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Observation-based sowing dates and cultivars significantly affect yield and irrigation for some crops in the Community Land Model (CLM5)

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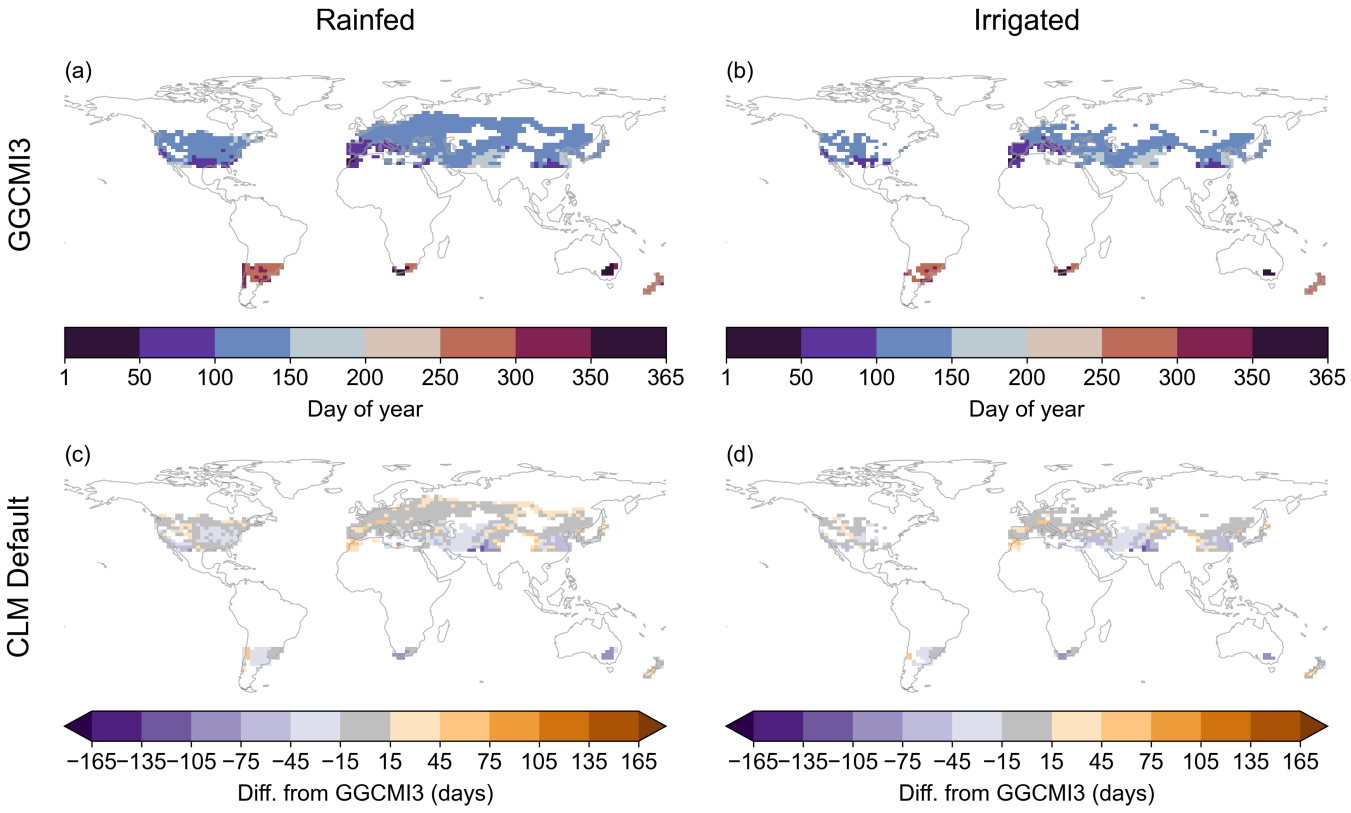


Figure S1. Sowing date for temperate corn in GGCMI3 prescribed calendars (a–b); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d). Prescribed Calendars dates match GGCMI3 exactly and are thus not shown. Equivalent of Fig. 2 in main text (spring wheat).

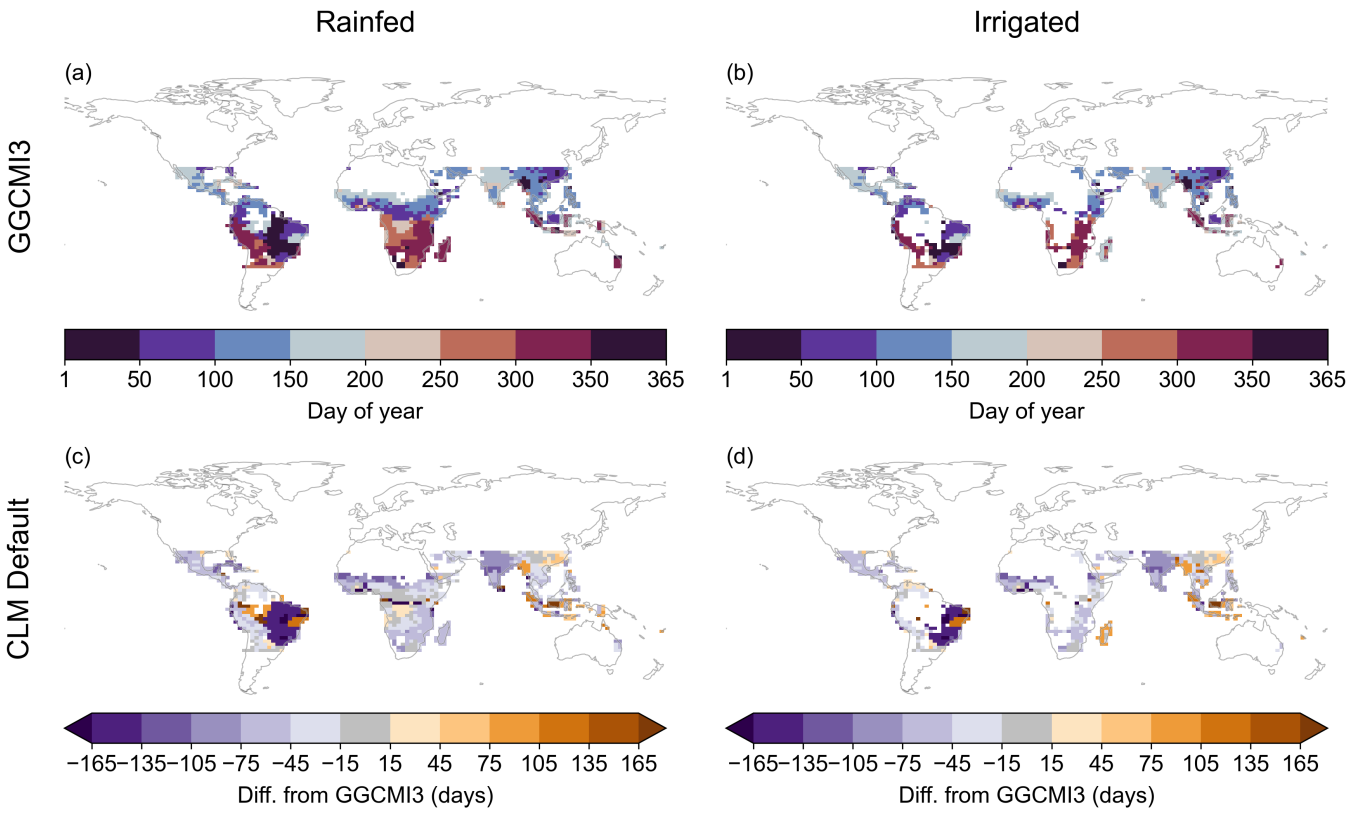


Figure S2. Sowing date for tropical corn in GGCMI3 prescribed calendars (a–b); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d). Prescribed Calendars dates match GGCMI3 exactly and are thus not shown. Equivalent of Fig. 2 in main text (spring wheat).

