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Interactive comment on "Streamflow forecasts from WRF precipitation for flood early warning in mountain tropical areas" *by* María Carolina Rogelis and Micha Werner

María Carolina Rogelis and Micha Werner

c.rogeliz@gmail.com

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Response to Referee No 2

We would like to thank the anonymous referee for the thorough and constructive

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Discussion paper

review of the manuscript. We have carefully considered the comments, and through this document we would like to provide a detailed response to each, as well as how we have adapted the manuscript where applicable. We have also attached a track changes version of the manuscript.

SPECIFIC COMMENTS

1. **The simulation uses 3 domains- please make it clear, perhaps on Figure 1, the boundaries of the three domains.**
   RESPONSE:
   We thank the reviewer for this suggestion. The domains were included in Figure 1.

2. **Also indicate the relationship between the domains, i.e. is there two-way nesting to allow communication between domains or does the communication only go one way.**
   RESPONSE:
   We thank the reviewer for pointing out the need for clarification on the relationship between domains. In the description of the WRF model (section 2.2 WRF model data and observed rainfall fields), the information was added as follows:

   The WRF model comprises three nested domains, centred in BogotaÌĄ. The coarsest domain covers most of the Colombian National territory with a spatial resolution of 15 km; the intermediate domain covers mainly the central and eastern Andean cordilleras with a spatial resolution of 5 km; and the finest domain covering BogotaÌĄ and the study area only has a spatial resolution of 1.67 km (Arango and Ruiz, 2011). The nested model domains have been set up using two-way communication (without smoothing).

3. **If communication is in fact two directions, please add discussion why results are different between the three domains**
RESPONSE:
In subsection 4.1 (Evaluating precipitation forecasts from the WRF model), the following paragraph was extended:

No significant differences among three domains of the WRF model were found in the behaviour of the scores for the tests carried out in this study. The two-way communication between the nested domains implies that precipitation volumes are aligned between the different resolutions, with the small differences found likely being due to differing ratios between the WRF model grid cell sizes and the sizes of the watersheds

4. **Model settings: The authors refer to another manuscript in regards to their model setup. It would be helpful if they listed a few of the major settings of the model in this manuscript, primarily choice of cumulus parameterization setting as well as microphysics setting.**
RESPONSE:
We agree that adding the major settings improves clarity. The major settings of the model were included in section 2.2 (WRF model data and observed rainfall fields), as follows:

The parameterisation of the model corresponds to that used by IDEAM for its routine forecasts (Arango and Ruiz, 2011), using the Kain-Fritsh cumulus parameterisation scheme, except for the finest domain where convection is not parameterised but resolved. Microphysics is parameterised as the WRF Single-Moment 3-class scheme (WSM3).

5. **The finest domain is 1.67 km, which is well within the grid-spacing necessary to adequately resolve convective precipitation. Please add discussion in this regard, as well as whenever it is mentioned that the model poorly**

resolved convective precipitation in the discussion
RESPONSE:
In section 4.1 we discussed the issue of resolution and we added an explanation of the scope of the paper:

...Other applications of NWP (e.g. Roberts et al. (2009)) show that finer resolutions are capable of producing more accurate predictions, and that physics configuration, resolution and initial conditions highly influence the WRF model performance (Kryza et al., 2013). The similarity of results regardless of resolution found in this study may be also related to deficiencies in the parameterisation of the model, or to the inability to sufficiently resolve the topography. A more detailed review of the WRF model would be required to reveal possible deficiencies, and to suggest improvements....
The WRF model has been shown to be highly sensitive to the parameterisation of cumulus and microphysical processes (Remesan et al., 2014; Rama Rao et al., 2012). Parameter sensitivity is generally dependent on local conditions (Di et al., 2014), and the best configuration varies with time and rainfall threshold (Jankov et al., 2005). While it was our objective to test the configuration of the WRF model as it is used operationally by IDEAM and optimitising the parameteriszation of the WRF model is outside the scope of the present paper, further work could test various model parameterisations, assessing their sensitivity and searching for an optimal or a set of optimal configurations that help to improve parameterisation (in the case of the coarser model domains) and in particular resolving (in the case of the finest model domain) of convective precipitation as frequently occurs in the case study area.

6. **References: there are numerous little errors within the reference list that could use correcting.**
RESPONSE:
The references were reviewed and corrected.

7. **P1,L6: WRF acronym used in abstract without its definition**
RESPONSE:
We added the meaning of the acronym to the abstract.

8. **P3, L9: Paramo, is this supposed to be capitalized or not. Not consistent throughout introduction**
RESPONSE:
The capital P was replaced by p.

9. **P4, L11: Please indicate the date range where the 107 selected days come from.**
RESPONSE:
The period was included as follows:
The dataset of WRF forecast used in this paper corresponds to 107 selected days when significant storms were recorded, during the period July 2009-December 2002

10. **MSE/MAE/ME equations come well after the first acronym is used, P5 L9**
RESPONSE:
We thank the reviewer for this comment; indeed the acronyms are used in a section before the equations are presented. However, when the acronyms are first used, it is made in the context of the introduction of the methodology (summary of the methodological approach) and the corresponding meaning of the acronym is used. After that, the acronyms are used to introduce the equations. We believe that this use of the acronyms is clear and there is no need to modify the text.

11. **P11 L33: this one sentence paragraph can be added into the previous paragraph**
RESPONSE:
The sentence was moved to the previous paragraph

12. **P12 L27: a comma (,) is surrounded by white space**
    RESPONSE:
    The white space was deleted

13. **P13 L1: 'Lead limes' should become 'lead times'**
    RESPONSE:
    The word was corrected

14. **Figure 1: include domain structure into this figure somehow.**
    RESPONSE:
    The domains were included in Figure 1

15. **Figure 2: "Precipitawon" shows up in the left side, strange formatting with this word too**
    RESPONSE:
    The error and formatting was corrected.

16. **Figure 3: Please describe what 'Q-Q' means within the manuscript and this figure caption**
    RESPONSE:
    In the manuscript the following sentence was added:
    Figure 3 shows the quantile-quantile plots (Q-Q plots) comparing the WRF precipitation and the bias corrected WRF precipitation with the observed precipitation obtained from IDW.
    The caption of the figure was changed to:
    Q-Q plots (quantile-quantile plot, plot of the quantiles of the first data set against the quantiles of the second data set) for the Mugroso watershed comparing observed precipitation with WRF and WRF bias corrected precipitation

17. **Figures 6-7: While all use the same legend style, the readers should not have to flip from one figure to the next to determine what each line means.**

Please include the legend on each figure.
RESPONSE:
The legend was added to figures 6-7.