

Earth's Future

Supporting Information for

SSP-Based Land Use Change Scenarios: A Critical Uncertainty in Future Regional Climate Change Projections

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Introduction

This Supplementary Information file contains additional information related to how the SSP-based land-use changes were applied in WRF

Text S1. Additional Details Related to the Application of LUCs in WRF

Multiple different delta-type methods for incorporating the LUCs into WRF were tested, within the timeframe allowed by the project, to take into consideration which options produced land-use changes in WRF that were most consistent with what was produced in the LUCs, which combinations of WRF land-cover types in the historical climate simulations were spatially most consistent with those from the LUMs, which made sense to the authors in terms of potential scenario storylines, and which could also be easily applied to other land-cover dataset options with different land-use categories available in WRF (e.g., MODIS). In the end, absolute fractional LUC deltas (LUM future minus historical period land cover fraction) were applied instead of percent deltas, as the latter produced LUC fields in WRF that were not consistent with the LUM change fields. First, though, as the LUM data do not have the same resolution as WRF, the LUM data were interpolated to the 25-km grid used in WRF before calculating the deltas. LUM crop change was then applied to crop categories 2 and 3 in WRF, non-mixed-type dryland and irrigated crop, respectively, depending on which one was already prevalent in a grid box. Dryland crop was modified if no crop type 2 or 3 was present in the baseline. LUM pasture changes were applied to land category 7, grassland, in WRF, and urban changes were applied directly to the urban land category 1. Other fractional land-types in a grid box were increased or decreased proportionally to account for the changes in crop, pasture, and urban land. Absolute crop and pasture change deltas were applied first in WRF, and then the fields were adjusted by adding or subtracting small uniform values from all crop/pasture points until the changes across the domain in WRF in crop and pasture were within 5% of those projected by the LUM. Urban land and water (category 16) fractions were not allowed to change during the application of crop and pasture changes. Urban changes were then applied, and considered to be the dominant changes during the land-use field modification process (i.e. they took precedence over any crop/pasture change at a point). Water fractions were not allowed to change in this step either. Finally, the resulting future land-use fraction fields for WRF were used to produce an updated dominant land-use category field for WRF.

