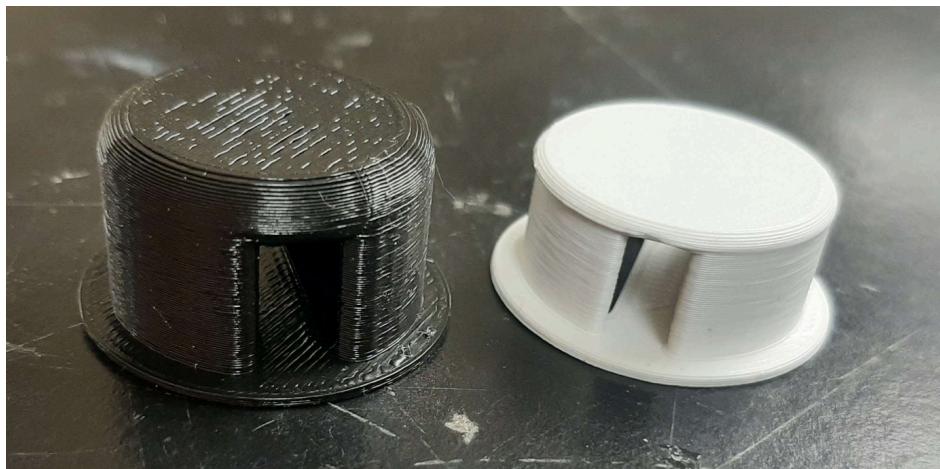


# Caps for Reducing the Impact of Ambient Lighting on Turbidity Data

The measurements taken from the turbidity sensor are affected by ambient light hitting the sensor. This can be seen in our turbidity data from the field that often shows clear day/night cycles and creates ambiguity between water turbidity and light hitting the sensor. To solve this, we designed a 3d printed cap that covers the turbidity sensor to lower the amount of ambient light that can reach the sensor. The purpose of this test was to analyze the effectiveness of these caps at blocking out ambient light in hopes of creating a consistent reading independent of the time of day, location, etc.



## Materials

- A Smart Rock V4
- One white turbidity cap
- One black turbidity cap
- A light proof container
  - Must be big enough to submerge a Smart Rock and have a lid
- A weight heavy enough to sink the Smart Rock
- A string or other method of affixing the weight to the Smart Rock



## Conditions

- Weather: Sunny, open sky. 76 degrees Fahrenheit.
- Time: 11:00 AM - 12:00 PM [insert times].
- Location: Sidewalk in direct overhead sunlight.

## Procedure

### Setup

1. Set the Smart Rock to take data every three seconds by editing the SD\_Config.JSON file on the SD card in the Hypnos board.

Name	Date modified	Type	Size
TurbTestSR3.csv	5/15/2024 11:21 AM	Microsoft Excel Com...	69 KB
TurbTestSR2.csv	5/15/2024 10:31 AM	Microsoft Excel Com...	2 KB
TurbTestSR1.csv	5/15/2024 10:29 AM	Microsoft Excel Com...	2 KB
TurbTestSR0.csv	5/15/2024 10:27 AM	Microsoft Excel Com...	3 KB
<b>SD_config.json</b>	5/15/2024 11:24 AM	JSON File	1 KB
debug	1/1/2000 12:00 AM	File folder	
.Trashes	7/13/2023 11:45 AM	File folder	
.TemporaryItems	7/13/2023 11:45 AM	File folder	
.Spotlight-V100	7/13/2023 11:45 AM	File folder	

**SD\_config.json - Notepad**

```
{
  "days" : 0,
  "hours" : 0,
  "minutes" : 0,
  "seconds" : 3
}
```

File Edit Format View Help

Ln 1, Col 1    100%    Unix (LF)    UTF-8

2. Fill the container with enough tap water to fully submerge the Smart Rock in the horizontal position.
3. Affix the weight to the Smart Rock so that it stays submerged in the horizontal position without support.
4. Move to an area where the inside of the container receives direct sunlight. Make sure there are no clouds or other obstructions that will change the light hitting the container.

## Data Collection

1. Turn on the Smart Rock so it begins to take measurements and log them to the SD card.
2. Close the Smart Rock, checking that a seal has been made with the O ring, and the LEDs are turning on every three seconds.