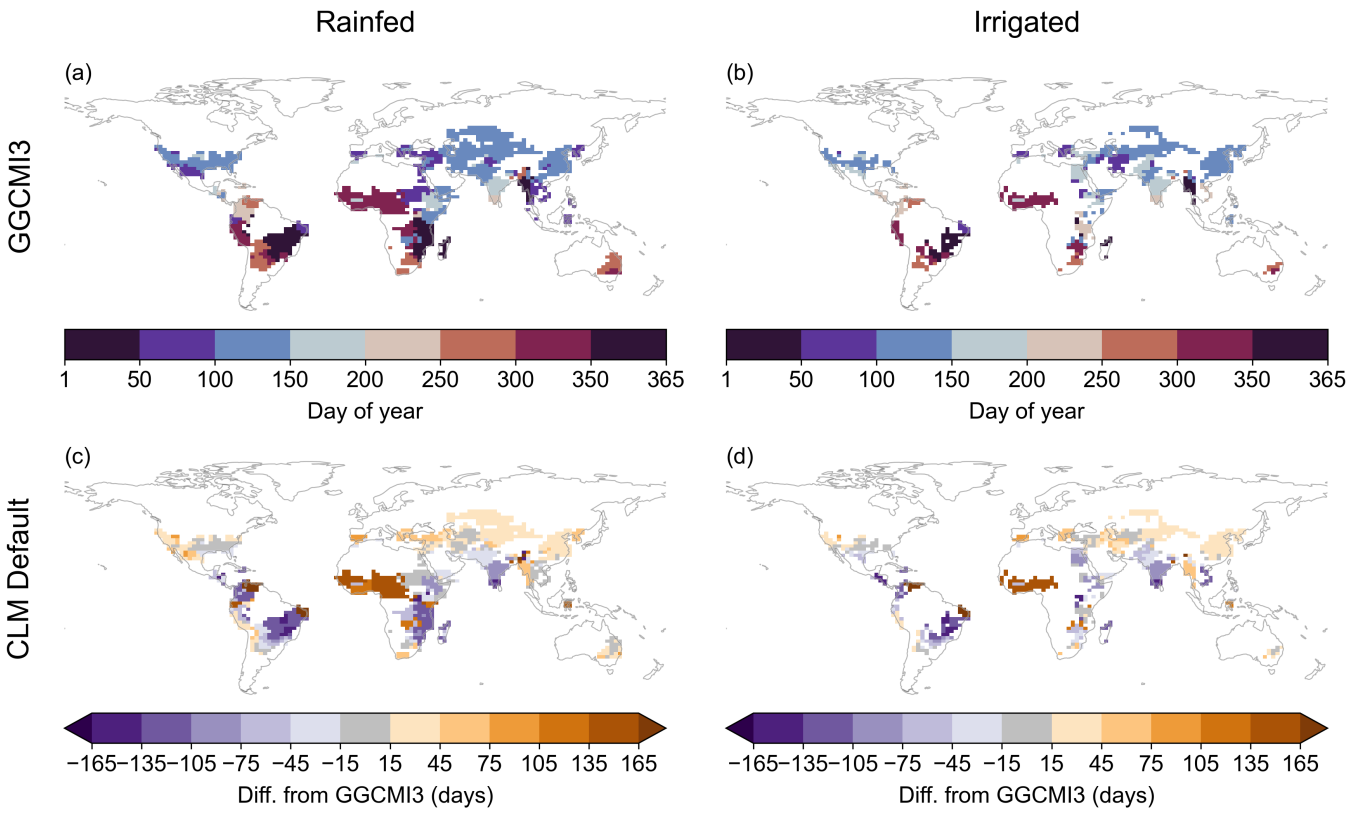


Figure S3. Sowing date for cotton in GGCMI3 prescribed calendars (a–b); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d). Prescribed Calendars dates match GGCMI3 exactly and are thus not shown. Equivalent of Fig. 2 in main text (spring wheat).

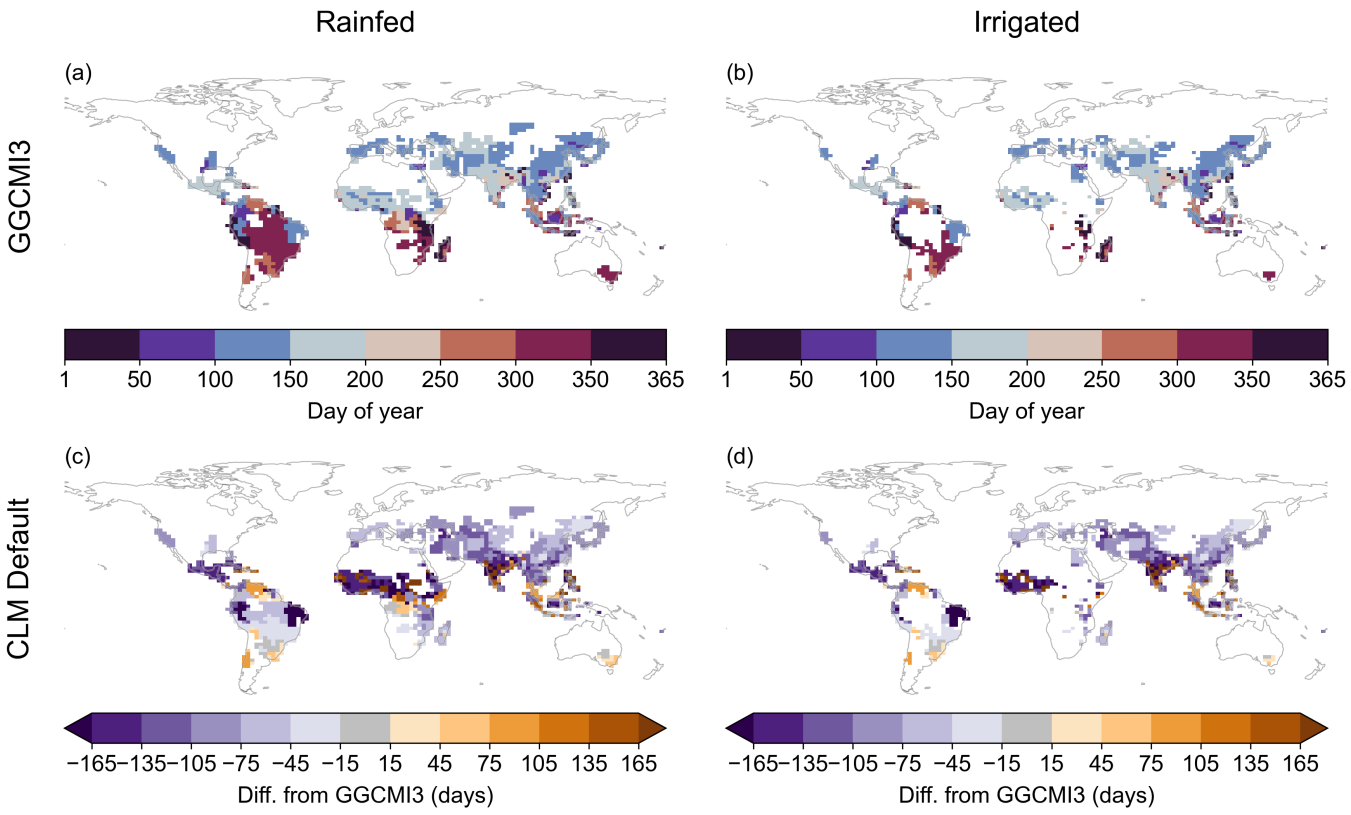


Figure S4. Sowing date for rice in GGCMI3 prescribed calendars (a–b); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d). Prescribed Calendars dates match GGCMI3 exactly and are thus not shown. Equivalent of Fig. 2 in main text (spring wheat).

