

Assessment of the Ph.D. thesis

Title of thesis: A model for remotely estimating water quality parameters in inland water bodies based on Landsat ETM+ data

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The Ph.D. thesis completed by Kwasi Asare Baffour Danquah refers generally to the field of monitoring and possibly predicting changes in surface water quality. An alternative monitoring strategy to in-situ approaches was applied here using satellite imagery data to derive water quality parameters. More specifically, the thesis aimed to develop the mathematical models relating the selected water quality parameters with the image data provided by LANDSAT 7 satellite equipped with Enhanced Thematic Mapper Plus radiometer. The models were developed and tested using the samples and image data from water bodies with relatively small area. This aspect of the research probably caused many technical obstacles compared to the greater water bodies. When driving his Ph.D. thesis to the above stated topic Kwasi Asare Baffour Danquah decided to face a complicated and complex problem with high environmental and social importance.

The theoretical background of thesis provides 1) detailed description of remote sensing fundamentals, including the problem of resolution and noise; 2) accurately elaborated chapter related to image processing methods with special attention to satellite images smoothing techniques and atmospheric correction; 3) well documented list of prior works in the field given and finally 4) brief description of standard in-situ strategy of water quality monitoring. The theoretical part of thesis is quite extensive, well arranged and supported by 252 references, which clearly demonstrate deep and long-termed study within available information sources.

The experimental data and results completed in thesis are divided in two groups, where the first one followed from standard water sampling and sample processing while the second one is represented by LANDSAT 7 data and the mathematical models derived. All the results are presented in well arranged tables and figures and are clearly understandable. Coherent and distinctive conclusions are then reported in the final part of theses.

Following the above stated facts I can confirm, that the Ph.D. thesis completed by Kwasi Asare Baffour Danquah presents an original and valuable contribution to the field of environmental monitoring, both in national and global level. The theoretical background, research methodology, experimental work, as well as final conclusions and recommendations formulated within the text are clearly defined and interconnected. The total extent of the thesis is quite satisfactory for the final document of the Ph.D. study program. All the text is written in excellent English.

A few comments and questions to discussion may be formulated as follows:

- A general comment may be related to the sampling technique applied for the in-situ measurement. It follows from Table 6 that two or three samples of water were typically taken within one pond (reservoir) and one day. The samples were taken close to the water surface (5 - 15 cm) and the results measured showed small deviations. In practice, however, we may often observe significant concentration (or temperature) profiles both across the water surface and to the depth. The data from satellite observation are, in water with higher clarity, representative for greater depth (in order of meters), as follows from the SDD results. Would

it be possible to improve the agreement between in-situ measurements and model performance by taking more samples within one water body?

- It seems that significant part of the satellite images was not suitable to the models formation because they were taken at cloudy weather. Is it possible to estimate how many days per year are really well suitable for high quality satellite images?

- Is there any institution in the Czech Republic (possibly abroad), which already applies satellite imagery data to systematic monitoring of water quality parameters?

- There are several notes in the thesis about the better capacity of the LANDSAT 8 system. What exactly will be improved here in relation to water quality monitoring?

Finally I would like to emphasize that the thesis submitted, according to my personal judgement, fully satisfied all the demands required for the final report of the Ph.D. study program.

Namely:

- the thesis presents an original and extensive work of high scientific quality and of indisputable practical importance
- the author proved his ability to independently formulate, manage, complete and publish the extensive scientific project (obviously the knowledge from many different fields had to be combined)
- the thesis has comprehensive character, which clearly drives a reader from introductory definition of the problem to the final conclusions

Based on the above stated it is a great pleasure to me to recommend the Ph.D. thesis of Kwasi Asare Baffour Danquah to the defence.

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