The reviewer's comment is written in bold. The reply of the authors is written in non-bold.

The Baatz et al. (2024) paper presents a very clear explanation of all the scaling factors used to correct cosmic ray neutron counts. In particular, sections 2.1.1 to 2.1.3 provide great detail on each. The intro paragraph at line 54 presents each very succinctly. I appreciate their efforts to really illustrate these concepts - and the fact that many of us have inherently considered these essentially fixed parameters.

The authors use inverse modeling to derive model parameters (e.g., beta, omega and psi) and their uncertainty. However, it is a little unclear what the forward model is they are inverting. Equations 1-3 and multiplied to get the total flux correction (Npih, eq. 4) at Line 186. The synthetic experiments are presented well. I am not following inversions of beta, omega and psi at the site level. Could you present the forward model and the error term that is being minimized? Or, if I am off target with the optimization scheme, could you elaborate on the inversion routine a little more?

Thank you for your thoughtful feedback and for highlighting the need to better clarify the inversion process. We will address this by modifying Section 2.2 "Inversion of Scaling Functions." Specifically, we propose removing lines 163–167 and replacing them with the following explanation of the forward model and inversion routine:

"The forward model used for estimating the parameters beta, omega, and psi is based on the combination of scaling functions for atmospheric pressure, absolute air humidity, and incoming neutron intensity, as detailed in Equations (1), (2), and (3). The forward model computes the neutron flux N at time t by applying these scaling factors to the observed neutron flux $N_{t-1,obs}$ of the previous time step (t-1). This previous time step essentially serves as reference condition:

$$N_{t,est} = N_{t-1,obs} \times exp\{beta(P_t - P_{t-1})\} \times \{1 + omega \times (abs_t - abs_{t-1})\} \times \{1 + psi \times (Inc_t - Inc_{t-1})\} \quad (4)$$

Parameters beta, omega and psi are the free parameters to be optimized. N, P, abs and Inc represent vectors of n days, and $N_{t,est}$ is the neutron flux estimated by using the corrections.

To optimize the three parameters, we use an inversion approach that minimizes the root mean square error (RMSE) between the observed neutron flux $N_{t,obs}$ and the estimated neutron flux $N_{t,est}$:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(N_{t,obs} - N_{t,est}\right)^2} \quad (5)$$

where n represents the total number of days."

We will continue Section 2.2 as in the manuscript from line 167 onwards with:
"Remaining uncertainty was assumed […]."