

Title: Reducing False Alarms in Urban Flood Detection: An Enhanced NDWI (ENDWI) with Hybrid Max Fusion on Sentinel-2 Data.

Reply to RC1: ['Comment on egusphere-2026-672'](#), Anonymous Referee #1, 19 Apr 2026

Note No.1: Reviewer comments in italics

Note No.2: Manuscript updates are in blue.

Note No.3: Author's clarifications in green.

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(General Comment)

Thank you for submitting this well-prepared and valuable manuscript. The manuscript presents a meaningful contribution by proposing an enhanced water index (ENDWI) and demonstrating its effectiveness in reducing false alarms in urban flood detection. The methodology is sound, and the results are convincing.

Response:

Dear Referee,

Thank you so much for your time and encouraging feedback.

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(SPECIFIC COMMENTS)

Only minor revisions are suggested to improve clarity:

1. The abstract could more clearly state whether ENDWI is a novel index or a modification of existing indices (e.g., NDWI) and briefly indicate its key characteristics.

Response:

Dear Referee,

Thank you so much for your time and valuable comments. Below is the revised and brief opening of the abstract, highlighting ENDWI and its key characteristics, stating that NDWI is based on the formulation proposed by McFeeters (1996); the underlying index will be further elaborated in the main text of the manuscript. (lines 7-10).

Abstract: Accurately distinguishing flooded from non-flooded pixels in built-up areas remains challenging due to spectral confusion. This study proposes the Enhanced Normalized Difference Water Index (ENDWI), an enhancement of NDWI, and compares it with seven established water indices. ENDWI is formulated as NDWI divided by the green band, whose key characteristic is suppressing urban noise.

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(SPECIFIC COMMENTS)

2. *A short explanation of the spectral rationale behind the reduction in false alarms would improve the interpretability of the results.*

Overall, the manuscript is well prepared and suitable for publication after these minor clarifications.

Response: Thank you for this valuable suggestion. To clarify the spectral rationale behind the reduction in false alarms, we have added the following statement to the abstract (lines 10-12).

This operation concentrates index values near zero, so enhanced normalization was applied to expand the histogram and create a suitable peak for Otsu thresholding, consistently applied across all indices.

While a full explanation is provided in the methodology section. For more clarity, in this aspect, the green band increases the contrast and enhances the visibility of water and wet pixels, as well as built-up surfaces, due to its sensitivity to moist objects. By dividing NDWI by the green band again ($ENDWI = NDWI / Green$), the green band's influence is reduced, causing index values to cluster near zero. This mathematical operation highlights water-saturated objects more prominently than others, which is why false alarms are reduced, and the values become concentrated around the zero boundary. To address the narrow, zero-clustered value range produced by ENDWI—resulting from its formulation as a ratio with the green band—we applied an enhanced normalization step. Although ENDWI effectively identifies truly flooded pixels, its values tend to concentrate near zero, making direct thresholding challenging. The improved normalization expands this compressed distribution away from zero, allowing Otsu's method to form a distinct peak for reliable binarization. This step is essential not only to enable effective Otsu thresholding but also to ensure a fair and consistent comparison between ENDWI and other indices.

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Thank you again, and please do not hesitate to provide any further comments.

References

McFeeters, S. K.: The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features, *Int. J. Remote Sens.*, 17, 1425–1432, <https://doi.org/10.1080/01431169608948714>, 1996.