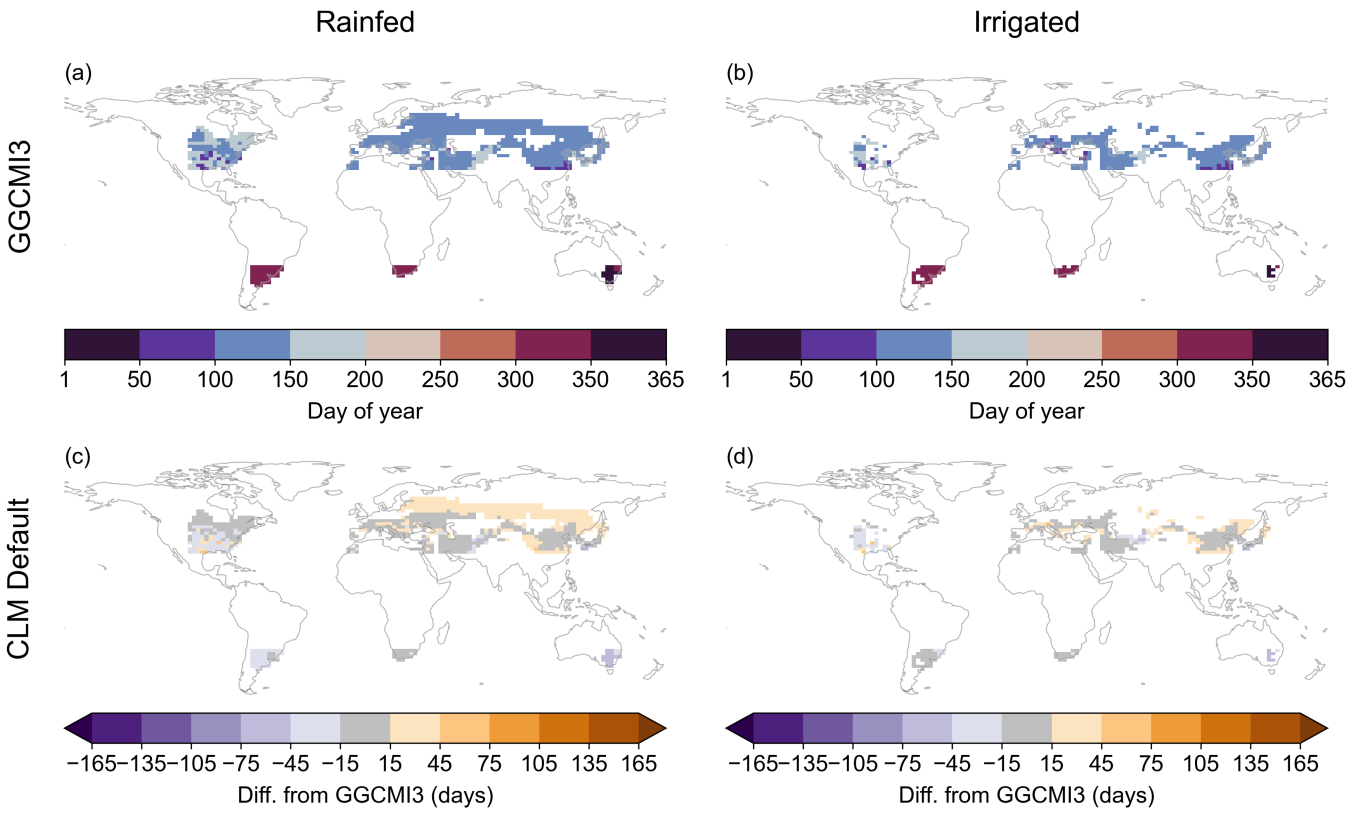


Figure S5. Sowing date for temperate soybean in GGCMI3 prescribed calendars (a–b); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d). Prescribed Calendars dates match GGCMI3 exactly and are thus not shown. Equivalent of Fig. 2 in main text (spring wheat).

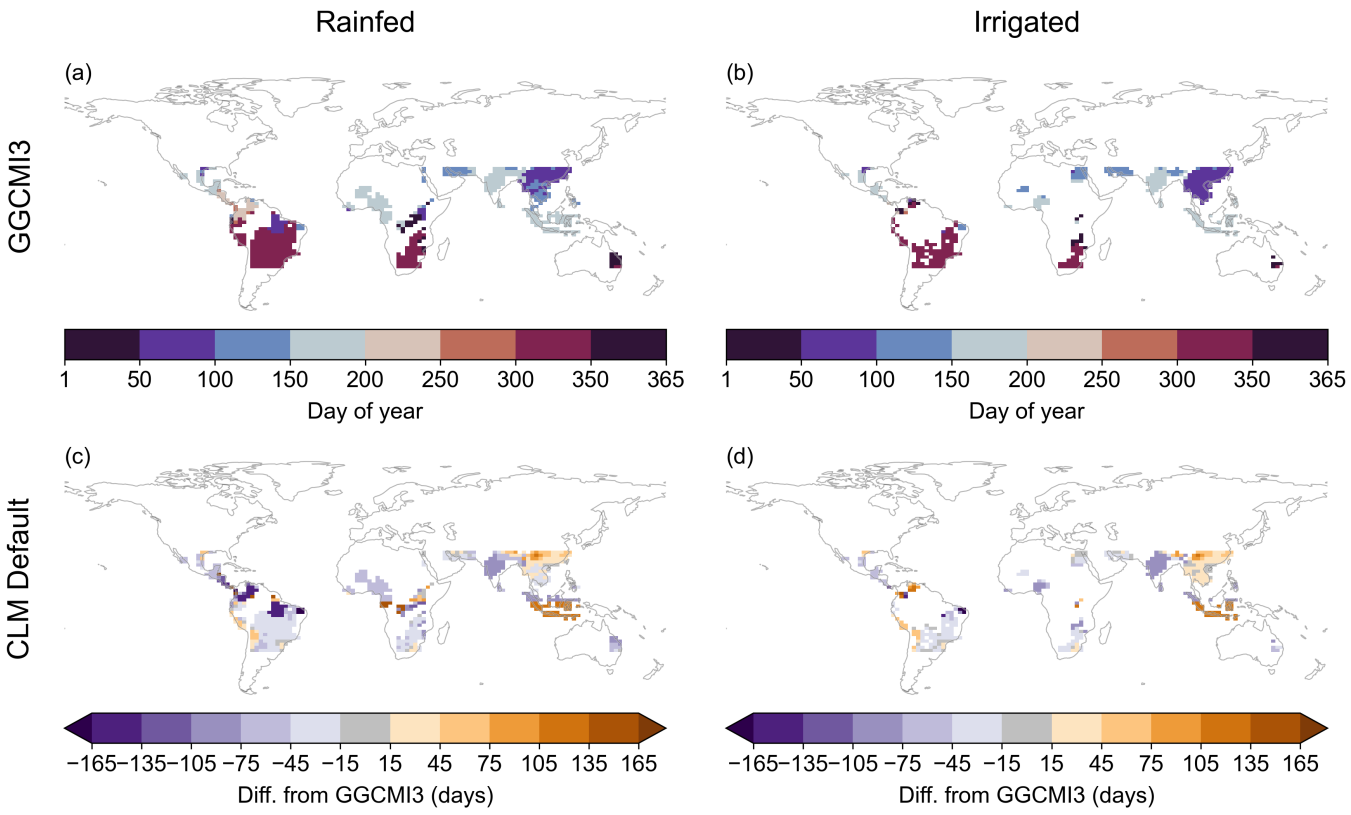
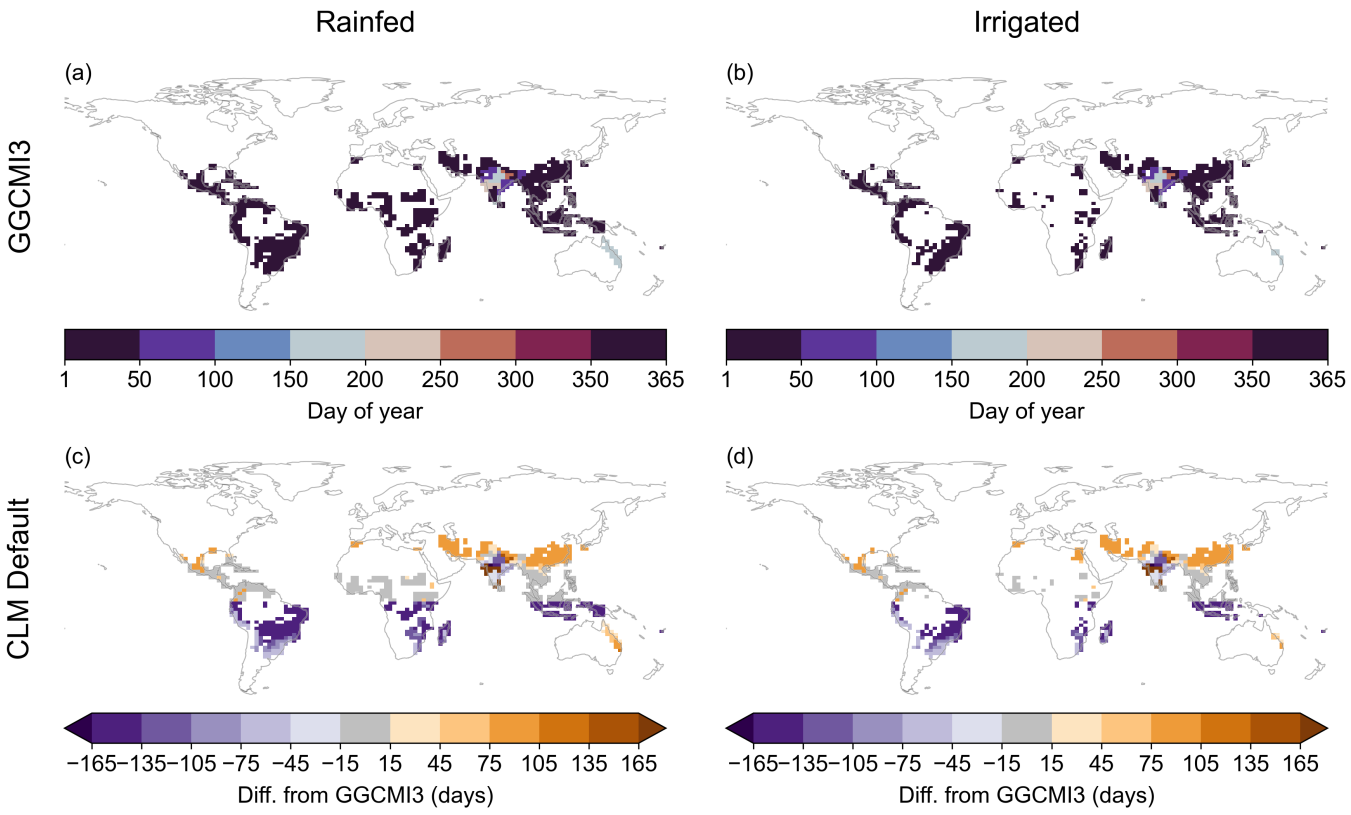


