

To the editorial board of HESS

Re: HESS-2017-740 “**Real time rainfall estimation using microwave signals of cellular communication networks: a case study of Faisalabad, Pakistan**”

Dear Reviewer

To begin with, I would like to thank you for your consideration of our paper. The comments you have given, made me to reconsider the paper on basic aspects.

Best regards,
Muhammad Sohail Afzal

Comments of the reviewer/Reply

Anonymous Referee #2

Received and published: 4 April 2018

Comment 1:

METHOD: - the data processing needs to be detailed. The authors used an existing and open source code provided by Overeem/ Leijnse/ Uijlenhoet, however the proposed algorithm needs to be tuned and some parameters set (for instance the exponent and pre factor of the attenuation/rainfall relationship in eq1). The authors have to explain how they did this, what choices were made and which uncertainties were analyzed. Given that the evaluation is done on a daily time step basis, while the data is gathered at 15 minutes, are the parameters set up at 15 ‘ or daily time step ? -They also need to provide more details on the way they calculate the baseline or reference attenuation. And what they call ‘corrected’ attenuations ‘free of errors’ (p6 l 150). - Also they mention the use in the processing of several neighboring links, with a range of operating frequencies; they should explain how their processing is adapted to this variation in CML characteristics within the network.

- The data processing needs to be detailed. The authors used an existing and open source code provided by Overeem/ Leijnse/ Uijlenhoet, however the proposed algorithm needs to be tuned and some parameters set (for instance the exponent and pre factor of the attenuation/rainfall relationship in eq1). The authors have to explain how they did this, what choices were made and which uncertainties were analyzed.

Reply/ See response of RC1, Comment-2 for detailed information about input parameters that have been used in this study. Further calibration of alpha and Aa (wet antenna attenuation) values have also been incorporated in the final revised manuscript [Overeem (2013, 2016)].

- Given that the evaluation is done on a daily time step basis, while the data is gathered at 15 minutes, are the parameters set up at 15 ' or daily time step ?

Reply/ Yes all the parameters are set at 15 min time step to estimate rainfall at 15 min temporal resolution, which is converted into commutative rainfall representing one value at daily time step. Furthermore paper presents analysis on daily time step basis rainfall as the observed rainfall for the observed rain gauges in Faisalabad (UAF-RG, WASA-RG and AR-RG) is available on a daily time step.

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Reply/ See the response to RC1, comment-2 for detail information and more detail with different results has been in cooperated in the final revised manuscript.

Comment 2:

TIME RESOLUTION -In the introduction and through the text the concept of high space-time resolution is put forward. However the evaluation is provided at the daily time step – mention of high time resolution should be suppressed. -'Real time 'should be suppressed from the title as the work is based on archived data. The RT prospect can of course be mentioned in the perspectives.

Reply/ The short comment (SC1) from the reviewer also mentioned the same reservation which is valid. Accordingly we have changed the title and mentioned in the text the prospective of the real time rainfall estimation.

Comment 3:

SPATIAL ANALYSIS Using the CML density to analyze the spatial structure of the rain field is an original idea. I encourage the authors to clarify and further develop the analysis presented in Fig 6.

Reply/ Spatial variation analysis of rainfall with respect to reference rain gauges has been performed to confirm stochasticity of rainfall using signal data of CML. The further in depth analysis at higher than 15 min temporal resolution would definitely make the rainfall structure and will be helpful for analyzing cause-effects relationship. As the signal data available with the telecommunication company is 15 minutes temporal resolution, therefore the presented analysis gives very good picture about the erratic pattern of the rainfall and leads towards further analysis related with "Rainfall estimation and predication using signal based rainfall in Punjab, Pakistan" and "Redefining rainfall distribution using signal based rainfall and modeling approach in Pakistan", which are forthcoming papers. Also long term trends of stochasticity nature of the rainfall would guide us to determine the band strip of maximum and minimum

rainfall, average rainfall at a site specific location, which will be value added information for irrigation and fertigation scheduling.

Comment 4:

Once the content of the work has been improved special care should be taken in the writing. But let's work one step at a time.

***Reply/** Yes, we have incorporated your comments to further improve quality of paper and presentation of the paper with improved writing.*