(GC21D-1317) Global Land Cover mapping and Estimation (GLanCE): a multi-temporal Landsat-based data record of 21st century global land cover, land use and land cover change

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Highlights

- We present early results of the *Global Land Cover mapping and Estimation* (GLanCE) product, the first set of global, annual thematic land cover/land cover change maps at 30-meter spatial resolution based on Landsat time series data
- GLanCE mapping characterizes local-scale land cover dynamics missed by coarse resolution remote sensing data
- This product will provide the broader science community with spatially-explicit information characterizing changes and trends in land cover as well as information on ecosystem properties, health and condition at each Landsat pixel

Project objectives

- Produce a 30m spatial resolution data record representing global land cover, land use and land cover change at annual time steps from 2000-2020, including:
  - Information on land-use, phenology and spatial characteristics as well as the timing/magnitude of change
  - Data at multiple spatial resolutions (30m, 300m, 3000m)
- Distribute land cover products and science data sets free of charge on NASA's Land Processes Distributed Archive Center

Methods

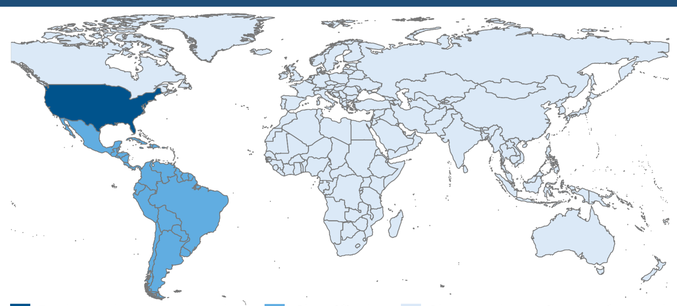

Figure 1. GLanCE processing status as of December 2019

- Training database includes reinterpretation of existing datasets, reference/field data from collaborators and data strategically augmented via a statistical analysis of spectral-temporal land cover features (Turlej et al., 2019)
- Land cover changes detected using *Continuous Change Detection and Classification* (CCDC) (Zhu & Woodcock, 2014), a temporal segmentation algorithm
- Classification performed using Random Forest on spectral-temporal features generated from CCDC models + ancillary variables (climate and topographic data)
- All processing/mapping performed on Google Earth Engine

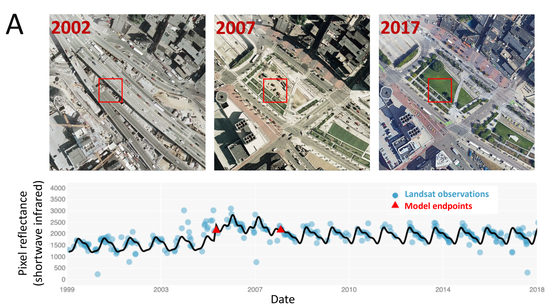

Figure 2. Examples of CCDC's change detection process. Black lines are CCDC model fits.

A) example of abrupt land cover disturbance from development followed by urban greenspace creation in Boston, Massachusetts.

B) example of gradual land cover change via post-harvest forest regrowth near Allagash, Maine.

Table 1. GLanCE Land cover legend. GLanCE products will also include a separate cropland data layer and a wetlands layer for all vegetated classes.

Level I	Level II
Water	Water
Snow/Ice	Snow/Ice
Built	Low-density built
	High-density built
Bare	Soil
	Rock
	Sand
Trees	Deciduous Broadleaf
	Deciduous Needleleaf
	Evergreen Broadleaf
	Evergreen Needleleaf
	Mixed leaf type
Shrub	Shrub
Herbaceous	Grassland
	Agriculture
	Moss/lichen
Woodland	Woodland

*Woodlands are not mapped below.

