Thank you very much for providing detailed comments, which allowed us to refine the manuscript and the dataset.

Please see the comments provided by the referee in black font, and our point-by-point response in blue font.

Anonymous Referee #2

I agree with the other comments posted about this manuscript— this new open-access dataset will be a great new resource for those interested in New Zealand hydrology and climatology. Similarly, I also find the manuscript to be well written and presented, and have only minor changes to suggest. These are as follows:

We would like to thank Referee #2 for the positive feedback and the insightful comments. Please find our detailed responses to each point below (blue font).

1. Introduction: The recency of its publication is probably the reason for this omission, but the ROBIN (Reference observatory of basins for international hydrological climate change detection) data set (Turner et al. 2025; https://doi.org/10.1038/s41597-025-04907-y) needs to be acknowledged here. As the name indicates, this is a global dataset of streamflow records that have minimal direct anthropogenic influence. Importantly, this includes 111 flow records for New Zealand. Although not diminishing the contribution that this new CAMELS-NZ dataset provides, it is important to note that another large streamflow dataset for NZ exists. Furthermore, it would be very helpful if an additional attribute could be added to this CAMELS dataset to indicate which of its records have passed the ROBIN standards around direct human influence.

   Thank you and we agree that the ROBIN data set is an important global data set that should be mentioned in our manuscript. We have therefore included a short description in Section 2, highlighting also the differences between CAMELS and ROBIN, which mainly lie in the temporal distribution:
   "It goes beyond global data sets such as ROBIN (Turner et al., 2025), which also include catchments in New Zealand (in ROBIN 111 catchments are included), but either have a lower temporal resolution and/or include much fewer catchments than the current CAMELS-NZ."

   As for the application of the classification of ROBIN in either Level 1 or Level 2, it is difficult to apply it here as the criteria are soft. For example, "artificial influences on the catchment minimal or at least stable although this should be based on judgement and local expertise" is hard to verify for the catchments. However, based on a previous study by Cattoën (2025), we have included indicators for each catchment if it is natural, controlled or abstracted. Around 300 catchments are seen as 'natural' and thus would probably belong to Level 1.
   As for the record length, we have around 100 stations that would be Level 1 stations, and around 200 stations that are Level 2 stations.

2. Line 73 and elsewhere: it seems a bit odd for the paper to cite itself – surely this is unnecessary?

This reference was meant to cite the data set itself, stored in the online repository at University of Canterbury, and requested by the journal. Indeed, there was a mistake in the citation pointing to the journal, which has now been corrected. We include this reference (similar to previous CAMELS papers) to provide the access link for the readers.

3. Line 87: Snelder & Biggs (2002) is not the best citation here, at least not in isolation. Although it has some relevance, it does not directly describe the nature of NZ gradients in climate, topography and geology, or the extent to which they are 'remarkable'.

   Thank you for pointing this out. We have added two references (Collins, 2020 and McMillan et al., 2016) that both provide details regarding these aspects.

4. Lines 103-104: volcanic catchments might be typical of Pacific Islands, but alpine settings are not.
   We agree that this formulation was misleading, as New Zealand indeed has some unique properties among the Pacific islands. We have now stated it more generally: "Secondly, New Zealand's catchments offer valuable insights into hydrological processes typical for Pacific Island nations, e.g. volcanic catchments."

5. Line 114: Naming conventions. While Aotearoa is commonly added to New Zealand (i.e. Aotearoa New Zealand) for the name of the country, it is not the official name of the country. Contrastingly, the North and South Islands do have official names in Te Reo, according to the NZ Geographical Board: Te Ika-a-Māui and Te Waipounamu, respectively (https://gazetteer.linz.govt.nz/). Further, use of Aotearoa New Zealand vs just New Zealand in the manuscript is not consistent. Perhaps use the Te Reo plus English versions could be given at first use (for all NZ place names), then only English thereafter?

   Thank you for pointing this out. We have followed this suggestion and added the Te Reo names upon first appearance in the text (once in the abstract, once in the main body of the manuscript), but not thereafter.

