Dear Editors and Reviewers,

We sincerely thank the editors and the anonymous reviewers for their constructive and insightful comments on our manuscript entitled "*An hourly 0.02° total precipitable water dataset for all-weather conditions over the Tibetan Plateau through the fusion of observations of geostationary and multi-source microwave satellites*" (Manuscript ID: essd-2025-365).

We carefully considered the reviewer's remaining suggestion, which recommended extending the separate evaluations of the fused TPW dataset under clear-sky and cloudy-sky conditions to cover all years from 2016 to 2022. We fully agreed with this valuable advice and have accordingly revised the manuscript by adding new statistical validation results and corresponding analyses. All modifications have been incorporated into the revised manuscript, with changes clearly marked for your review.

We believe these revisions have further improved the quality and completeness of the manuscript. Thank you for your time and effort in handling our submission, and we look forward to your further evaluation.

Thank you and best regards,

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Response to Reviewer Comments

The authors addressed most of my questions and concerns. The manuscript is greatly improved. However, it is still one suggestion that needs the author's attention before accepting the manuscript.

Response: We sincerely thank the reviewer for providing these additional constructive comments and for the positive assessment of our previous revisions.

Comment 1: The authors use the Himawari-8/9 (H8/9) clear-sky TPW product as the foundational reference for both bias correction and spatial downscaling, from which the fused TPW data under cloudy conditions are subsequently derived. Therefore, it is recommended that the authors provide a separate evaluation of the fused TPW specifically under clear-sky and cloudy conditions to more comprehensively assess its accuracy and reliability.

In the current version of the manuscript, although the authors evaluate the fused TPW data under all-weather conditions for the period 2016 – 2022, the separate evaluations for clear-sky and cloudy conditions are only provided for the year 2017. It is recommended that the authors extend this separate evaluation to the same years (2016 – 2022) to ensure the robustness and consistency of the dataset.

Response: Thank you for this valuable suggestion. We fully agree that separate and extended evaluation of clear-sky and cloudy-sky conditions is critical to verifying the dataset's robustness. We have revised the manuscript by supplementing statistical validation results of the fused TPW dataset under clear-sky and cloudy-sky conditions for the entire 2016–2022 period, and added corresponding analysis in the results section.

Specifically, two new tables (Table 5 and Table 6) have been added to present the statistical metrics (R, Bias, RMSE, RRMSE, and sample size N) for clear-sky and cloudy-sky conditions across all years. Meanwhile, relevant analysis content has been supplemented in Section 4.1.4 (Validation of the fused TPW dataset for all years, Lines 566–586) to compare the performance of the fused dataset under different weather conditions and confirm its interannual consistency. The revised content is as follows:

"**4.1.4 Validation of the fused TPW dataset for all years**

To comprehensively evaluate the reliability of the fused TPW dataset, statistical validation was performed against GNSS observations from 2016 to 2022 under three weather conditions: all-weather, clear-sky, and cloudy-sky. The results are presented in Tab. 4 (all-weather), Tab. 5 (clear-sky), and Tab. 6 (cloudy-sky).

Table 4. Statistical validation of the fused TPW dataset against GNSS observations under all-weather conditions for all years (2016–2022).

Year	R	Bias (mm)	RMSE (mm)	RRMSE (%)	N
2016	0.91	-1.49	3.98	43.09	253194
2017	0.91	-1.39	3.82	40.38	285733
2018	0.92	-1.23	3.82	40.43	311143
2019	0.91	-1.02	3.37	39.99	174298
2020	0.91	-1.39	4.24	38.68	201789
2021	0.92	-0.99	3.50	38.69	300686
2022	0.92	-1.04	3.56	39.37	279514

Table 5. Statistical validation of the fused TPW dataset against GNSS observations under clear-sky conditions for all years (2016–2022).

Year	R	Bias (mm)	RMSE (mm)	RRMSE (%)	N
2016	0.92	-0.06	2.41	35.40	124831
2017	0.95	0.38	1.94	27.24	143670
2018	0.95	0.27	2.00	27.37	142859
2019	0.95	0.30	1.85	27.74	78360
2020	0.95	0.28	2.00	24.72	106901
2021	0.96	0.43	1.82	26.81	138246
2022	0.96	0.30	1.80	26.52	136784

Table 6. Statistical validation of the fused TPW dataset against GNSS observations under cloudy-sky conditions for all years (2016–2022).

Year	R	Bias (mm)	RMSE (mm)	RRMSE (%)	N
2016	0.91	-2.74	4.95	43.51	140840

2017	0.95	-2.78	4.92	42.32	142063
2018	0.92	-2.50	4.85	43.10	168284
2019	0.92	-2.10	4.23	42.81	95938
2020	0.90	-3.28	5.81	40.84	94988
2021	0.92	-2.20	4.46	40.59	162440
2022	0.92	-2.33	4.66	41.63	142730

Under all-weather conditions (Tab. 4), the fused TPW dataset exhibited stable performance throughout the study period, with correlation coefficients remaining within 0.91 – 0.92, RMSE values within 3.37 and 4.24 mm, and slightly dry biases around −0.99 to −1.49 mm. Note that fewer validation samples were available in 2019 and 2020 due to reduced GNSS observations, rather than changes in the fused dataset. Under clear-sky conditions (Tab. 5), the correlation coefficient ranged from 0.92 to 0.96. The Bias was between -0.06 mm and 0.43 mm. The RMSE was from 1.80 mm to 2.41 mm, and the RRMSE ranged from 24.72% to 35.40%. The accuracy under clear-sky conditions is higher than that under all-weather conditions. Under cloudy-sky conditions (Tab. 6), the correlation coefficient ranged from 0.90 to 0.95. The RMSE ranged from 4.23 mm to 5.81 mm, with a relatively higher value in 2020. However, the RRMSE in 2020 was 40.84%, which fell within the fluctuation range of 40.59% to 43.51% observed in other years without abnormal deviation. Overall, the fused TPW dataset showed relatively stable accuracy across different years and weather conditions."