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Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Evaluation of TRMM 3B42 (TMPA) precipitation estimates and WRF retrospective precipitation simulation over the Pacific-Andean basin into Ecuador and Peru" *by* A. Ochoa et al.

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The main concerns of the referee are on the 'structure' of the paper and that the 'aim and objectives are not clearly stated upfront'.

Certainly, the goal and motivation of our work arise from the increasing amount of studies that report the use of satellite products and NWP precipitation outputs for water resources applications. This is also the case for the target region, mainly due to the limited density of rain gauge networks (i.e. Arias-Hidalgo et al., 2013). In such

scope, our work performs an evaluation to assess how well satellite and model based products capture spatial and temporal features of precipitation among different basins. This is mandatory before any intake of precipitation products for hydrological studies given the variety of precipitation regimes and mechanisms. We clarify that performing such a tailored evaluation is the intended contribution of our work. We will make clear emphasis of this statement and improve the structure of the revised manuscript.

The referee also claims that 'a justification of the methodological steps is often lacking'. We reply in greater detail to the questions on methodology posted in the 'Specific Comments' and embedded in the 'Technical Corrections' in this response. We will address them as appropriate in the final revision of our manuscript.

Why is not CMORPH part of the rainfall product evaluation? The starting point of our methodology rests on the identification of what for the target region are promising satellite products and NWP precipitation outputs from which we can detect strengths and deficiencies in rainfall estimation. Among the satellite products the TRMM 3B42 was identified at the forefront. The work by Dinku et al. (2010) over a similar region (the Pacific-Andean basin and the Northern coast of Colombia) offered, to the best of our knowledge, a key reference due to the similarities on climatological features. While comparing several precipitation products Dinku and co-authors reported contrasting results for the referred Colombian regions. For the northern dry littoral these authors found 'estimation skills particularly bad for CMORPH' and better for TRMM 3B42V6 at 10-daily accumulations. The converse was found over the wet western Pacific coast where CMORPH was slightly better especially at daily scale. Obviously, the generality of these results cannot be extrapolated to our study region; however, it provided the starting hint on the choice of the satellite product to evaluate. A second reason why CMORPH was no considered has to do with the length of the dataset. The production of the CMORPH product starts 2nd December of 2002. This has implications that go beyond the setting of a common period for comparison. Omitting the year 1998, one of the wettest years in the record due to El Niño anomalies would have resulted in a sampling error with implications in the comparison between precipitation products. We are aware that CMORPH also has a high potential of applicability and it is extensively tested and used, combined with gauge observations, in different regions of South-America (see De Vera and Terra, 2012; Pereira et al., 2010; among others). We acknowledge this fact and we will mention it as an avenue for future research in the 'Conclusions' section.

p. 417 L10-12: Were values outside the time period of interest also excluded from the dataset? Yes, first the quality control was performed for the long-term records. Then the period of interest was restricted to the common range between the TRMM products and the WRF retrospective simulation. We will make this clear in the corresponding section.

p. 418 L18: TRMM 3B42RT is mentioned but not considered in the comparison. Why? The focus of our work is not on real time applications. Rather it is a retrospective assessment of precipitation products. The TRMM 3B42 estimates supersede the 3B42RT estimates as each month of 3B42 is computed. The 3B42 processing is designed to maximize data quality, so 3B42 is strongly recommended for any research work not focused on real-time applications (Huffman and Bolvin, 2012). We will remove the reference to the 3B42RT in the introductory sentence because indeed it was misleading. Further, we will better argue the choice of the 3B42 and upgrade the section with relevant literature on validating 3B42 V6 and/or comparing V6 and V7.

p. 419 L8: Could you not produce a longer WRF simulation (e.g. 1998-2013) to provide say 15-years long time series for this comparison? The North Western Retrospective Simulation (OA-NOSA30) was produced by The Scientific Modelling Centre from Venezuela (CMC) and the National Institute of Meteorology and Hydrology from Ecuador (INAMHI) for the period January 1996 to December 2008 in the scope of the Observatorio Andino project implementation (Muñoz et al., 2010). Since then, the production of a longer simulation has not been carried out. In our study, we restrict to evaluate this product as available.

