

## ***Interactive comment on “Cost-effective rain gauge deployment and rainfall heterogeneity effect on hydrograph simulation in mountainous watersheds” by Jr-Chuan Huang et al.***

Jr-Chuan Huang et al.

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### **Comment:**

This paper investigates the minimal number of rain gauges necessary to still describe the spatial rainfall pattern sufficiently accurately for discharge modelling. Next to the fact that the paper needs a lot of grammatical corrections, I have some major concerns with respect to this paper: - The whole analysis is only based on two extreme events (typhoons) and may therefore not be representative for common rainfall events

### **Reply:**

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As reviewer suggested, now we took 8 typhoon cases with a wide spectrum of typhoon rainfall (from 168 to 980mm).

**Comment:**

-The analysis uses Thiessen polygons to interpolate rainfall in a mountainous area, which is not optimal! Normally, one would expect an interpolation technique that accounts for elevation.

**Reply:**

As replied above, now we used three interpolation techniques including ordinary kriging, inversed weighted distance and Thiessen polygons. The results showed that the differences among interpolations were insufficient in terms of total rainfall and rainfall field estimates. This argument is also supported by the Goovaerts's work (P. 11, Line 13).

**Comment:**

In order to make the paper publishable, the analysis should at least be expanded to cover more rainfall events and second, an analysis of rainfall intensity with topography should be made in order to verify the validity of the Thiessen interpolation. I would urge that a more extensive analysis would be provided (which not only focuses on extreme rainfall, but which also includes more regular rainfall fields).

**Reply:** As mentioned above.

**Other comments include:**

- bias is not defined by an RMSE but is given by the average error. However, at a number of places, the term bias is probably correctly used.

**Reply:**

Reviewer is right. We used the term "bias" carefully in this revised version.

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**Comment:**

- the radar used should be discussed in section 2

**Reply:**

As reviewer suggested, we added section 2-1 to describe Taiwan radar network.

**Comment:**

- units of discharge (see page 2173, line 10) is not cm!

**Reply:** Corrected

**Comment:**

- it is not clear how spatial rainfall is implemented in the TOPMODEL: please better comment

**Reply:**

We added the sentence "three interpolation... applied to estimate the rainfall fields and project to this fixed extent and pixel. And then those sampled rainfall fields are inputted to the TOPMODEL. Note that each terrain cell within the rainfall pixel receives the same rainfall." to describe how to implement the spatial rainfall into TOPMODEL (P.8, Line 18 to 21).

**Comment:**

-in your experimental design you describe different classes of rain gauge numbers. This is expressed in number of points per total number of pixels: what pixels? Model pixels or radar pixels?

**Reply:**

We now use cell for terrain (model input) and pixel for radar rainfall in this revised version to clarify it.

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**Comment:**

- better describe that you are running a twin experiment in order to answer to the objective of your investigation, and that it doesn't use the observed discharge

**Reply:**

We appreciated this necessary reminder. We re-organized and re-wrote Section 2-4 and section 2-5. In section 2-4 (P. 7, Line 21 to P.8, Line 5), we explain why we preferred using the reference hydrograph than the observed discharge. In section 2-5, we explain why this experiment can evaluate the effect of imperfect rainfall input on hydrographs.

**Comment:**

- since the whole analysis is only performed on two major storms (typhoons) in a mountainous area, the extrapolation to Mediterranean areas is probably exaggerated (see page 2182, lines 20-21)

**Reply:**

The extrapolation to Mediterranean areas was unsuitable. We removed this statement.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 2169, 2008.

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