Local Algorithm for Monitoring Total Suspended Sediments in Micro-Watersheds Using Drones and Remote Sensing Applications. Case Study: Teusacá River, La Calera, Colombia.

Nataly Saenz, Daniel Paez and Cesar Arango (Colombia)

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SUMMARY

Total suspended sediments (TSS) determination in a water streams normally requires large sampling field campaigns, which are costly and usually cover small areas. For large water bodies, such as lakes, it is normal to use satellite images to determine TSS. However, using remote sensing for small water bodies is difficult due to satellite image resolution, and also because satellite images are not often available at those times required by researchers (e.g. soon after a discharge from a water treatment plant). This research presents and tests a methodology to determine TSS using photography from an unmanned aerial vehicle or drone. Results from applying the methodology in a small river in Teusaca, Colombia demonstrated the capability of drones to determine TSS. However, to achieve replicable results, careful calibration of the camera on site is required. Further research concerns the use of this drone methodology for large water bodies and over larger areas of rivers.

Methodology is based on a comparison of reflectance values obtained with aerial images and the concentration of this pollutant from in-situ samples. Method includes the image processing performed in ArcMap, necessary for the transformation of digital numbers to reflectance values required for using made-consumer grade digital cameras, whereby the reflectance is the only stable parameter with lower error aspects, suitable for remote sensing applications. In the interest of use these results in remote sensing applications it was necessary to use a method of radiometric normalization that transforms digital numbers to reflectance values. In this research the Clemens method was used, the same one used at the AggieAir Flying Circus, a service center at the Utah Water Research Laboratory at Utah State Laboratory.

Results show a high relationship between concentration of TSS and reflectance bands 4, 2 and 1 from an analysis of covariance. Followed, 25 regressions were analyzed from goodness of fit tests,

hypothesis testing and comparisons with observed data from RMSE. The result was the regression model SST = 46.61479*(Band 4+Band 1)-39.2955 with adjusted R^2 of 0.8781 and RMSE of 3.4827. Based on this success, the investigation result was the visualization of the distribution of TSS concentration in the Teusacá River with a map performed on ArcMap with the regression model.

The evaluation performed in this research is an initial point for the investigation of the use of remote sensing in water quality, from which it follows other possibilities in environmental modeling and regulation control tools.