Figure S6. Sowing date for tropical soybean in GGCMI3 prescribed calendars (a–b); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d). Prescribed Calendars dates match GGCMI3 exactly and are thus not shown. Equivalent of Fig. 2 in main text (spring wheat).



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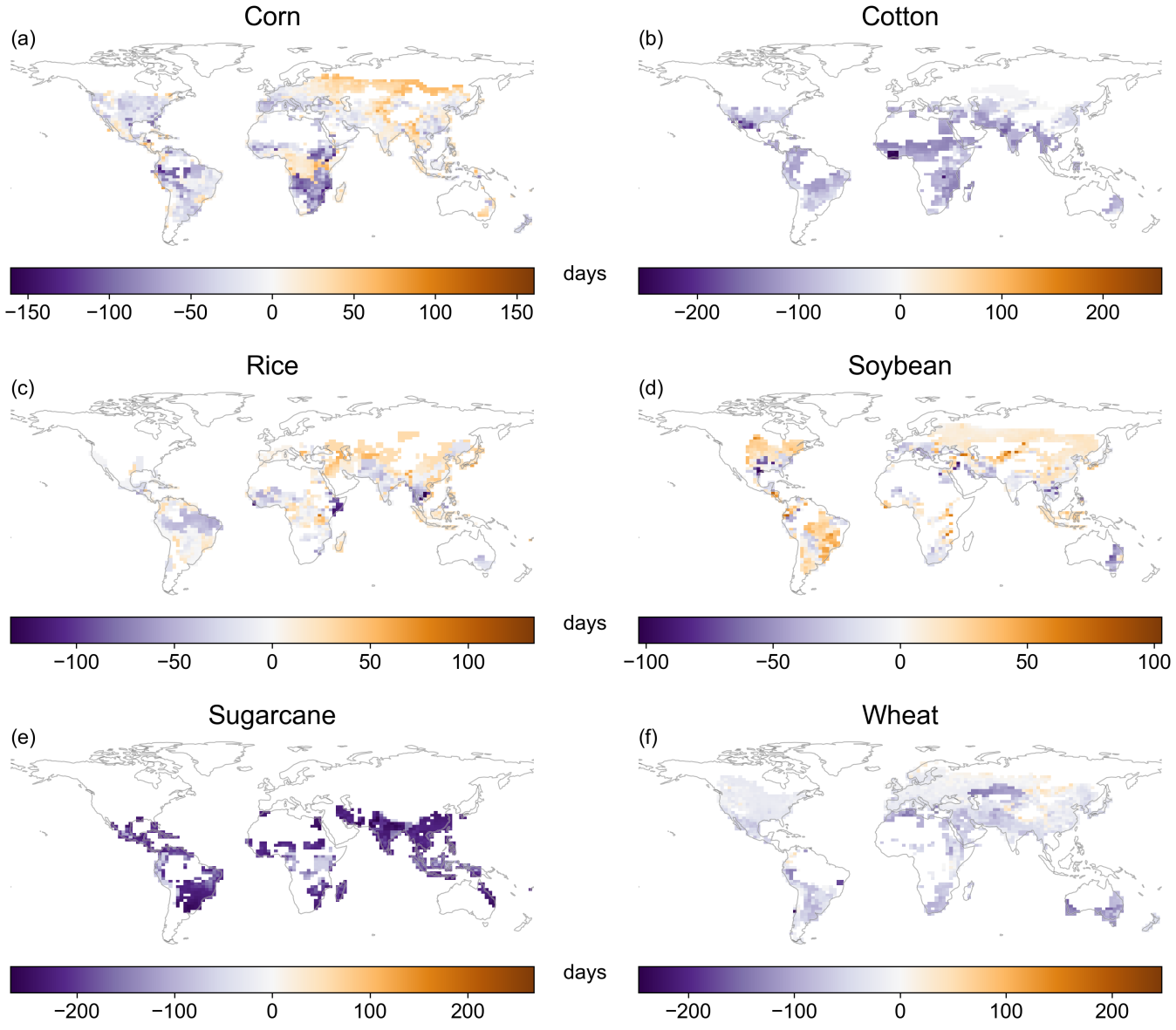


Figure S8. Mean 1980–2009 growing season length bias for CLM Default relative to GGCMI3 dataset. Value in each gridcell is the area-weighted average of rainfed and irrigated (for corn and soybean: also temperate and tropical) instances of each crop.

