



Assessing global biogeophysical effects of land use and land cover change on climate using a land-atmosphere-ocean model

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Background

- Inconsistent non-local (global) effects: land surface models, LULCC implementation, and ocean coupling schemes (fixed SST, slab ocean, fully-coupled)
- Model internal variability or global-scale teleconnections?

Objective

Through what mechanisms LULCC exert global effects using an oceanland-atmosphere model

LULCC effects on global TMP

- LULCC Regions: +0.48 K
- Non-LULCC Regions: -0.18 K caused by DLW decrease corresponding to a cooling atmosphere

Temperature difference



Yearly updated LULCC map



LULCC effects on global precipitation

Local precipitation reduces: LULCC areas and adjacent ocean

Tripole anomaly around warm pool:

- ITCZ shifts southward
- Induced by moisture flux convergence (MFC)

Precipitation difference

Zonal PRE, EVP, MFC (LULCC – CTL)



LULCC effect on global TMP

LULCC effect on global PRE

Stronger atmospheric cooling in Northern Hemisphere



Energy transport towards Northern Hemisphere

Southward shift of ITCZ





Energy flux framework (Kang et al. 2009)

- LULCC cause a warming effect in degraded region and a cooling outside LULCC regions (climate feedbacks).
- LULCC reduces the local rainfall and displaces the ITCZ southward
- The key to connect local and global effect is the change of atmospheric energy from the decreased non-radiative heating (LH)

More interest?

Huang, H., Xue, Y., Chilukoti, N., Liu, Y., Chen, G., and Diallo, I.: <u>Assessing global and regional effects of</u> <u>reconstructed land use and land cover change since 1950 on climate using a coupled land-atmosphere-ocean</u> <u>model</u>, *Journal of Climate*, 10.1175/JCLI-D-20-0108.1, 2020