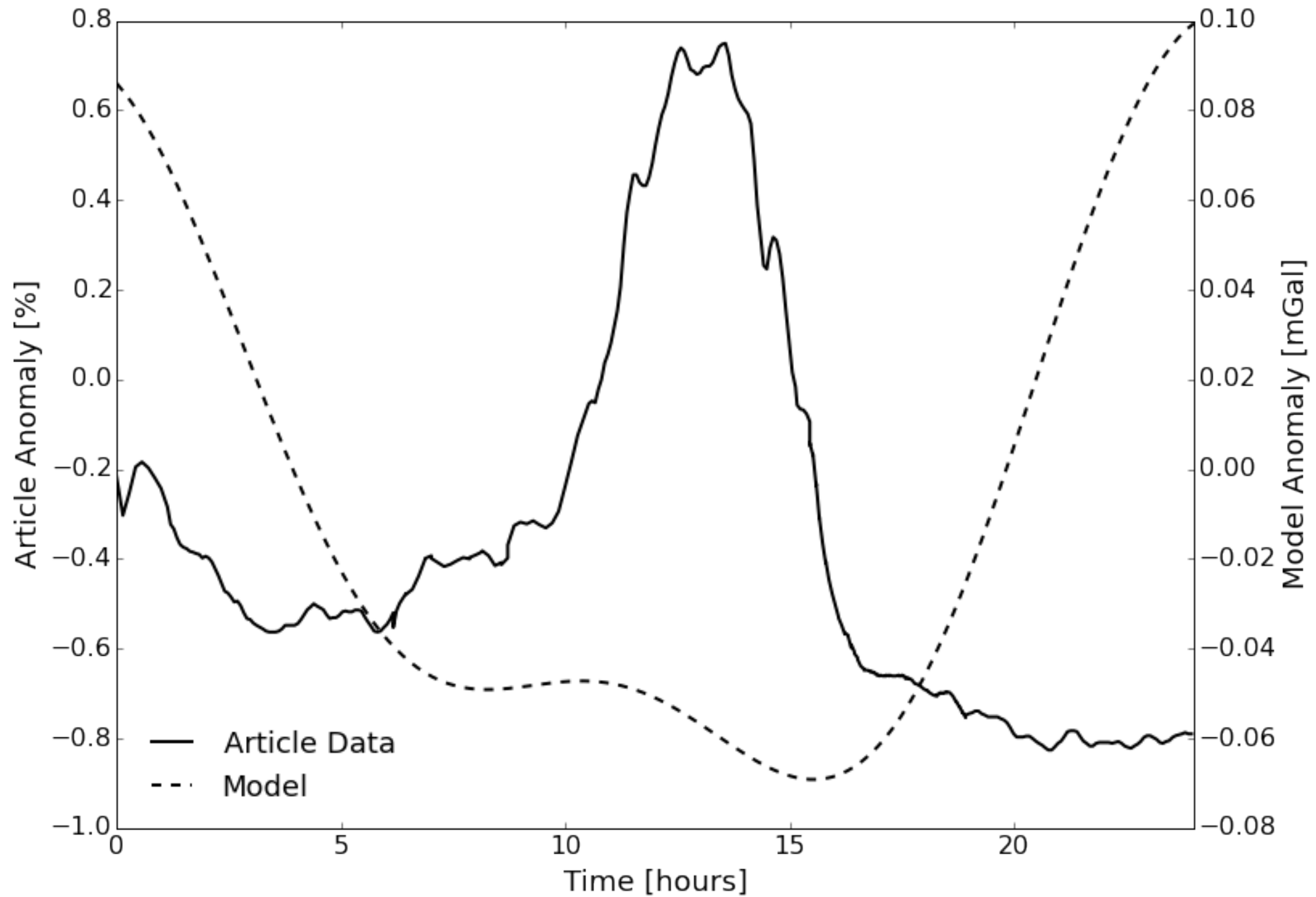




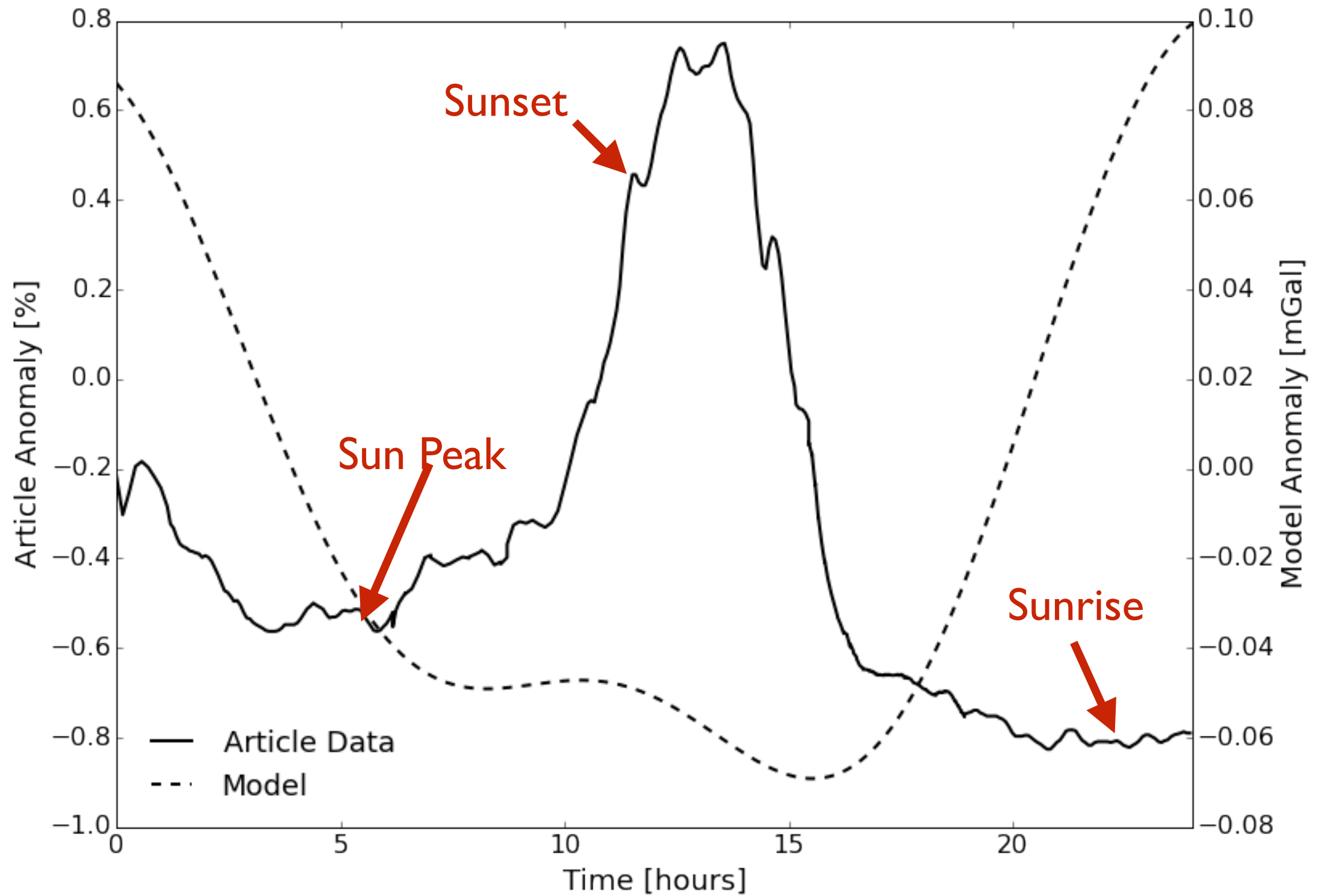
I even ran the system in a vacuum chamber



I also couldn't model the author's dataset



I also couldn't model the author's dataset



The moral: test your sensors as rigorously as you would your hypothesis

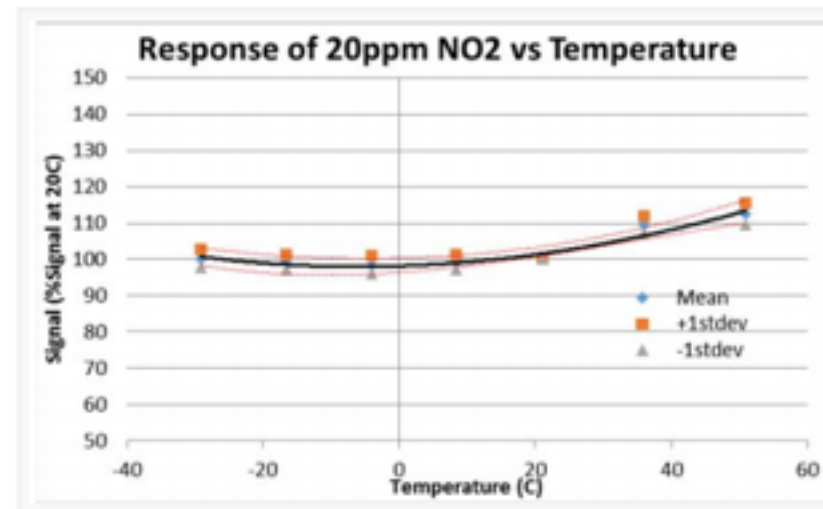
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Temperature Compensation

Posted on July 14, 2015 by admin in [AQE](#), [Microcontroller](#)

We've got some upcoming software updates in this area, and wanted to take the opportunity to explain how and why we need temperature compensation in the Air Quality Egg.

From the datasheets for NO₂ and CO in the version 2 Egg, you can find the following plots in the section titled "Temperature Effect." Get ready for some SCIENCE! (...technically it's mostly MATH! but equally fun...)



Explore the world of cheap, open-source instruments... carefully



All Presentation Content, Data, and more at
www.johnrleeman.com and the session blog