6. Line 140: Glacier formation is not quite the right term—this is a process that takes many years (and probably is not occurring anywhere in the world right now?). Perhaps glacier mass balance would be more appropriate.

   We appreciate this suggestion for a much better formulation, which was incorporated as suggested.

7. Line 143: state the emissions scenario this projection corresponds to. Same comment for the following precipitation projections. Note that the King (2010) report has also been superseded by more recent assessments.

   Thank you and we agree with your comment. We have now updated the paper with more recent assessments for this section based on Gibson et al. (2025) as follows:

   "Recent high-resolution (~12 km) downscaled climate projections for New Zealand, based on six global climate models (GCMs) and three regional climate models (RCMs), project a national annual mean warming of 3.1°C (range: 2.0–3.8°C) by 2080–2099

relative to 1986–2005, under the high-emissions SSP3-7.0 scenario (Gibson et al., 2025). Summer maximum temperatures are expected to increase by 3.9°C on average (range: 2.8–4.8°C), particularly affecting inland North Island and high-elevation areas (Gibson et al., 2025). These findings are qualitatively consistent with earlier CMIP5-based projections (Mullan et al., 2018; King et al., 2018)

Precipitation projections show a distinct seasonal and spatial pattern, with winter and spring rainfall increasing by over 20% in parts of the South Island's west coast, while northern and eastern regions of the North Island are likely to experience reduced rainfall, especially in spring and summer (Gibson et al., 2025). Across much of the country, extreme precipitation events are expected to become more intense but less frequent, occurring over shorter durations – except on the South Island's west coast, where both totals and extremes increase, likely due to topographically enhanced dynamical processes (Gibson et al., 2024). Overall, these projected changes reinforce trends identified in earlier CMPI5-based assessments (Gibson et al., 2025)."

References:

Peter Gibson, et al., 2025, Downscaled CMIP6 future climate projections for New Zealand: climatology and extremes, Weather and Climate Extremes, https://doi.org/10.1016/j.wace.2025.100784.

8. Line 249: Given that this paper describes a dataset, more specific information on estimation of PET would be helpful. Conventionally, the Priestley-Taylor equation uses an empirical constant to model the effects of vapour pressure deficit on evaporation, meaning that relative humidity data are not used. Similarly, net radiation (rather than temperature) data are used. However, the Clark et al. (2008) study that is cited here states that "radiation terms are estimated empirically", followed by a citation to Shuttleworth (1993). Correspondingly, it would be helpful to state explicitly how PET is calculated for this data set, and thus how it differs from the conventional Priestley-Taylor method.

We thank the reviewer for their helpful comment. The PET calculation used in this dataset follows a modified Priestley–Taylor method, as implemented in Clark et al. (2008) and McMillan et al. (2016), and differs slightly from the conventional formulation.

Net radiation is estimated as the sum of net shortwave radiation (adjusted for surface albedo) and net longwave radiation, the latter computed empirically using surface air temperature, vapour pressure (from dew point temperature), and a cloudiness factor, following Shuttleworth (1993). Ground heat flux is assumed negligible.

The PET equation uses the Priestley–Taylor form (Equation 14 in Priestley & Taylor, 1972), with alpha = 1.26 for humid conditions. The slope of the saturation vapour pressure curve (Equation 4.2.3 in Shuttleworth, 1993) and the psychrometric constant (Equation 4.2.28) are both explicitly calculated from air temperature, thus making temperature a key input. While relative humidity is not directly used, its influence is implicit via dew point estimates for vapour pressure.

We have updated the manuscript to clarify these points and to distinguish this implementation from the standard Priestley–Taylor method as follows:

“Potential evapotranspiration (PET) was calculated using a modified Priestley–Taylor method (Priestley & Taylor, 1972), following the implementation in Clark et al. (2008) and McMillan et al. (2016). Net radiation was estimated as the sum of net shortwave radiation (adjusted for albedo) and net longwave radiation, computed empirically using air temperature, vapour pressure (from dew point temperature), and a cloudiness factor (Shuttleworth, 1993). The ground heat flux term was assumed negligible. The slope of the saturation vapour pressure curve and the psychrometric constant were calculated using Equations 4.2.3 and 4.2.28 in Shuttleworth (1993), both of which are explicit functions of air temperature. The Priestley–Taylor coefficient (\alpha) was set to 1.26, appropriate for humid conditions. While relative humidity was not used directly, it affects vapour pressure as dew point is derived from relative humidity. This approach offers a computationally efficient and physically grounded estimate of PET, suited to large-scale hydrological modelling in New Zealand's climatic conditions.”

