



HydroColor App for measuring reflectance (R_{rs}) of water



Article

The HydroColor App: Above Water Measurements of Remote Sensing Reflectance and Turbidity Using a Smartphone Camera

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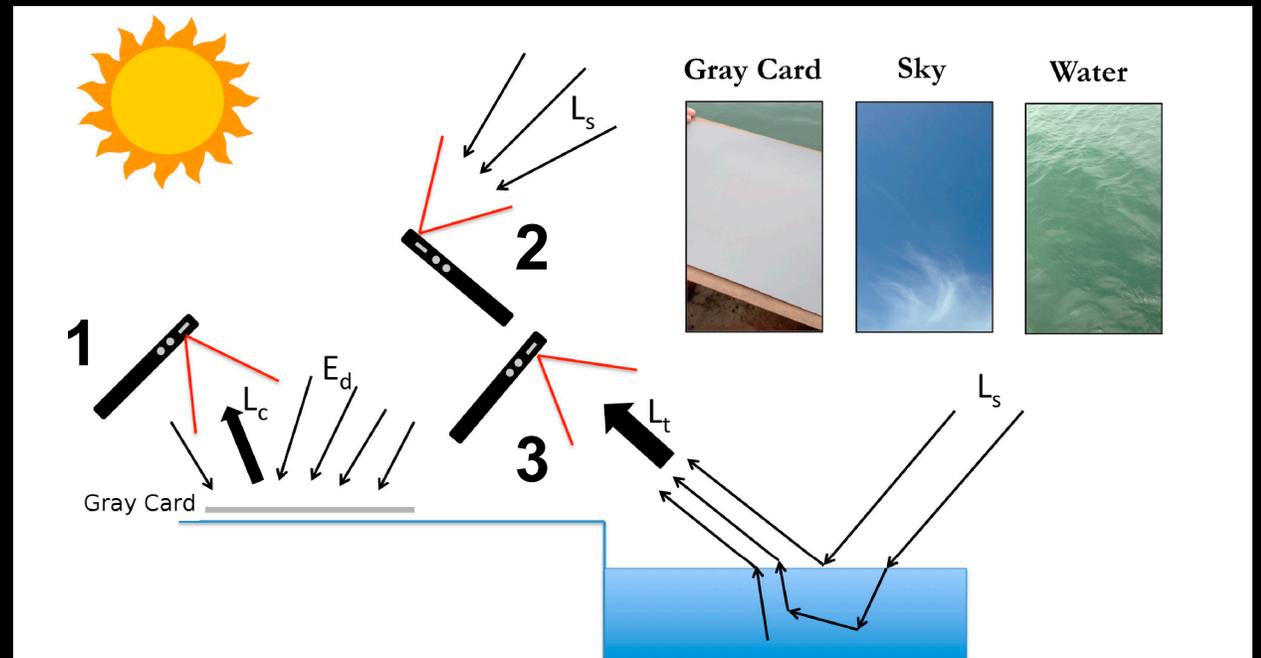


Figure 1. Example of three images collected with HydroColor and the optical features captured in each image. The gray card image is captured at 40° from nadir and 135° from the sun. The sky image is captured at 130° from nadir and 135° degrees from the plane of the sun. The water image is captured at 40° from nadir and 135° degrees from the plane of the sun.

