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Discussions

Interactive comment on "High resolution land surface modeling utilizing remote sensing parameters and the Noah-UCM: a case study in the Los Angeles Basin" *by* P. Vahmani and T. S. Hogue

Anonymous Referee #2

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The paper addresses the important topic of providing urban land models with accurate inputs related to the surface properties. The authors derive a set of properties from satellite data (most notably leaf area index, green vegetation fraction, and impervious surface area) and provide them as inputs to the offline NOAH-UCM urban model to compare the resulting outputs to those obtained with the default tabulated model input. They proceed to perform a sensitivity analysis of the model and then to assess the influence of the new parameters on the model's ability to match observations.

The paper is in general interesting and well written but some major revisions are needed.

Major Comments:

The authors write in the conclusions: "Nevertheless, the model still underestimates remotely sensed LST values, over highly developed areas. We speculate that the underestimation of LST values, particularly over high intensity residential and industrial/commercial areas, is due to structural parameterization in the UCM and cannot be immediately solved with available parameter choices." In other parts they attribute this to a phase-lag in the discretization of the UCM. While this phase lag might play a role, an inconsistency that was recently pointed out in NOAH-UCM is that over urban terrain the model in fact computes the surface temperature of a homogeneous grass field that exchanges the same sensible heat flux with the atmosphere as the urban mix in the pixel. This is not the true urban temperature one (or satellites) would sense. WRF-UCM computes the fluxes from each subfacet (urban grass, roofs, urban canyons) separately and correctly but then uses the thermal roughness length of grass to infer a surface temperature. It is possible to compute a physically relevant surface temperature from WRF-UCM from the outputs it provides. I strongly encourage the authors to check the following reference for the details and potentially compute the surface temperature as done in that reference: Li, D., & Bou-Zeid, E. (2014). Quality and sensitivity of high-resolution numerical simulation of urban heat islands. Environmental Research Letters, 9(5), 055001. doi:10.1088/1748-9326/9/5/055001.

When computing albedo or emissivity from satellite data, I presume the result is some sort of an effective/average albedo or emissivity over the whole pixel. But for urban grid cells or pixels in NOAH-UCM, these parameters are imposed separately for the vegetated fraction of the cell, the roof, the walls, and the impervious ground surfaces (almost like a tiling or MOSAIC approach). It is unclear how the authors imposed these values in NOAH-UCM . Did they impose the same values for all facets? Did they use these only for the vegetated fraction (which would be problematic), etc. The authors should clarify what parameters in NOAH-UCM they override over urban pixels.

The figures are extremely difficult to read. The different line types are very similar and

I don't know why the authors do not use different colors since color figures are free in HESS anyway. If it is to allow B/W printing (which I think they should not worry about that much) then they should try to make the line types easier to distinguish.

Page 7477, lines 16-17. Are these values from Stenberg et al. (2004) derived for urban areas in that study? If not, do the authors expect different results over urban terrain?

NOAH-UCM to the best of my knowledge requires atmospheric fields at some elevation above the buildings. On page 7481 the authors describe driving it with measurements at 2m. Is that accurate? Can it be run with inputs at that height or did they have to extrapolate to some higher elevation?

Page 7482, lines 5-8 are unclear. An equation might help. Are they referring to the point they describe before about increasing these values since the remote sensing data presumes they are spread over the whole pixel?

Have the authors tried to look at the impact of shorter time steps since most tests of NOAH-UCM are in online mode where the time steps are much shorter? I think a test showing insensitivity to the time step would be useful since 1 hour is not much shorter than other significant times scales related to the surface such as the conductive time scale in the surface.

Page 7488: I am a bit surprised that "The changes in absolute surface albedos do not affect simulated latent heat fluxes (Fig. 3l)." Any explanation for that? The albedo alters available energy and should influence both H and LE.

Minor Comments

Page 7472 line 12: replace "Tahah" by "Taha".

Page 7473 line 3: replace "later" by "layer".

Page 7482, lines 8: replace "sending" by "sensing"

Page 7491, lines 21: replace "result" by ", resulting"

Results in figure 4: are these averaged over all individual CIMIS stations and corresponding pixels? Or did they use flux maps interpolated from CIMIS and then compare to the whole model domain? The averaging in the figure is unclear.

Caption of figure 2: mention that fully vegetated corresponds to row 2, etc.

The symbols in figure 7 are not defined anywhere.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 7469, 2014.