

Interactive comment on “Remapping precipitation in mountainous area based on vegetation pattern” by Xing Zhou et al.

Anonymous Referee #2

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This is a very interesting and clearly written paper on precipitation distribution in a mountainous river basin. Mountains, in particular high mountains in Asia, are the source of freshwater for many people, but the observation of precipitation is far from enough. For example, the first item of Scientific Questions of GEWEX under WCRP is the observation of precipitation. As such, the topic of this paper is within the scope of HESS, and is a hot topic in hydrology. As already described above, the paper is very clearly written, thus easy to follow. Therefore, I basically want to recommend this paper toward publication in HESS. Nevertheless, I would also mention that there are concerns, comments, or suggestions as written below.

1. In the title, abstract and also in any other part of this paper, the authors should clearly mention that the target of this research is annual mean or climatological mean precipitation amount. The authors compared their product with IDW (of gauge-based

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precipitation) and a TRMM-based product. I can accept this product is better for annual mean and climatological mean. However, IDW and TRMM can provide us short time-scale data, such as daily data. This is a major difference between these products against the product which the authors try to show in this paper.

2. It is also recommended to clearly describe that this study is a case study for a specific area, in the title, abstract, and also in other places of this paper. Why I recommend so is described in the following. As shown in Figure 2 and Figure 6, in this target area, precipitation amount is larger for areas of lower elevation. In areas of lower elevation, it is usually expected that air temperature is warmer. It means, in the areas of lower elevation in this study, both precipitation and temperature are better, favorable, for NDVI. I suspect, this the reason why the authors can get a clear positive relationship between precipitation and NDVI. But, this is specific to this particular area. Of course, there could be other similar areas in the world. However, there must also be areas with different characteristics between NDVI and precipitation. Thus, the authors are requested to explicitly describe in the title and the abstract and also in relevant places of the main text that this study is a case study with such characteristics shown in Figures 2 and 6.

3. This comment is a comment following the above comment. Very in general, precipitation is larger if elevation is higher. This is in contrast with what is seen in Figures 2 and 6. But, I need to add to “precipitation is larger if elevation is higher”. Such a general tendency is probably true to 2000m or 3000m in elevation. In this regard, “we note that for simplicity, the extra determinants are assumed to have linear relationship with precipitation” is somewhat suspicious because this area has elevation up to 7000m. Is it possible to make a figure in which horizontal axis is elevation and vertical axis is precipitation (and NDVI) using observed precipitation data and NDVI data. There might be a positive relationship between elevation and precipitation up to 2000 or 3000m in elevation, and a negative or flat relationship between elevation and precipitation after it. Also, because NDVI favors large precipitation and warmer temperature (= lower elevation), the response of NDVI is different up to 2000 or 3000m and after it. NDVI-

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precipitation relation may depend on elevation bands such as lower than 3000m and higher than 3000m (of course, I do not know it would be 3000m or not which changes the relationship), but such an analysis was not done in this study as far as I can see. I think the authors can easily analyze.

4. Although target temporal and spatial scales are different, a recent study submitted to HESSD (Beck et al., 2016) provides a globally distributed precipitation data (called MSWEP) in which mountainous precipitation is corrected for gauge under-catch and also orographic effect was introduced by inferring catchment-average P from stream-flow (Q) observations at 13762 stations across the globe. I found mountainous precipitation is somehow well represented in the product by Beck after downloading the data from <http://www.gloh2o.org> and by making figures of the data by myself. Thus, it is recommended to have discussion in terms of Beck et al. (2016).

Specific minor comments are as follows.

- A map of sub-basins is better to be provided (for Figure 10).

- I do not think Figure 7 is good to show. I can understand if the authors show the difference between Figure 8 and Figure 6. At least, I would say Figure 7 is awkward.

- I also suspect that all the areas in Figures 6, 7, 8 are appropriate to show. I mean, there is almost no observation station in the left lower quarter of Figure 2. Then, I suspect whether the values of precipitation amount shown in Figure 6, 7, 8 for the left lower quarter of those figures are enough valid, particularly for the main product of this study and the IDW-based output.

Very finally, this is probably out of scope of this paper, but I am interested in whether major precipitation season is the same over this particular region. I mean, summer precipitation and winter precipitation (particularly solid precipitation like snow) may have different responses.

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