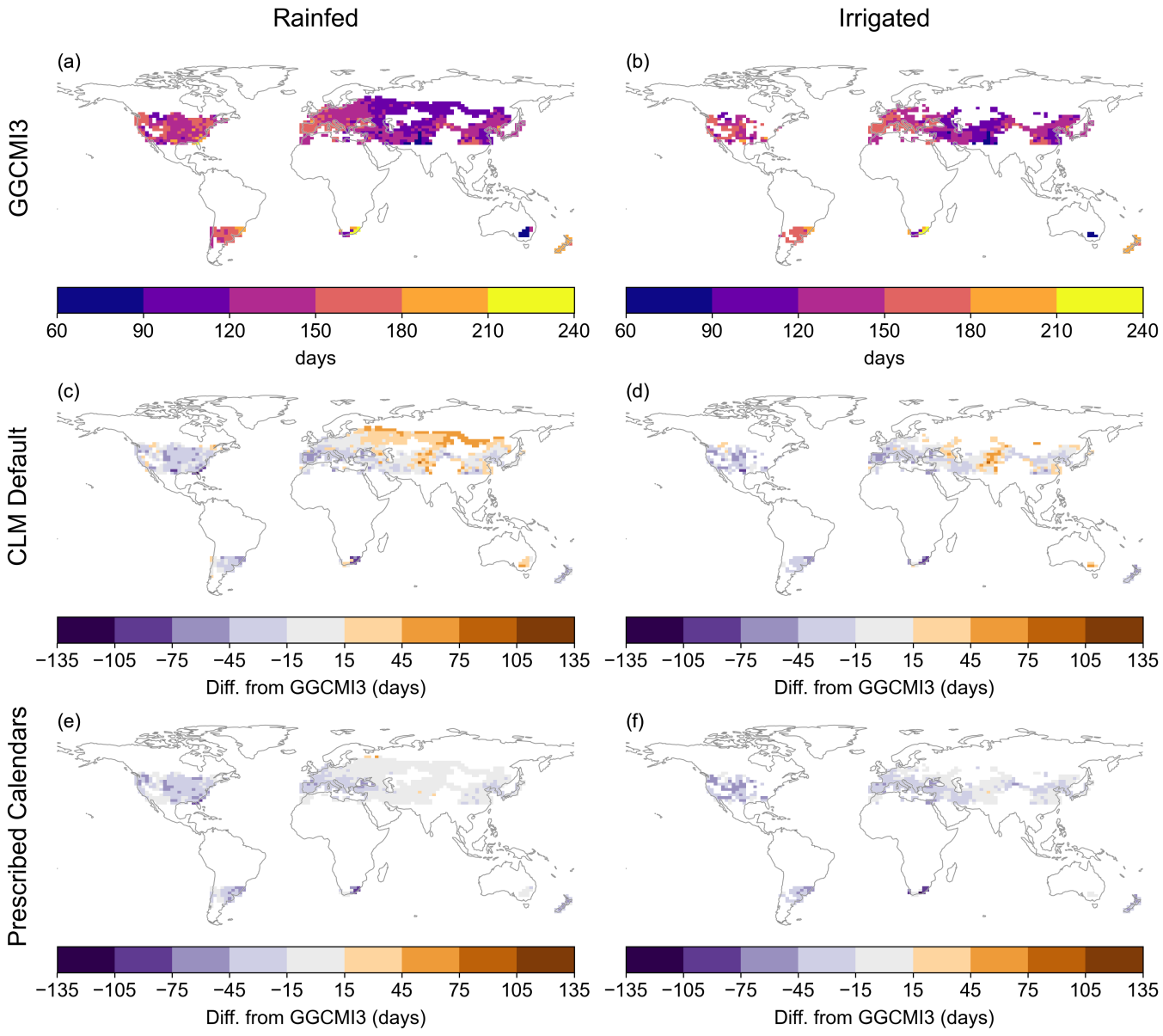


Figure S9. Growing season length for temperate corn in GGCMI3 prescribed calendars (top row); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d) and Prescribed Calendars run (e–f). Equivalent of Fig. 3 in main text (spring wheat).

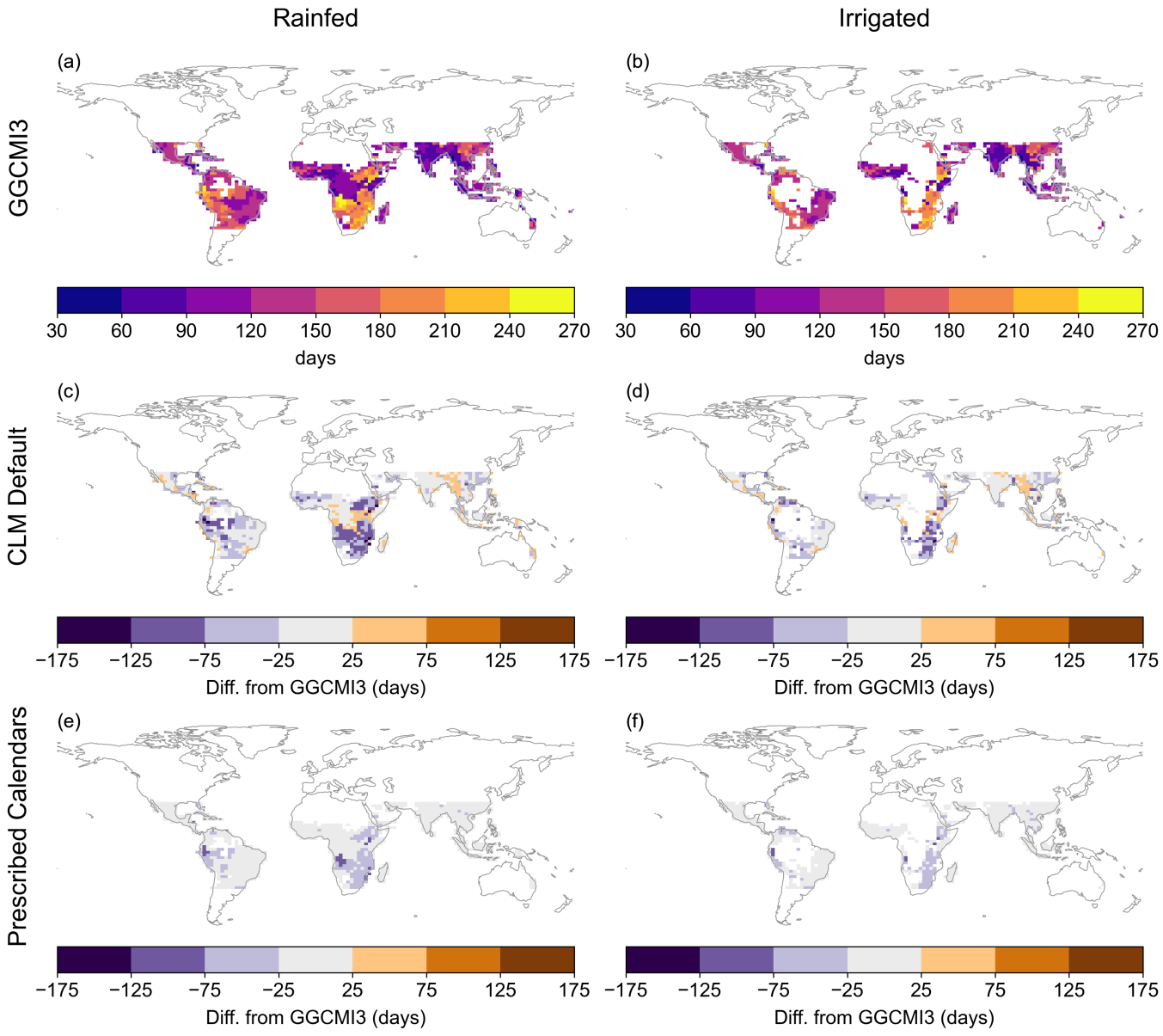


Figure S10. Growing season length for tropical corn in GGCMI3 prescribed calendars (top row); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d) and Prescribed Calendars run (e–f). Equivalent of Fig. 3 in main text (spring wheat).

