

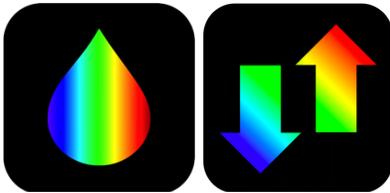
# Measure surface reflectance and albedo using smartphone apps *Hydrocolor* and *Albedo*

## Directions for using the smartphone apps:

### Description

The following instructions detail how to set up the smartphone apps and record measurements with a smartphone camera. These instructions were developed for measuring water reflectance using the Hydrocolor app. The procedure is extremely similar using the Albedo app.

### App Setup



1. Download the Hydrocolor App (raindrop) and/or the Albedo App (arrows).
2. Connect the app to our shared Dropbox folder using the following credentials:

Go to “Settings.”

Choose “Link Dropbox Account”

When your data file has synced to the shared folder, there will be a check mark saying “Data File Synced.”

### Measurements

Optional: Punch a hole in your grey card and connect it to some sort of lanyard.

1. Plan your day(s) and time to take the measurement.

Ideally, as close to mid-day (noon) as possible on a sunny day with no clouds. If you would like to compare these measurements to surface reflectance measurements from

satellites, take them on sunny days with known satellite overpasses happening, preferably within 3 hours of the overpass.

2. Bring smartphone and grey card to dock.
3. Open the Hydrocolor App on your device. More information is written in the “About” tab on the bottom left of the screen. Full information is available in the peer-reviewed journal article by Leeuw et al. 2018 (see References section at end of document).
4. Go to “Collect Data.”
5. Look at the map and make sure it shows your location. If not, choose “Edit Lat Lon” to manually enter your coordinates or “Get GPS Fix.” (The location usually works, so don’t worry too much about this).
6. Click the rectangle under “Grey Card” to start taking your measurements.
7. Lay grey card flat on a flat surface. Step on or hold onto the corner of the grey card to keep it in place especially if it is windy.
8. Take your measurements by snapping three photos:
  - a) Take a picture of the grey card making sure that BOTH angles are aligned using the green arrow markings on the app (see screenshot below). You may have to turn around or use a different side of the dock. Try to get as much of the grey card in the camera frame as possible.
  - b) Take a picture of the sky. Again, make sure BOTH angles are aligned using the green arrow markings on the app.
  - c) Take a picture of the water surface. Align your angles similar to the way you did it for the grey card.

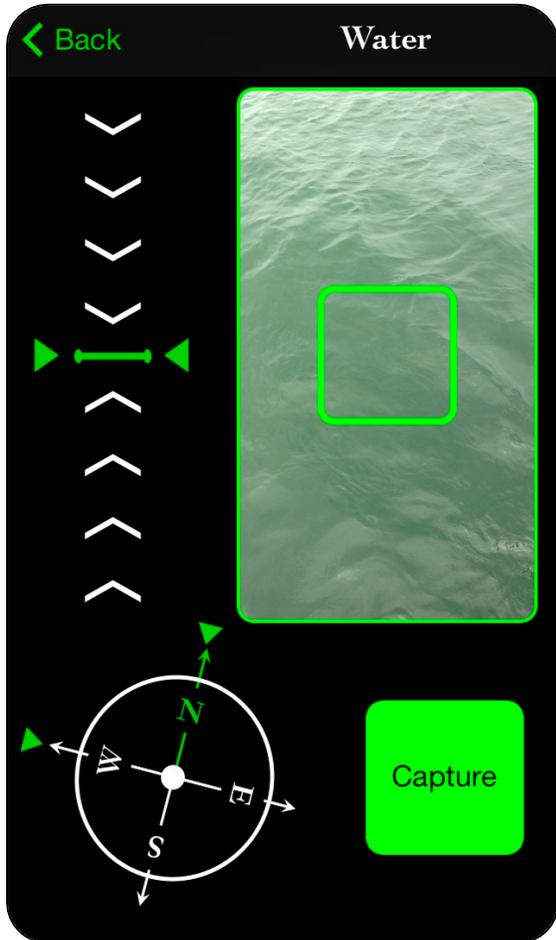


Figure 1. Correctly aligned image capture for the “Water” image. Left upper side with the bar and notches shows how to align the zenith angle – the up-and-down angle, like nodding your head to say “yes.” Left lower corner with the compass shows the azimuth angle – the side-to-side angle, like turning your head to say “no.” The sun should be almost behind you in the side-to-side direction. The left lower corner compass gives you two options, for the sunlight to come from over either one of your shoulders.