References:

Priestly and Taylor (1972) "On the assessment of surface heat flux and evaporation using large-scale parameters" Monthly Weather Review, 100, 81-91.

Shuttleworth WJ. Evaporation. In: Maidment DR, editor. Handbook of hydrology. New York: McGraw-Hill; 1993 [chapter 4]. https://hydrology.usu.edu/dtarb/cee6400/ShuttleworthHandbookofHydrologyCh41993.pdf

9. Line 224-225. It would be more accurate to state that whilst a very dense gauging network would be needed to capture the high spatial variability in rainfall for the mountainous regions of NZ, such a network does not currently exist.

   We agree that the previous formulation was misleading, and we changed it as suggested.

10. Line 226-227. While the VCSN does provide these data, access to the VCSN is largely restricted behind a paywall (https://data.niwa.co.nz/products/vcsn-timeseries?_gl=1*1q6gqoh*_ga*MTg1MTUxMzY0OS4xNzUwODE2ODg1*_ga_4CXN46915J*czE3NTA4MTY4ODUkbzEkZzAkdDE3NTA4MTY4OTIkajUzJGwwJGgw). If this new CAMELS-NZ dataset effectively bypasses that paywall for these catchment-average time series, this is good news and should be more clearly noted!

    Thank you. We would like to point out that the VCSN is gridded data at 5km resolution across the whole country. We are providing bias-corrected catchment averaged information at the selected 369 sites, bias-corrected to the long-term water balance of the catchment-average timeseries.

11. Some comment on the use of catchment average rainfall should be provided, particularly in regions of high rainfall gradients such as the eastern side of the Southern Alps Main Divide. In regions such as this where mean annual rainfall can drop by an order of magnitude across a catchment, how informative is catchment average rainfall? Perhaps an additional data set attribute quantifying this rainfall gradient would be helpful?

We agree that rainfall in New Zealand is quite diverse and cannot be captured by a single characteristic. Besides the rainfall time series, we therefore now provide in the updated version two rainfall characteristics: mean annual rainfall and the coefficient of variation of rainfall for each catchment. This covers not only the magnitude of rainfall but also the gradient in terms of variability. In addition, we provide the number of days per year with high amount of rainfall (usDaysRainGT25, usRainDays10) to also better understand the inter-annual variability.

12. Finally with respect to the VCSN – previous studies have highlighted issues problems with these data with respect to interpolation across complex terrain using a sparse observational network, e.g. Tait and Macara (2014; https://doi.org/10.2307/26169743) and Tait et al. (2012; https://www.jstor.org/stable/43944886). These need to be acknowledged here.

We thank the reviewer for highlighting this important point. We have modified the paper to acknowledge this issue as follows:

"While the VCSN offers valuable national coverage, previous evaluations have noted interpolation errors in areas of complex terrain due to sparse observational coverage (Tait and Macara, 2012; Tait et al. 2012). Additionally, the number of contributing stations has declined significantly overtime, ranging from a peak of approximately 1,400 stations between 1970 and 1986 to fewer than 400 stations in recent years."

References:

Tait, Andrew, and Gregor Macara. "Evaluation of Interpolated Daily Temperature Data for High Elevation Areas in New Zealand." *Weather and Climate* 34 (2014): 36–49. https://doi.org/10.2307/26169743.

Tait, Andrew, James Sturman, and Martyn Clark. "An Assessment of the Accuracy of Interpolated Daily Rainfall for New Zealand." *Journal of Hydrology (New Zealand)* 51, no. 1 (2012): 25–44. http://www.jstor.org/stable/43944886.