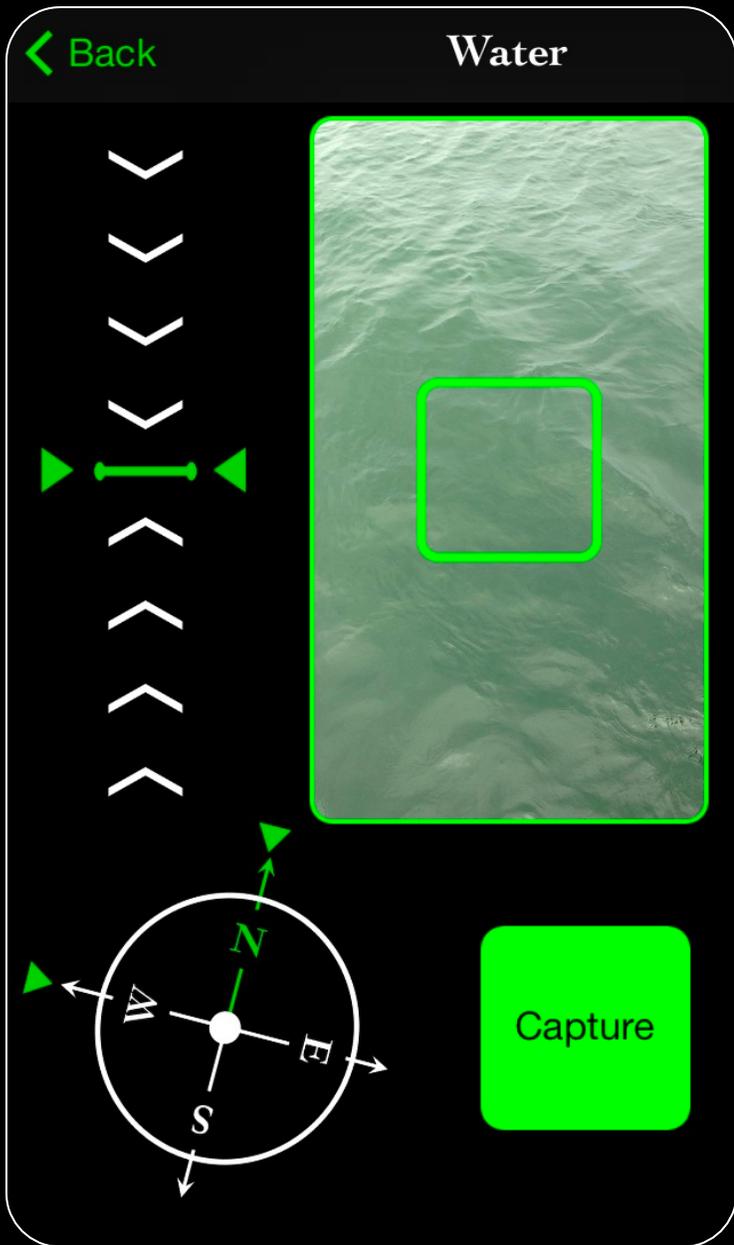
More information on website:

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



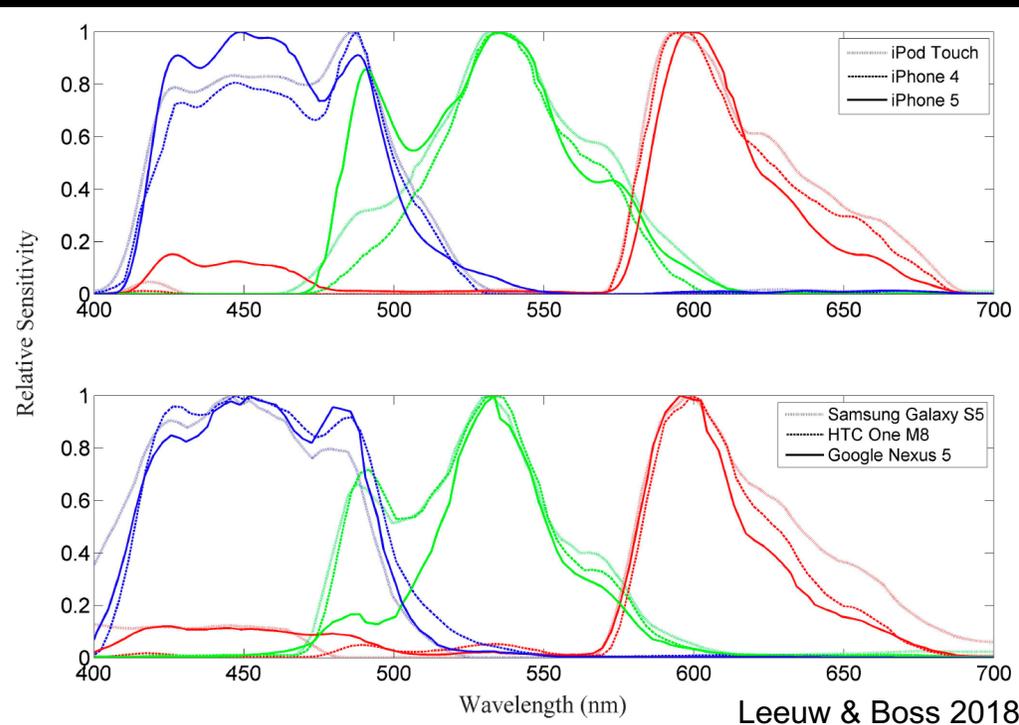
40° from nadir
(sky image guides user to 130°)