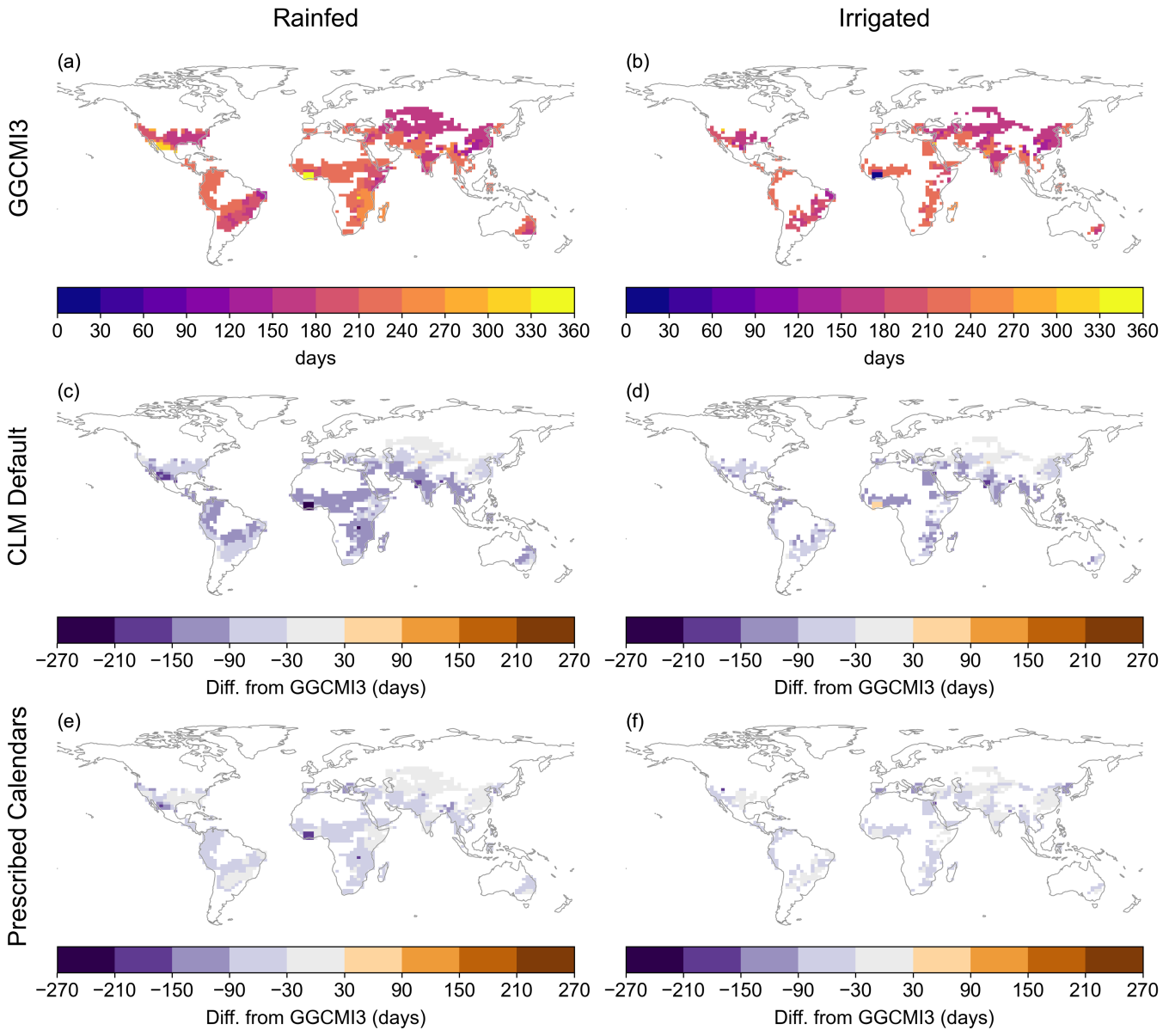
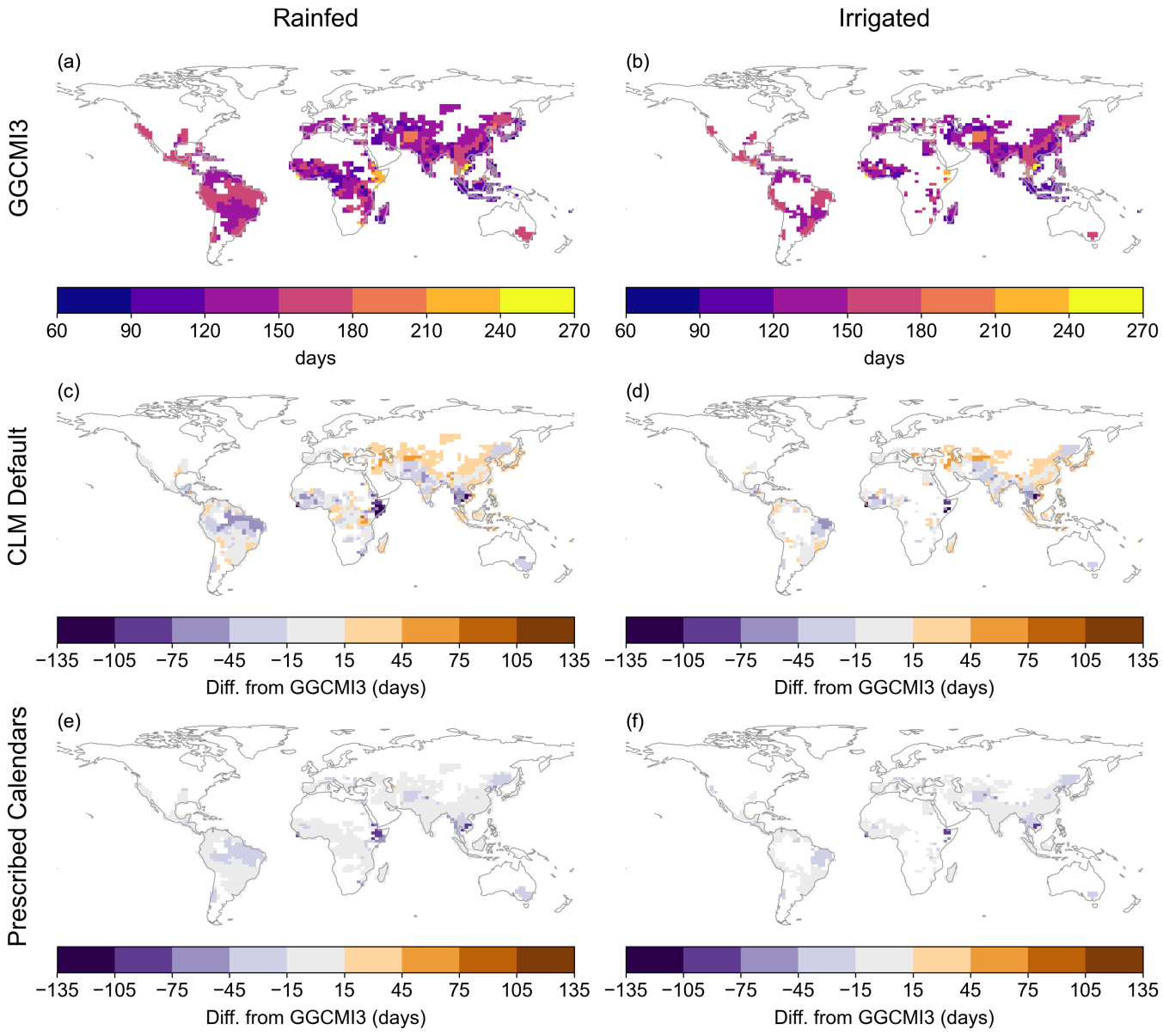


Figure S11. Growing season length for cotton in GGCMI3 prescribed calendars (top row); differences in mean 1980–2009 sowing date from prescribed value for CLM Default run (c–d) and Prescribed Calendars run (e–f). Equivalent of Fig. 3 in main text (spring wheat).



