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Interactive comment on "A national dataset of 30-m annual urban extent dynamics (1985–2015) in the conterminous United States" *by* Xuecao Li et al.

Xuecao Li et al.

yuyuzhou@iastate.edu

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Reviewer #1: The manuscript outlined a research result that used Landsat historic datasets and Google Earth Engine to develop a 30 m annual urban extent in the United States. The mapped urban extents reached an overall accuracy between 96% and 88%. In general, these accuracy levels for urban mapping, especially for mapping the change in such long term and large scale, are very impressive. The result also shows high agreement with the existing national land cover database. The manuscript is also well prepared. However, I have following major comments for the manuscript.

Response: thank you very much for your positive comments. Below please find point-

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Discussion paper

by-point responses.

#1-1: The research used change vector as the foundational change detection tool to characterize urban change as an annual base. The authors did not use conventional change vector approach, which uses all spectral band information. Only three derived indexes were used to build up the change vector. The author did not explain why these three indexes were used. Are they best choice? No matter what answer is, sensitivity tests are necessary to compare with other approaches using other indexes or full spectral bad information.

Response: thank you for your suggestion. We explained the reason of using three indicators (i.e., NDVI, MNDWI, and SWIR) in our change vector analysis (CVA) approach, and compared the performance of the CVA approach using three indicators and six spectral bands as suggested. First, three indicators of NDVI, MNDWI, and SWIR can well represent vegetation, water, and bare lands, respectively. In the urban environment, these three land covers are primary conversion sources to urbanized areas. We clarified it in our revised manuscript.

"After that, we generated the normalized difference vegetation index (NDVI), the modified normalized difference water index (MNDWI), and the shortwave infrared (SWIR) reflectance. These three indexes can well represent vegetation, water, and bare lands, respectively, and are primary conversion sources to urbanized areas (Li and Gong, 2016a)."(page 5, line 15-18).

Second, we compared the performance of the CVA approach using three indicators and six spectral bands as suggested (Fig. S1) in the Chicago region in the period of 2001-2011. We found the derived ΔV1 from three indicators performs similarly with or even better than ΔV2 from six spectral bands (Fig. S1, a-b, d-e, and h-j). The overall accuracy of the derived potential urbanized map from ΔV1 is better than that from ΔV2 (Fig. S1, c and f). We clarified this in the revised manuscript.

"The change magnitude (ΔV) was calculated using three indicators (Eq. 1). Compared

to the six spectral band information of Landsat, the three indicators show similar or even better performance in capturing the change magnitude (Fig, S1), as well as providing the information of conversion sources of urbanized areas." (page 6, line 15-17).

Insert Fig. S1

Fig. S1. Comparison of the performance of the change vector analysis (CVA) approach using three indicators (i.e., NDVI, MNDWI, and SWIR) and six spectral bands (i.e., B1, B2, B3, B4, B5, and B7) in the Chicago region during 2001-2011. Change vectors of ΔV1 (a) and ΔV2 (d) and their histograms (b and e) were derived from three indicators and six spectral bands, respectively. The detected change areas from ΔV1 and ΔV2 are presented in (c) and (f), respectively, and they were further compared with the reference data of NLCD (g). Enlarged examples are given in (h), (i), and (j), respectively. The dotted line in histograms (b and e) are determined thresholds.

#1-2: Fig. 4. These are interesting graphics. However, colors for these lines (Fig.4b) makes these graphics hard to read. Should use different colors to clearly illustrate annual growth rate.

Response: thank you for your suggestion. We revised Fig. 4 using two different colors to illustrate annual growth rates of NLCD and our results as below.

Insert Fig. 4

Fig. 4: Annual growth of urban areas in the conterminous US (1985-2015) (a) and their annual growth rates (km2/y) compared to the NLCD in three periods (shadow frames) of 1992-2001, 2001-2006, and 2006-2011(b).

#1-3: Fig11. The colors of Landsat images are confused. It is hard to compare your mapped urban extents with satellite images. More clear and meaningful graphics are needed to clearly illustrate urban extent change and corresponding images.

Response: as suggested we improved our figure for better illustration. We improved the color scheme of urban dynamics maps to show a better comparison between urban

extent changes with corresponding Landsat images (Fig. 11).

Insert Fig. 11

Fig. 11: Comparison of annual urban dynamics with Landsat images. The geographic location of each region (A-H) corresponds to the black frames in Fig. 10. The spatial extent of each region is 25 km2.

Please also note the supplement to this comment:
https://www.earth-syst-sci-data-discuss.net/essd-2019-107/essd-2019-107-AC1-supplement.pdf

