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MONITORING WATER TURBIDITY WITH CAMERA: A REAL SCALE EXPERIMENT

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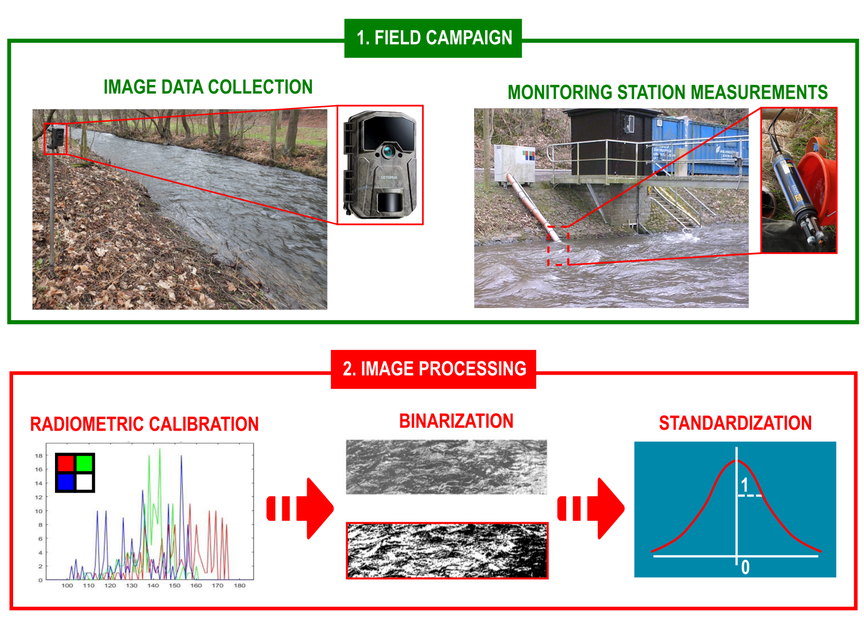
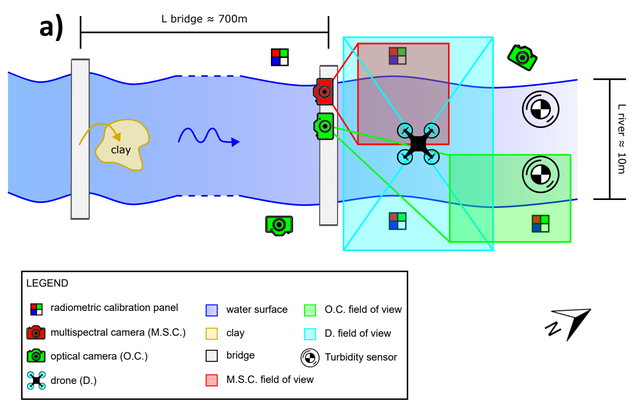
INTRODUCTION

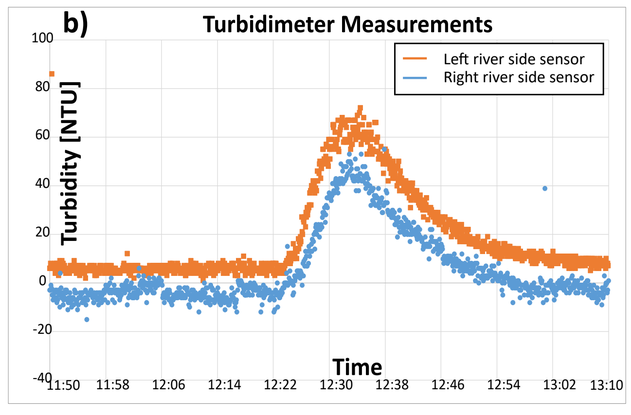
Turbidity is a key optical property of water. High turbidity values in river basins can be a proxy for both organic and inorganic material presence. Improving river monitoring techniques is essential, due to climate change, pollution and population growing impacts in recent years. Since existing techniques are usually pointwise and rarely performed throughout the year, optical cameras could provide significant advantages by reducing the survey costs and exponentially increasing the amount of information on water bodies. In this work an image processing procedure has been identified to estimate river turbidity from water spectral reflectance. A real scale experiment has been carried out artificially increasing the level of turbidity by adding natural clay into the river. The development of the camera system will increase temporal and spatial resolution in river monitoring and support existing techniques with early warning strategies. The development of this tool can help many aspects of water resources management and decision support processes for environmental risk prevention.



Graphical abstrct of the camera turbidity monitoring procedure

FIELD CAMPAIGN





The monitoring field campaign has been conducted in Selke River within the Bode catchment, instrumented and managed by UFZ Research Centre in Germany. Different types of camera and installation settings has been investigated, in order to understand the full potential of this technology in water quality monitoring practices. The gathered data was compared to the measurements of the turbidimeters, which has been installed in the river cross-section.
The experiment setup (Figure a) shows the position and the type of camera and sensors. In Figure b) the turbidity measurements of the two turbidimeters, installed on the opposite river sides, prove that the clay tracer has been added upstream enough from the monitored river cross-section to ensure the complete mixing in water.

The **multispectral camera** has been installed during the experiment to investigate the **potential application of wavelenghts** outside the visible spectrum, for turbidity monitoring.

