

## ***Interactive comment on “Modeling the Changes in Water Balance Components of Highly Irrigated Western Part of Bangladesh” by A. T. M. Sakiur Rahman et al.***

### **Anonymous Referee #2**

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This paper investigates changes in water balance components between 1981-82 to 2012-13 in an area of Bangladesh that is intensively irrigated. First, historical trends are examined using the Mann-Kendal test and discrete wavelet transformation. Then, ARIMA models are developed in order to forecast changes in water balance components. The paper produces some interesting results; particularly around the use of ARIMA models that are fitted to wavelet denoised time series data.

The paper is well organised and about the right length for a study of this kind. Generally speaking the equations are well laid out and easy to follow. However, as it stands the level of English used in the paper is poor, which makes some sections very difficult

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to follow. I would strongly advise the authors to consult a proofreader who has full professional proficiency in written English. Nevertheless in my judgement the scientific content is sound and represents an interesting approach to analysing and forecasting changes in the water balance. Thus, I would reconsider this paper for publication following a major revision to improve the quality of English as well as addressing the specific points mentioned below.

1. The Introduction lacks focus, does not provide much critical analysis and does not place the work in the broader context of water resources management. I would like to see the aim of the paper clearly stated in the first paragraph of the paper, so that readers know what the paper is setting out to achieve. The paper is methodological in nature, so the Introduction must make clear to the reader the state-of-the-art in time series analysis for water resources management. Line 82 onwards does include some critical analysis but, in my opinion, it is insufficient to persuade the reader of the approach and its relevance to hydrology more generally. Focus less on the results of studies and instead examine and compare the different ways that previous researchers have tackled the problem.

2. The first half of Section 2.3.1 is probably superfluous: it is well known that Penman-Monteith is the most appropriate method to use to calculate PET, data permitting.

3. Line 137: I'm not exactly sure what 'Deficit' and 'Surplus' mean in this context (nor is it clear why they are capitalised) – provide additional explanation.

4. Line 137-139: It is presented as a fact that 'the concept of water balance in unsaturated zone...give the best estimation for the real world' - this is quite a statement and surely unjustified. I note that Bakundukize et al 2011 were investigating hydrology in Burundi – are there similarities to Bangladesh? Provide some additional arguments for using the Thornthwaite and Mather model.

5. Line 143: Wolock and McCabe (1999) examined hydrology in the United States – is it reasonable to assume a 5% runoff in Bangladesh, given its tropical climate?

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6. Line 145-151: Express the water balance model as equations. The calculation of the water balance is fundamental to the subsequent analysis, so it should be clear what you have done.
7. In my view Section 2 would benefit from a short overview describing the reason for carrying out the various steps (water balance, Mann-Kendal, wavelet analysis, ARIMA) and how they relate to one another. At the moment this is not clear.
8. Line 154: Which hydrological variables were investigated?
9. Line 159: What are these 'Z' values, and what is their importance? This is the first time they have been mentioned.
10. Section 2.3.7 is unnecessary here unless it specifically influences the scientific results. Instead put this information in an Appendix or similar (however, I congratulate the authors for putting their computer code alongside the paper – this is not done often enough).
11. I think Section 3 should simply describe the results, with an additional 'Discussion' section for placing the results in the context of other studies (e.g. Line 281, 288, 321 etc. should be put in a Discussion section). The discussion should include additional analysis discussing the various limitations and weaknesses of the present study as well as suggesting improvements.
12. Line 265: Use 'Potential evapotranspiration' rather than 'Pet' in section headings.
13. Line 359: This is just a piece of computer code – what does it do, and what insight does it provide that you cannot gain from manual interpretation of ACF, PACF, AIC, BIC?
14. Line 362: What is a Q-Q plot?
15. Line 386-416: To my mind this passage is the strongest part of the paper – the discussion should emphasise this result and its relevance to water resources manage-

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ment more generally.

16. As I mentioned earlier, I would strongly suggest creating an additional Discussion section in which to discuss the results in the context of other studies, highlight limitations and propose future research directions.

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