p. 420 L14: How many GTS stations were excluded from the analysis? And where they are situated (in case that had any effect on the TRMM 3B42 products? Three GTS stations were identified in our dataset and excluded. The location of all GTS stations (five) in the PAEP region are presented in the Figure 1b (dotes). Whether they were used in the monthly gridded rain gauge analysis to correct the final TRMM product is hardly to asses given the difficulties to identify the dates when they were incorporated in the GTS. Therefore, we exclude all of them to assure the independence of the validation dataset.

p. 424 L28: By what criteria does KED outperform other interpolation techniques? Table 2 shows that KED performed better in all statistics (Correlation, MSE and Performance). This will be clearly stated in the corresponding section.

p. 430 L7: Have these studies also compared TRMM 3B42 rainfall products, or WRF model outputs as well? Cheng and Steenburgh (2005) and Ruiz et al. (2010) performed evaluations of WRF over North and South American region respectively. Habib et al. (2009) and Scheel et al. (2011) conducted TRMM evaluations over North American regions and the Central Andes in South America. The full paragraph will be improved for consistency and precision in the use of these references.

p. 434 L13: What is the authors' definition for 'aceptable skills'? We acknowledge that the term 'acceptable skills' in the context may become ambiguous. We will replace it by 'best skills' in the revised manuscript.

Figure 2: What are the units for the 'uncertainty'? Total and KED uncertainty are normalized to their maximum values. Both are expressed in percentage. Further, KED uncertainty is scaled as to represent the proportional contribution to the Total uncertainty.

Finally the referee asks for a shortening of the manuscript and thorough revising for clarity and concision. We will rewrite and condense sections wherever possible and edit the manuscript entirely to highlight the main messages.

We thank the reviewer for the overall assessment and suggested technical corrections. They will be taken into full consideration in the revised manuscript.

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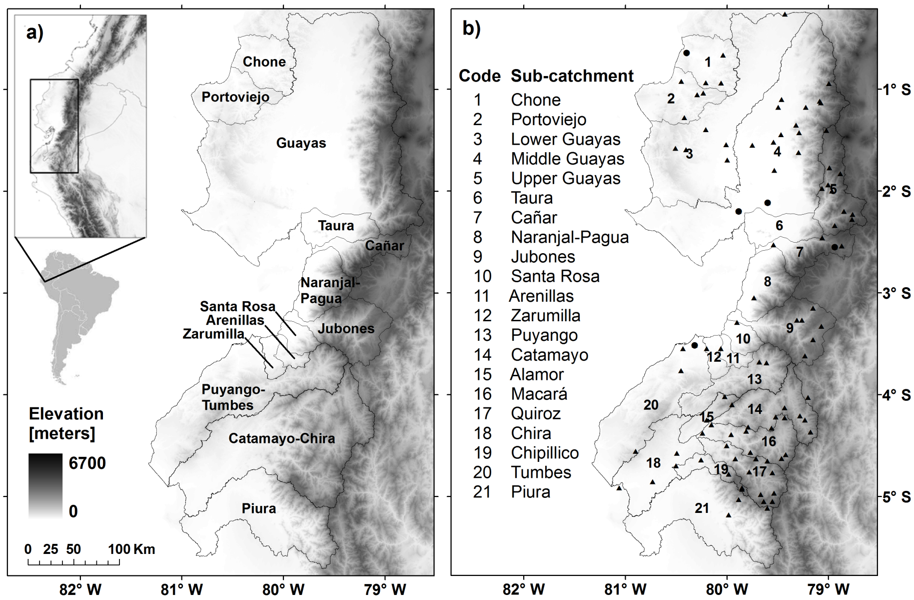

Fig. 1. (a) Study area. Topography and catchments (grey line) in the PAEP region. (b) Sub-catchments (grey line) and rain gauge stations (triangles) used for the evaluation. Dotes indicate GTS stations.