Preliminary results

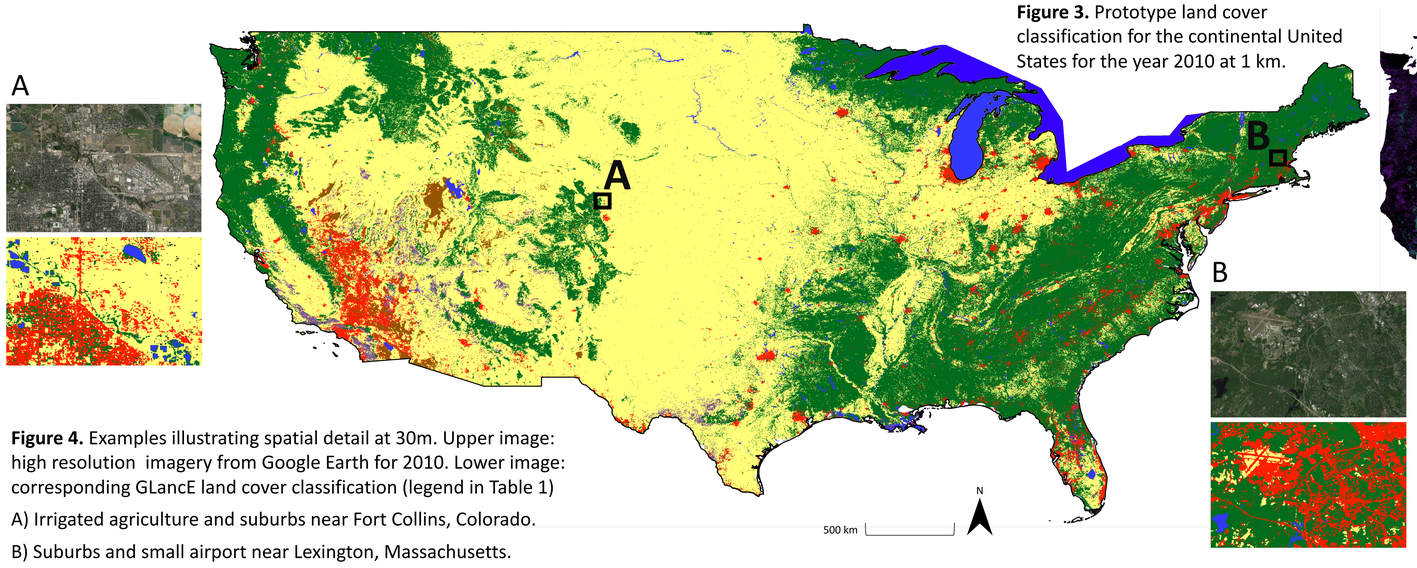

Figure 3. Prototype land cover classification for the continental United States for the year 2010 at 1 km.

Figure 4. Examples illustrating spatial detail at 30m. Upper image: high resolution imagery from Google Earth for 2010. Lower image: corresponding GLancE land cover classification (legend in Table 1)

A) Irrigated agriculture and suburbs near Fort Collins, Colorado.

B) Suburbs and small airport near Lexington, Massachusetts.

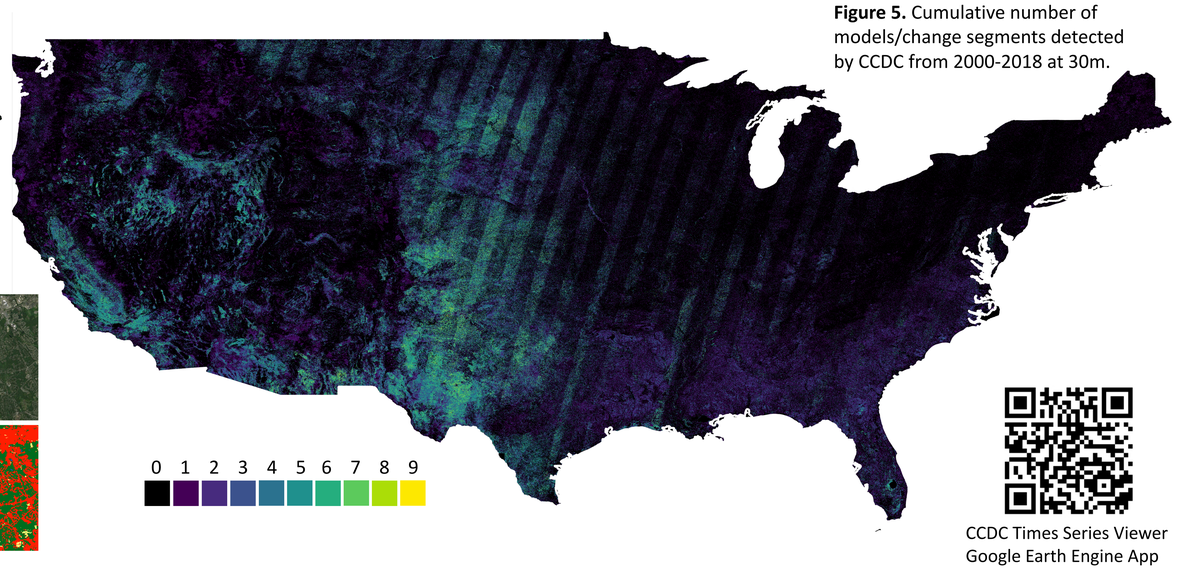

Figure 5. Cumulative number of models/change segments detected by CCDC from 2000-2018 at 30m.

CCDC Times Series Viewer Google Earth Engine App

- Early maps able to characterize land cover dynamics at varying scales and magnitudes
- Substantial commission errors for mapped *built/developed* class; under-representation of shrubs

Future work

- Improve accuracy/consistency via post-processing
- Quantify error and uncertainty with statistical accuracy assessments; include in final product
- Develop wetland and cropland data layers
- Complete first versions of North and South America

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Acknowledgements & References

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Turlej, K., Woodcock, C.E., Tarrio, K., Zhang, Y., Arevalo, P., Bullock, E.L., Friedl, M.A. (2019), An approach for collecting and evaluating land cover training data using time series of Landsat data, Abstract B11l-2286 presented at 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.

Zhu, Z. and Woodcock, C.E. 2014. Continuous change detection and classification of land cover using all available Landsat data. Remote Sensing of Environment. 144: 152:171. https://doi.org/10.1016/j.rse.2014.01.011