3. Place the Smart Rock in the container horizontally, facing the sun. Leave the lid off of the container so the turbidity sensor is getting direct sunlight. Set a timer for one minute.



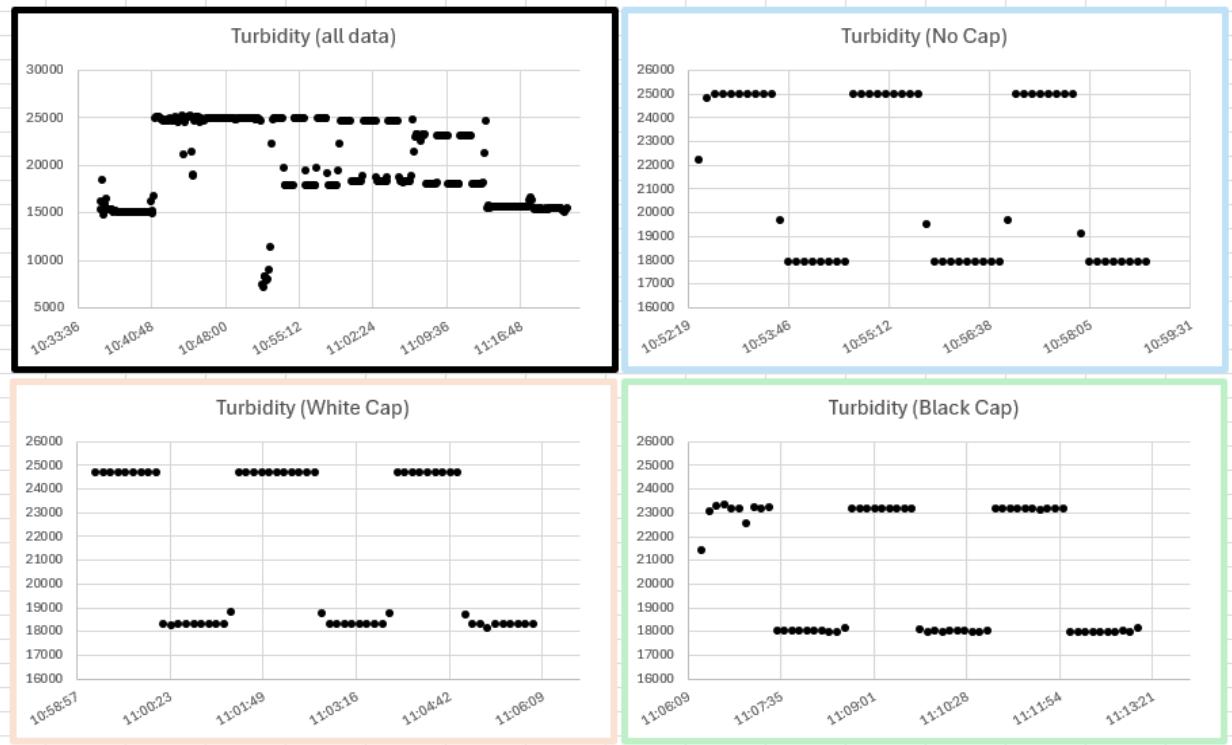
4. Once one minute has passed, without disturbing the Smart Rock or container, place the lid on the container. Set another timer for one minute.



5. Repeat steps three and four until you have collected data for three minutes with the lid off and three minutes with the lid on.
6. Take the Smart Rock out of the container. Dry the Smart Rock off and turn it off.
7. Turn it back on and repeat steps one through six with the white cap on, and then with the black cap on. (Turning it off and back on starts logging data to a new .csv file on the SD card.)
8. Remove the SD card from the Hypnos board and analyze the data in excel.

## Results

We predicted the turbidity cap would be an effective solution for reducing the effects of ambient light on the turbidity sensor's readings. This would appear in the data as minimal difference between the measurements taken with the lid on and the measurements taken with the lid off compared to the control (no cap).



Contrary to our prediction, the turbidity caps had marginal effects on the data compared to the control. Unfortunately, this means that the turbidity caps are not a viable solution to reducing the effect of ambient light on the turbidity sensor.