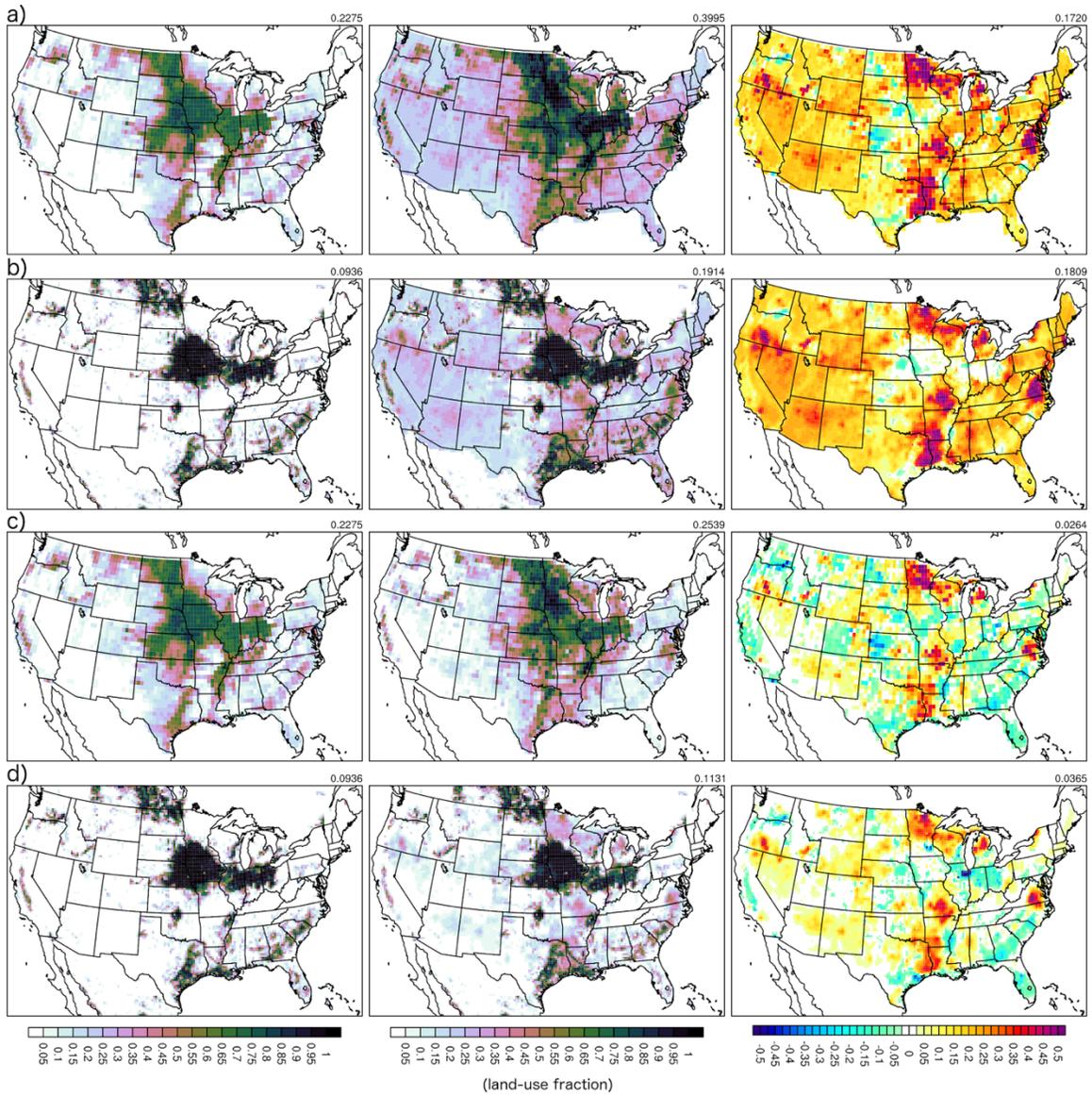


Figure S1. Left column: Baseline crop fraction from a) LUM, b) WRF, c) LUM, d) WRF. In WRF, crop fraction is the total of land-use categories 2 and 3. Center column: as in the left column, but for the future crop fraction under SSP3+RCP8.5 in rows a and b, and SSP5+RCP8.5 in rows c and d. Right column: Change in crop fraction from the baseline to the future under SSP3+RCP8.5 in rows a and b, and SSP5+RCP8.5 in rows c and d. Values in the upper right corner of each panel represent the area average for that panel. Note that values outside of the U.S. in WRF have not been masked.

