Review of the HESS Paper # hess-2010-276 titled: Evaluation of Satellite Rainfall Estimates Over Ethiopian River Basins, by T.G. Romilly and M. Gebremichael

Though the paper definitely has scientific interests, I first hesitated to categorize it. Considering the paper lacks detailed results interpretations, I recommend accepting it with minor revision. Below are main points which motivated my recommendation. In this manuscript, three satellite based rainfall estimates (SREs) are evaluated against in-situ observations over six specific regions of Ethiopia. Such procedure is of high interest especially for quantifying and understanding the uncertainties in the satellite products over complex topography regions. The authors evaluated the spatial and seasonal pattern of these products, and confirmed as a main finding a relation between elevation and bias (commonly known but not always demonstrated as is in this study).

The results part is very descriptive and no clear explanation is performed on why those results are occurring. As an example, the authors could include brief overviews of the retrieval methods/algorithms of the satellite products in their description section, and later use it to explain some discrepancies/similarities in the results.

> [Author's Response] We have added the following paragraphs within Section 3.3.
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> "The physical mechanisms or processes that could potentially cause a relationship between elevation and precipitation could be explained by the fact that the precipitation in the highlands of Ethiopia (Northwest) is strongly influenced by the ITCZ, whereas the precipitation in the lowlands of Ethiopia (Southeast) is influenced more by the southerly winds than the ITCZ.
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> In the highlands of Ethiopia (Northwest), one hypothesis for the overestimation exhibited by CMORPH and TMPA 3B42RT could be associated with the deep convection of the ITCZ in the lower elevations leading to an increase in ice aloft, which is perceived by the MW sensors to be precipitation. Segele et al (2008) showed that the ITCZ, which is the major rain producing mechanism during the Kiremt, is centered to the North of Ethiopia and extends into the Blue Nile River basin. The overestimation of precipitation by CMORPH within deep convective systems has been shown by Nesbitt et al. (2008). The observance that PERSIANN is closer to the rain gauge data at these lower elevations could possibly be that the ice that is aloft is sufficient to bring the cloud top temperature within a range for the IR sensor to associate it with a precipitation intensity closer to the rain gauge data. The decrease in the bias ratio when moving from the lower elevations to the higher elevations for CMORPH and TMPA 3B42RT could be attributed to shallow convective systems. Nesbitt et al. (2008) showed that there is an underestimation of precipitation by MW products, such as CMORPH and TMPA 3B42RT, within shallow convective system because there is not enough ice aloft for the MW sensors to detect. In the case of PERSIANN, the underestimation could be due to poor detection of light rain events, consistent with the findings of Hong et al. (2007).
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> In the lowlands of Ethiopia (Southeast) the underestimation over regions such as the Rift Valley, Genale Dawa and Wabi Shebele River basins could be attributed

to the southerly winds (Segele et al. 2008) not producing sufficient ice aloft (MW sensors) or having warmer cloud top temperatures (IR sensors)."

Also, the authors could explore the average rainfall diurnal-cycle to better understand and comment on the rainfall mechanism in those regions (satellite data are already at 3-hourly resolution and it would be a significant plus to the study if they could get in-situ observations at the suitable time resolution).

[Author's Response] Our data set is available at a monthly scale preventing us from looking a diurnal cycle.

Specific comments:

In-situ observations uncertainty should be discussed.

[Author's Response] The rain gauges are owned by the Ethiopian Meteorological Agency and have different classification levels. We have selected the high quality data sets for inclusion in our study. We are using 100 rain gauge station distributed across Ethiopia, so if there is a problem with 1 station it should not affect the outcome of the entire study. We are also using a 5 year average so it should decrease any random errors with point-pixel discrepancies. Please see Section 2.3.

Table 1: the results of this study could be integrated in this table and discussed relatively to the other studies in the conclusion part.

[Author's Response] We have integrated relevant studies into Section 3.3 when discussing the mechanisms that could potentially influence the rainfall bias.

Mount west should be replaced by western mountain everywhere in the text.

[Author's Response] These corrections have been made in response to comments from Reviewer No. 1.