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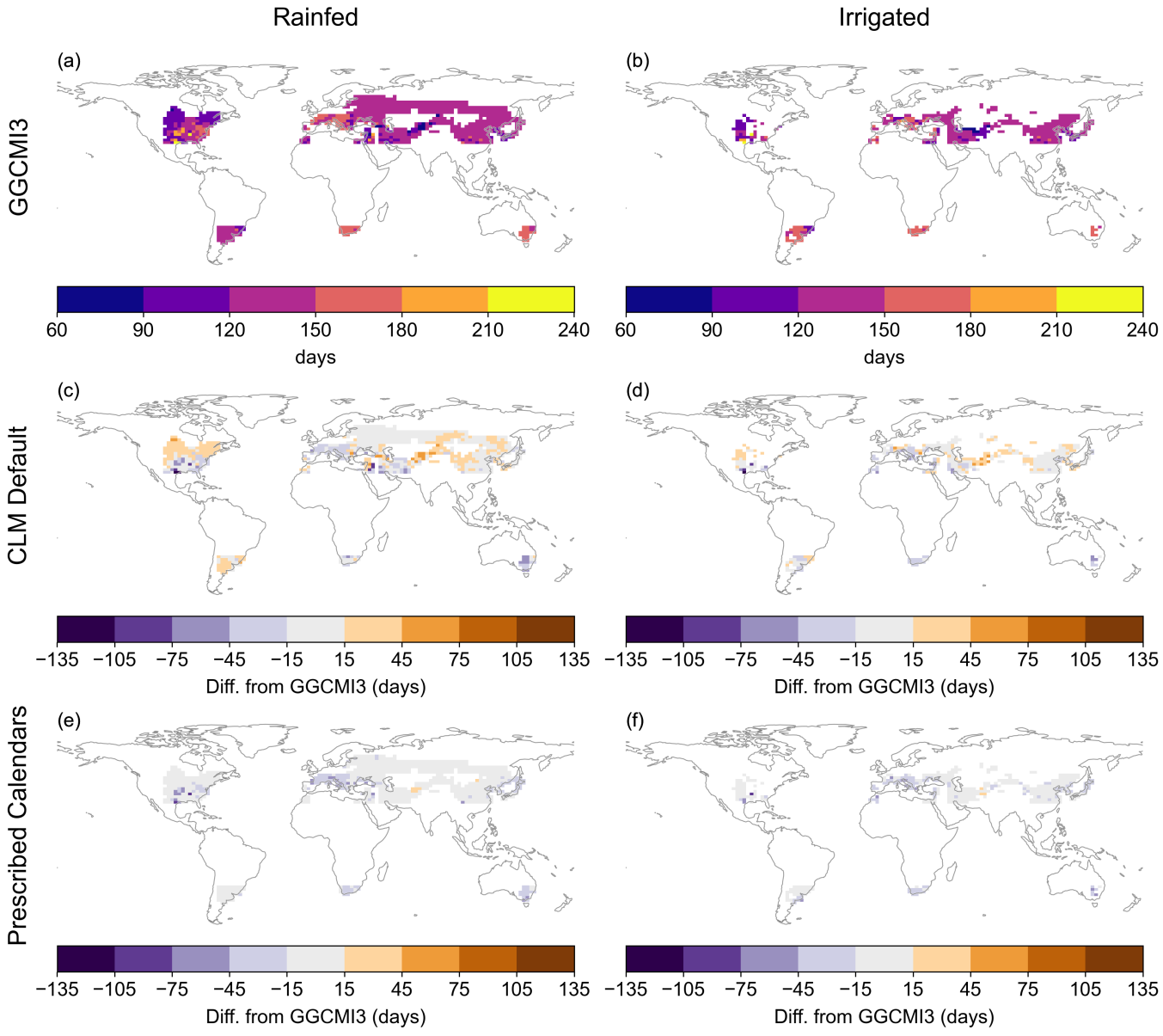

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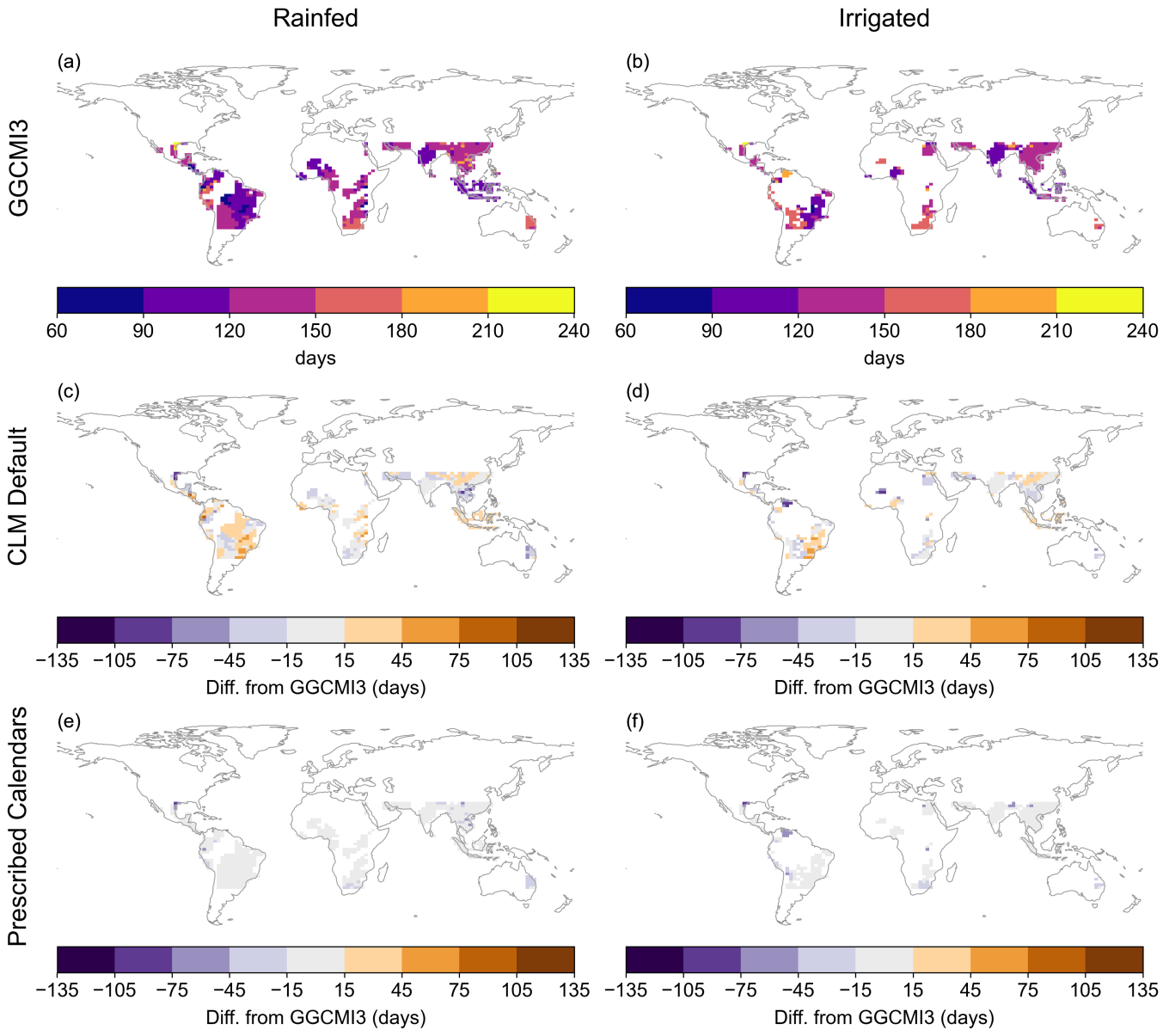