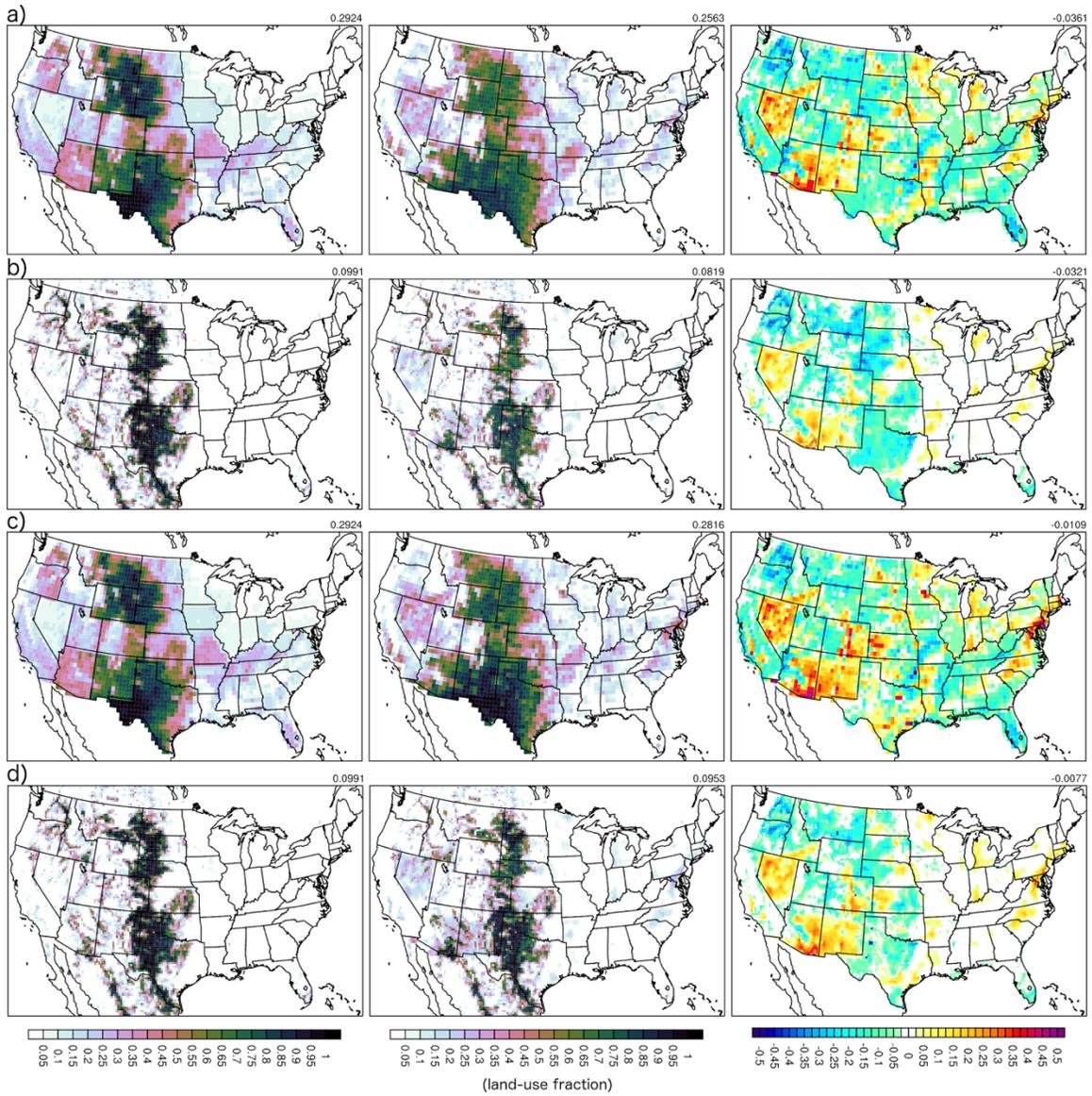


Figure S2. Left column: Baseline pasture fraction from a) LUM, b) WRF, c) LUM, d) WRF. In WRF, pasture fraction is represented by land-use category 7. Center column: as in the left column, but for the future pasture fraction under SSP3+RCP8.5 in rows a and b, and SSP5+RCP8.5 in rows c and d. Right column: Change in pasture fraction from the baseline to the future under SSP3+RCP8.5 in rows a and b, and SSP5+RCP8.5 in rows c and d. Values in the upper right corner of each panel represent the area average for that panel. Note that values outside of the U.S. in WRF have not been masked.