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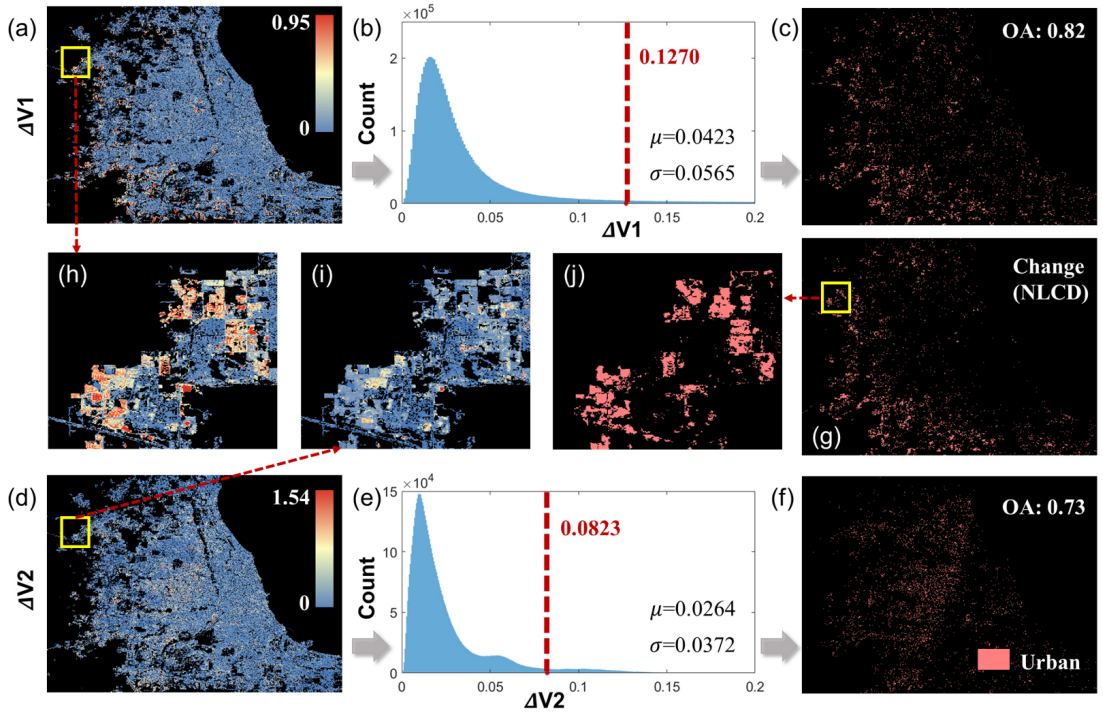

Fig. 1. Fig.S1

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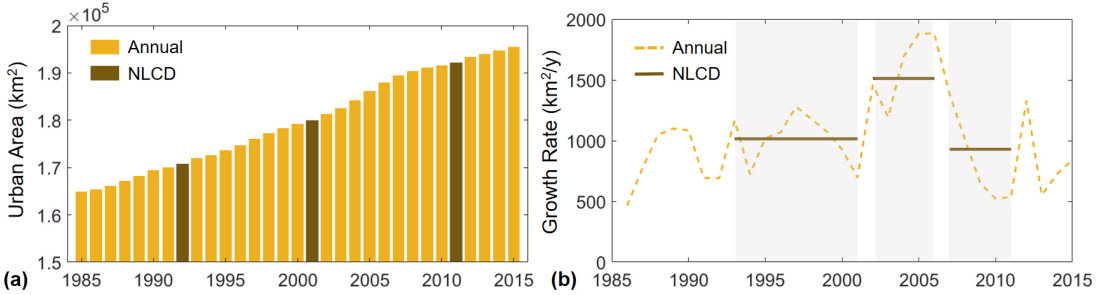

Fig. 2. Fig.4

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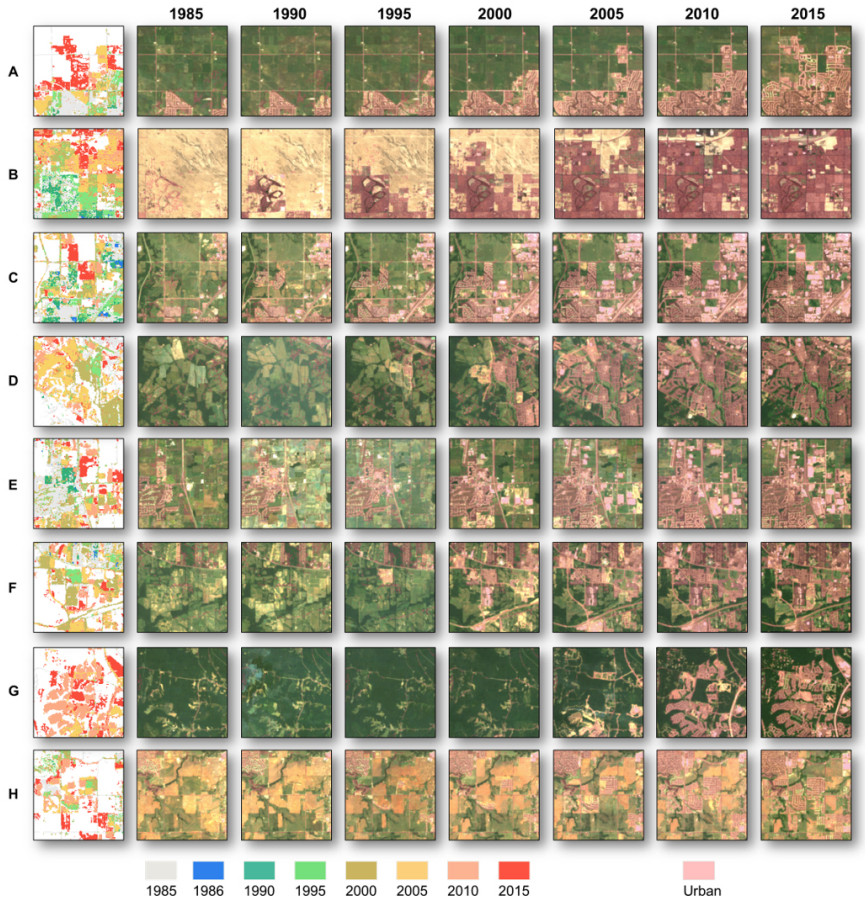

Fig. 3. Fig.11