Things to avoid in your pictures:

- Shadows (your own shadow, the shadow of the dock on the water, object shadows)
- Whitecaps
- Foam
- Large amounts of bubbles
- Debris
- Glint
- Dock pilings, shoes, or other objects.

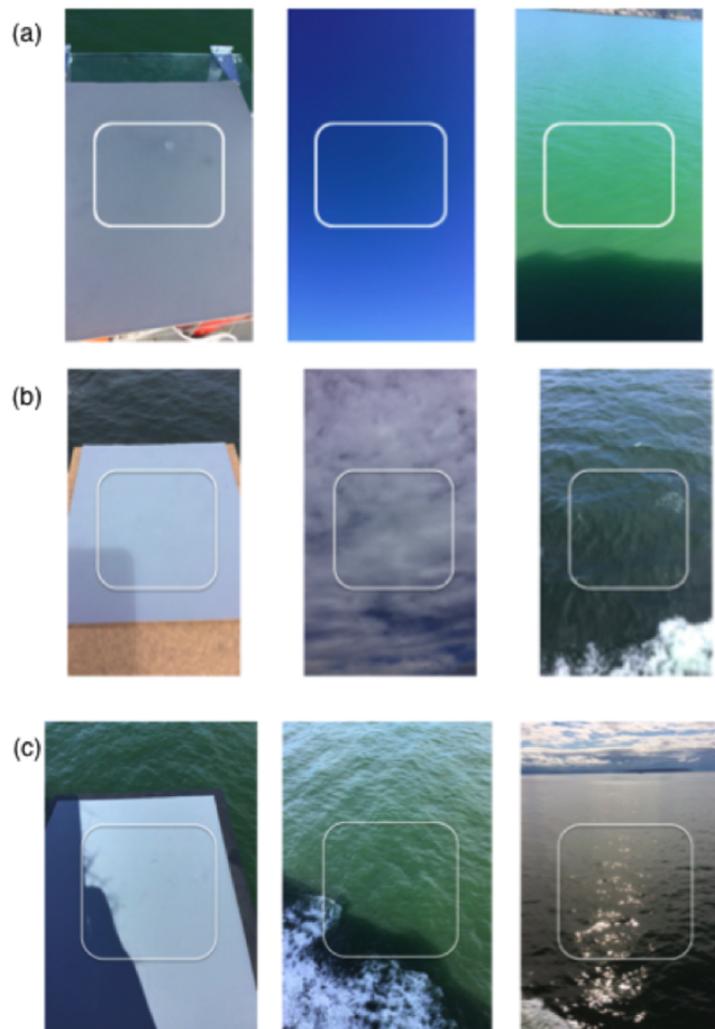


Figure 2. Example of Hydrocolor measurements by the quality of the images: a) perfect, b) good, and c) bad. Adapted from Figure 5 in Yang et al. 2018.

9. When you are done with all three pictures, click the button: “Analyze Images.”

10. Name the file something you will remember. I recommend “Location\_date\_A” for the first measurement.

11. Repeat steps 4 through 10 above two more times, for a total of three measurements saved to your library in the app.

### **File Naming**

You can name the replicates something like “...A, ...B, ...C” or “...1,...2,...3.”

For example, I named three measurements taken at Croaker Pier on the upper York River on January 26, 2020:

CroakerPier\_2020-01-26\_A

CroakerPier\_2020-01-26\_B

CroakerPier\_2020-01-26\_C

Whenever you go back to that same location, you can use that same starting phrase to name the files. This will help you keep track! After taking a lot of measurements, you'll see that it's much nicer to look back on in the "Library" tab when you know where and when all the different pictures were taken.

### **References:**

Leeuw, T., Boss, E., 2018. The HydroColor app: Above water measurements of remote sensing reflectance and turbidity using a smartphone camera. *Sensors* 18.

<https://doi.org/10.3390/s18010256>

Yang, Y., Cowen, L.L.E., Costa, M., 2018. Is ocean reflectance acquired by citizen scientists robust for science applications? *Remote Sens.* 10, 1–18. <https://doi.org/10.3390/rs10060835>

MISC Lab, University of Maine, 2014. "HydroColor" Webpage. Maine In-situ Sound and Color Lab, School of Marine Sciences.

<http://misclab.umeoce.maine.edu/research/HydroColor.php>