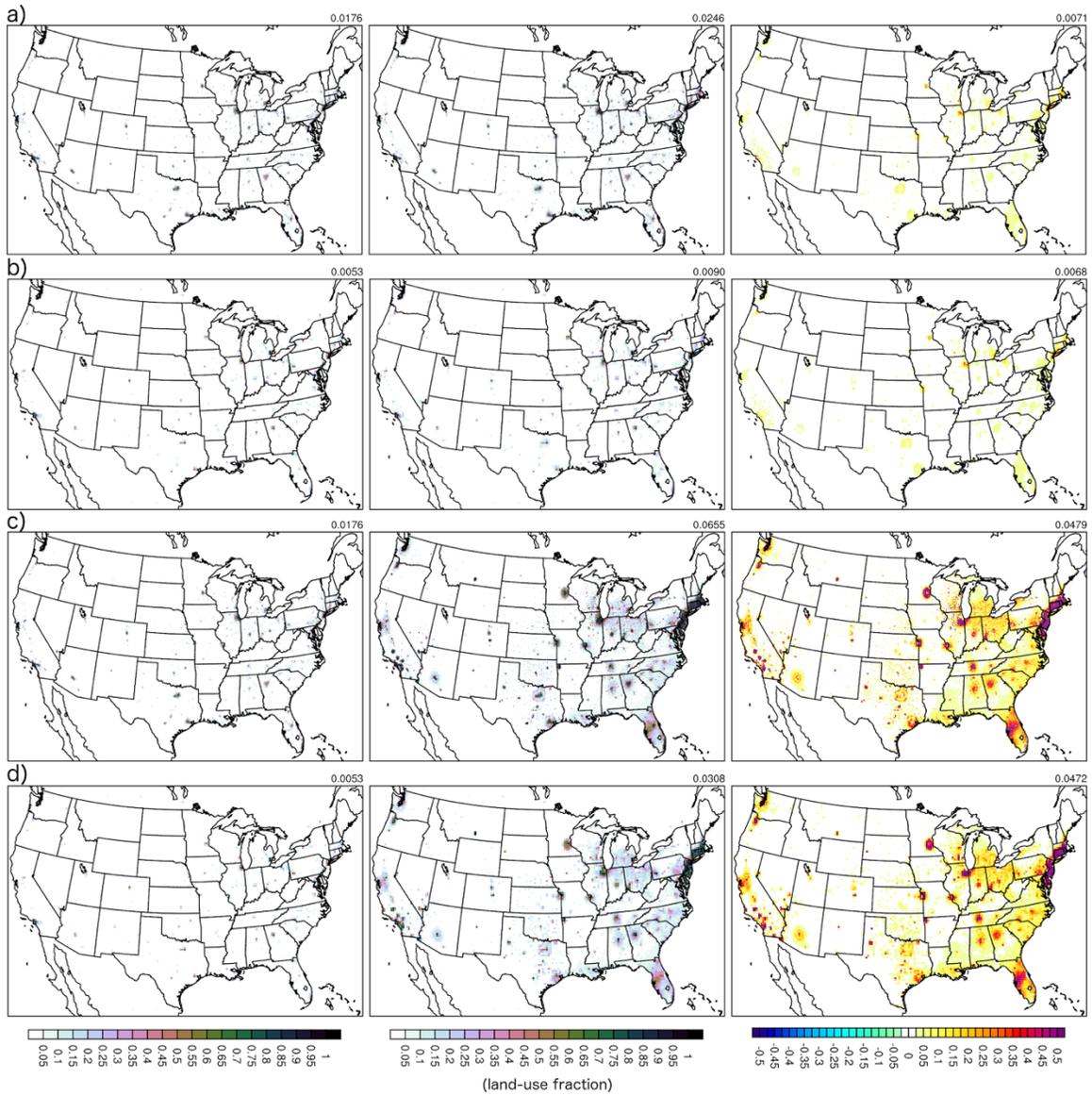


Figure S3. Left column: Baseline urban land fraction from a) LUM, b) WRF, c) LUM, d) WRF. In WRF, urban land fraction is represented by land-use category 1. Center column: as in the left column, but for the future urban fraction under SSP3+RCP8.5 in rows a and b, and SSP5+RCP8.5 in rows c and d. Right column: Change in urban land fraction from the baseline to the future under SSP3+RCP8.5 in rows a and b, and SSP5+RCP8.5 in rows c and d. Values in the upper right corner of each panel represent the area average for that panel. Note that values outside of the U.S. in WRF have not been masked.