Multispectral camera Tetracam ADC Snap (camera spectral range: 520nm to 920nm)

The **drone** has been used during the experiment, for taking in account the influence and the advantages of the **zenithal view angle** in water turbidity monitoring.

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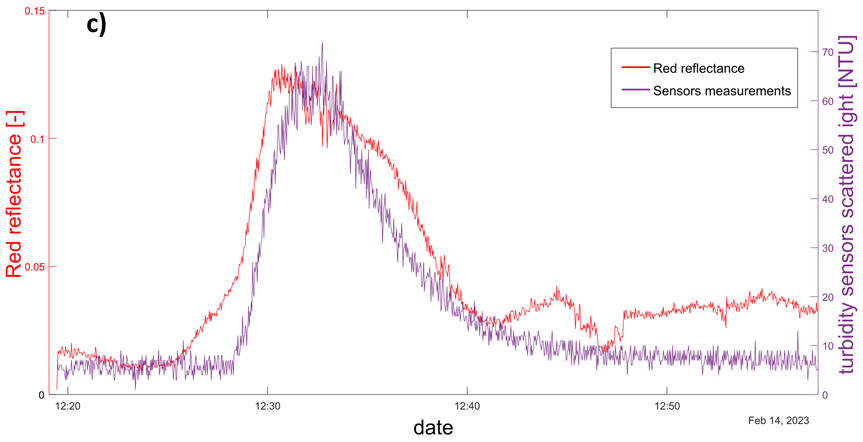
The final goal of this work is to optimize the image processing procedure for cheap camera like this to get a **widespread information in time and space** on the water status at catchment scale. That's why the **trail camera** has been used in all the experiments carried out so far

Camera type: trail camera
Photo/Video resolution: 20 MP/ 1080 P
Stand-by battery lifetime: months
Storage capacity: 32 GB
Waterproof
Low cost

Trail Camera Ceyomur CY50

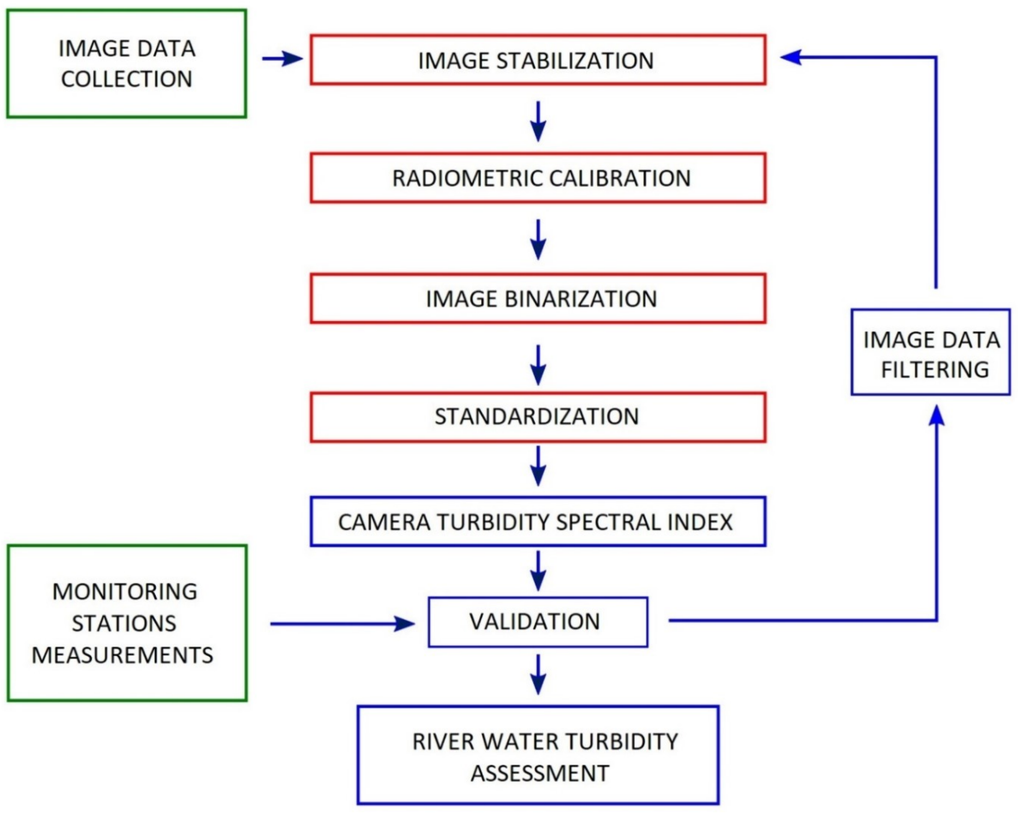
CAMERA TURBIDITY INDEX

The preliminary results prove that this image processing procedure can represent the water turbidity trend using RGB camera in actual case studies. As shown by the figure below, there is a good match between the camera red band reflectance and the turbidity sensors measurements. Forthcoming experiments will test the reliability of the method under different hydrological and environmental conditions. Moreover these activities will help in the definition of a robust turbidity spectral index derived from camera data.



c) Comparison between turibidimeter measurements (purple line) and camera red band reflectance (red line) after the image processing procedure; **d**) Scatter plot of the above variables.

IMAGE PROCESSING PROCEDURE



Workflow of camera data processing procedure for turbidity assessment

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