Title: "Urban Weather Modeling using WRF: Linking Physical Assumptions, Code Implementation, and Observational Needs

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We thank the reviewer for this constructive and insightful review. We have prepared the following detailed author response narrative.

1. **Reviewer comment**: This paper provides a thorough review on the urban parameterizations implemented in WRF version 4.5.2. The inherent shortcomings in the urban parameterizations are discussed and corrected. More importantly, the paper offers guidance on the observational strategy, which potentially benefits a better representation on the urban canopy layers in numerical models.
   The reviewer really likes this paper, as it holds important implications for the experimental design in the urban boundary layers. The contribution of this paper is sufficient to merit publication in GMD. But before that, the reviewer has several comments for the authors to respond as listed below:

   (a) Line 100: (FLHC) seems to be a typo
   Author response: The authors sincerely appreciate the reviewer's careful reading of the manuscript. However, after careful verification, the authors confirm that this instance is not a typographical error. The term FLHC and its definition in the subsequent lines are consistent with the WRF code version under study.

   (b) The reviewer finds numerous typos in the paper (e.g., lines 240-242, 249, 275, 379, 409). The reviewer suggests the authors to thoroughly proofread the editing of the paper.
   Author response: The authors sincerely thank the reviewer for pointing out typographical errors. We have thoroughly proofread the entire paper again and corrected all identified typos.

   (c) Appendix A is important and should be moved to the main text.
   Author response: We thank the reviewer for recognizing the importance of the material presented in Appendix A. Our intention in placing this content in the appendix was to maintain the manuscript's primary focus—namely, outlining the physical assumptions, code implementation of the mathematical formulation, and observational strategies aimed at improving the WRF-Urban model. While the identification and correction of code bugs are certainly valuable, they represent a more technical layer of detail that, in our view, would interrupt the main narrative flow if integrated directly into the core text. Unlike supplemental material, the appendix remains readily accessible to all readers and provides a convenient reference point for those interested in the implementation details.

   (d) Section 3.3: The difficulties in evaluating and modeling the flux-gradient relation over the heterogeneous surface are beyond the arguments that the authors mentioned. For example, the heterogeneity could lead to the space-dependent flux-gradient relation. To evaluate the existing flux-gradient relation, one has to carefully design the setup of the field campaign. The authors can have an in-depth discussion on this topic.
   Author response: The authors would like to thank the reviewer for this insightful comment. We agree that evaluating and modeling the flux-gradient relationship over heterogeneous urban surfaces involves complexities beyond those initially discussed. In particular, spatial variability in surface properties can lead to space-dependent flux-gradient relationships that challenge both observational design and model validation. To address this important point, we have revised Section 3.3 to include a more in-depth discussion on how surface heterogeneity affects flux-gradient relationships and the implications for field campaign design.
   Manuscript revision: Lines 328-335 (revised version): "Flux-gradient relationships, which form the basis of similarity functions, in urban areas are challenging to evaluate not only due to complex surface conditions and limited observations, but also because urban heterogeneity can lead to space-dependent flux-gradient behavior. Differences in building geometry, surface materials, and vegetation across small spatial scales can alter local turbulence and vertical gradients, complicating the assumption of horizontally homogeneous conditions underlying traditional similarity theory. As a result, evaluating existing flux-gradient formulations requires carefully designed field campaigns that account for spatial variability—such as deploying dense sensor networks or mobile platforms to capture local gradients. These considerations are critical for assessing the validity of parameterizations and improving model performance in heterogeneous urban environments."