135° from the sun



Methods

- Free Application for smartphones
- Need photography 18% gray card (~\$3)
- Uses phone GPS, time to compute sun angle
- Uses phone gyroscope and compass to guide user to the correct angles
- Uses RGB color channels of camera:

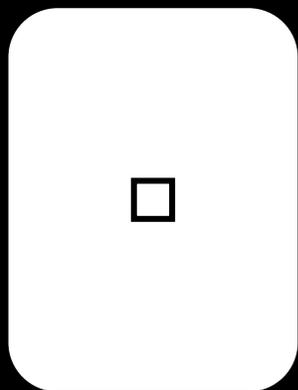




Data products

$$R_{rs} = \frac{L_{water} - 0.028L_{sky}}{\frac{\pi}{0.18}L_{card}}$$

- Calculates Rrs(Red,Blue,Green) from average RGB pixel values over the 200x200 pixels at center of each image

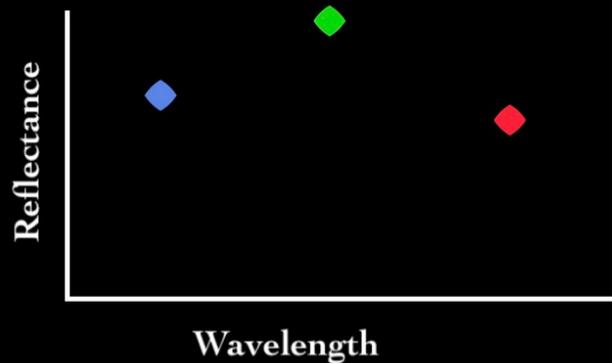


(For 12MP Camera)

- Estimates turbidity from Rrs(Red)

Damariscotta River Estuary, Maine

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Reflec. Red	0.007 ± 0.001 1/sr
Reflec. Green	0.011 ± 0.002 1/sr
Reflec. Blue	0.008 ± 0.001 1/sr
Latitude	43.93434°

Gray Card



Sky

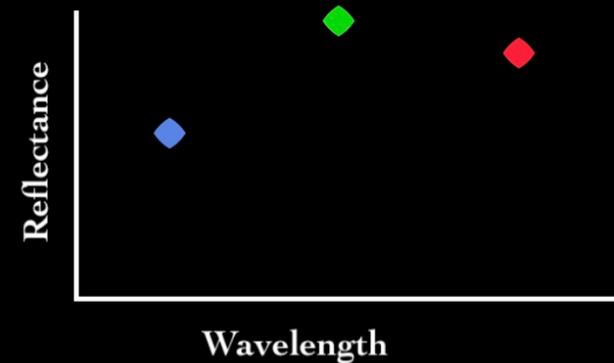


Water



York River Estuary, Virginia

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Reflec. Red	0.015 ± 0.002 1/sr
Reflec. Green	0.017 ± 0.003 1/sr
Reflec. Blue	0.010 ± 0.001 1/sr
Latitude	37.24812°

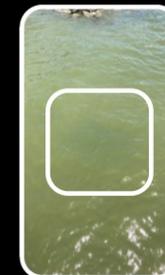
Gray Card



Sky



Water





Advantages and disadvantages

Pros

- Free and simple, controls for many user errors
- Accuracy within 26% of a radiometer
- Data can be backed up automatically as one .txt file to Dropbox in the app
- Can see most user errors (angles, etc) in metadata in .txt files generated
- Most accurate: at noon, clear sky conditions, trained user

Article

Is Ocean Reflectance Acquired by Citizen Scientists Robust for Science Applications?

by Yuyan Yang ^{1,*} , Laura L.E. Cowen ¹ and Maycira Costa ²

Cons

- Light intensity is from images, not directly from phone light sensor
- Sky and water not instantaneous (+/- 30 seconds to 1 minute)
- Wide bands, green and blue pixel “cross talk”
- Bad: untrained user, waves, patchy-cloud sky conditions, if done morning/evening