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November 29th, 2025

Dr. Thomas Kjeldsen
Handling Editor
Hydrology and Earth System Sciences (HESS)

Dear Editor,

We would like to thank you for the efficient processing of our manuscript and for the positive, helpful and concise feedback on our second submission.

In this resubmission, we implemented several minor edits based on your valuable suggestions. We did not add new analyses or discussions, for the reasons outlined in our response letter..

We hope that we have successfully addressed all your comments.
Thank you for helping us to improve the manuscript.

Sincerely yours,

Mauricio Zambrano-Bigiarini
(on behalf of all authors)

Revision of manuscript **egusphere-2025-621**

"Developing Intensity-Duration-Frequency (IDF) curves using sub-daily gridded and in situ datasets: characterising precipitation extremes in a drying climate"

Responses to Reviewers

Cristóbal Soto-Escobar, Mauricio Zambrano-Bigiarini,
Violeta Tolorza, and René Garreaud

November 29, 2025

We would first like to express our sincere gratitude to the handling editor, Prof. Thomas Kjeldsen, and to the two anonymous reviewers for their valuable comments and suggestions, which have helped us to substantially improve the quality and clarity of our manuscript.

We hereby submit our detailed responses to the comments made by two reviewers, regarding our article entitled "*Developing Intensity–Duration–Frequency (IDF) curves using sub-daily gridded and in situ datasets: characterising precipitation extremes in a drying climate*".

The revisions introduced in the current version of the manuscript are as follows:

1. **Elimination of outdated notations**: following a comment made by Reviewer 01, we have now carried out an additional thorough read through of the full text and corrected all residual instances of outdated notation for precipitation.

2. **Revision of colour tables on figures**: Based on the notification received from Polina Shvedko, we review the colours of the figures using the Coblis - Color Blindness Simulator and the suggestions performed by a colour-blind colleague.

3. Additional clarification regarding the application (or absence) of bias correction in the IMERG and ERA5 products is provided to complement the reviewers' previous comments.

In the following sections, we provide a point-by-point response to the two comments raised by the reviewers. We hope that our detailed explanations will satisfactorily address all concerns.

Comments from reviewers

C0: Please consider the following two comments from the reviewers, who are overall happy with the authors' revisions and recommend acceptance upon addressing these final minor issues.

We are pleased to know that the reviewers had an overall positive opinion of our revised version of the manuscript, and we thank all the thorough comments made by the reviewers in this new review round. In the following paragraphs we provide detailed replies to each one of them.

C1: The authors have dealt with my earlier comments and concerns to a satisfying degree. The only recommendation I still have is another thorough read-through of the text: here and there some of the old abbreviations (P) that the authors have replaced are still there. But that's purely textual, the manuscript as a whole reads much better and the inclusion of the newly added figure 7 (scatterplot) shows the robustness of the used methodology.

We thank the reviewer for the positive evaluation of our revisions and for recognising the enhanced clarity of the manuscript and the usefulness of the newly added figure. We also appreciate the comment regarding the remaining abbreviations. Following this suggestion, we conducted an additional thorough review of the full manuscript and have corrected all remaining instances of outdated notation.

C2: 13) I understand the Authors reply that "both IMERG products tended to overestimate Imax at short durations, with median bias correction factors between 0.65 and 0.82 for 1–6 h, but this overestimation decreased for longer durations, reaching values between 0.92 and 0.98 for 24–72 h."; please see similar results that are drawn from Longo-Minnolo et al. (2022; `https://doi.org/10.1016/j.atmosres.2022.106131`) regarding the ERA5-Land in winter and autumn (20% and 40% underestimation, respectively), and from Koutsoyiannis et al. Koutsoyiannis et al. (2023; `https://doi.org/10.3390/w15091711`) regarding the IMERG rain depths in higher and lower altitudes (underestimation and overestimation, respectively), and discuss how the satellite data for Chile over/underestimate the rain depths based on the season and altitude.

We thank the reviewer for providing these references, which demonstrate a strong familiarity with the relevant literature. However, although the cited studies are valuable, they are not directly comparable to the analysis presented in our work. Longo-Minnolo et al. (2022), for example, evaluated ERA5 precipitation at monthly and seasonal scales in the Simeto River basin. Their reported seasonal underestimations in winter and autumn refer to aggregated precipitation totals rather than to sub-daily annual maximum intensities. Conducting an assessment comparable to theirs in our context would require a monthly evaluation of gridded precipitation datasets, which lies outside the main objective of our study, focused on annual maximum intensities at sub-daily scales.

Second, Koutsoyiannis et al. (2023) do not provide explicit quantitative estimates of bias for IMERG. Instead, they refer to Kazamias et al. (2022; `https://doi.org/10.1016/j.atmosres.2021.106014`), who report a relative bias of approximately 5.1% for IMERGv06 at the monthly scale. As with the previous example, these analyses concern monthly accumulations, whereas our study examines extreme rainfall intensities and the behaviour of annual maxima at short durations.

Regarding the potential influence of altitude, we evaluated whether bias in the $I_{\max}$ estimates derived from satellite–gauge comparisons was related to elevation, following the approach of Ombadi et al. (2018). We did not detect a meaningful relationship between the two variables ($R^2 < 0.3$; see Supplementary Material S3 in Soto Escobar et al. 2025). Based on this result, we did not implement an elevation-based correction.

It is also relevant to highlight that, in the Mediterranean climate of central and northern Chile, all maximum rainfall intensities occur during the wet season (April–August). A detailed seasonal analysis of overestimation or underestimation patterns in gridded precipitation products, in relation to local hydroclimatic regimes, would require a different methodological framework and therefore falls outside the scope of the present study.

In summary, although the cited literature offers useful context on potential seasonal or altitude-dependent biases in gridded precipitation products, these studies analyse monthly precipitation totals, whereas our work focuses on annual maximum intensities. For this reason, direct comparisons should be made with caution.