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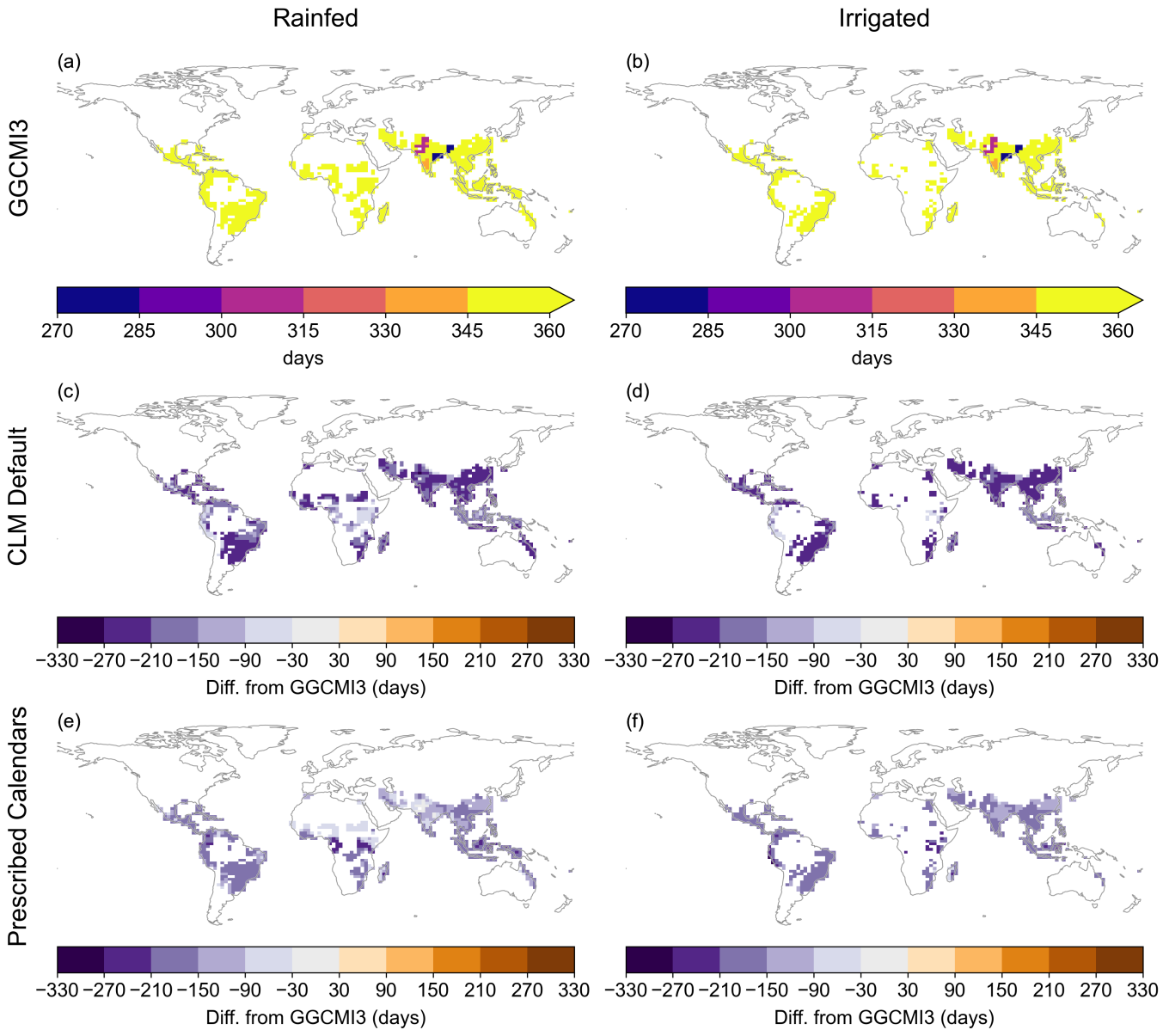

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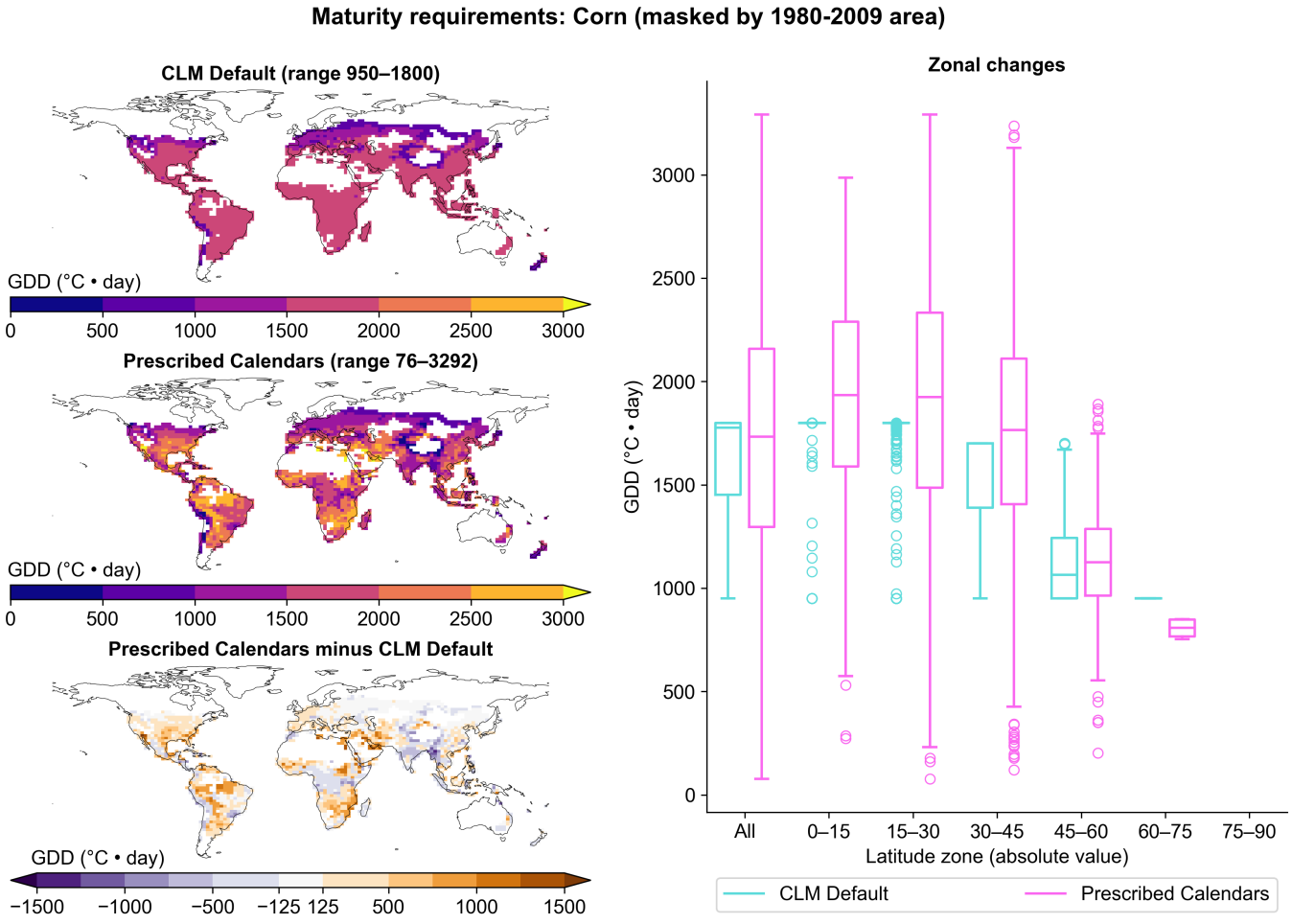


Figure S16. Maturity requirements for corn (area-weighted average of rainfed and irrigated, temperate and tropical). Box plots compare, at different latitude zones, distributions of maturity requirements for CLM Default (cyan) and Prescribed Calendars (pink). Boxes' central lines are medians, box edges are 25th and 75th percentiles, and whiskers extend to the minimum and maximum of the data excluding any outliers (points outside the median ± 1.5 times the interquartile range; circles). Equivalent of Fig. 4 in main text (spring wheat).

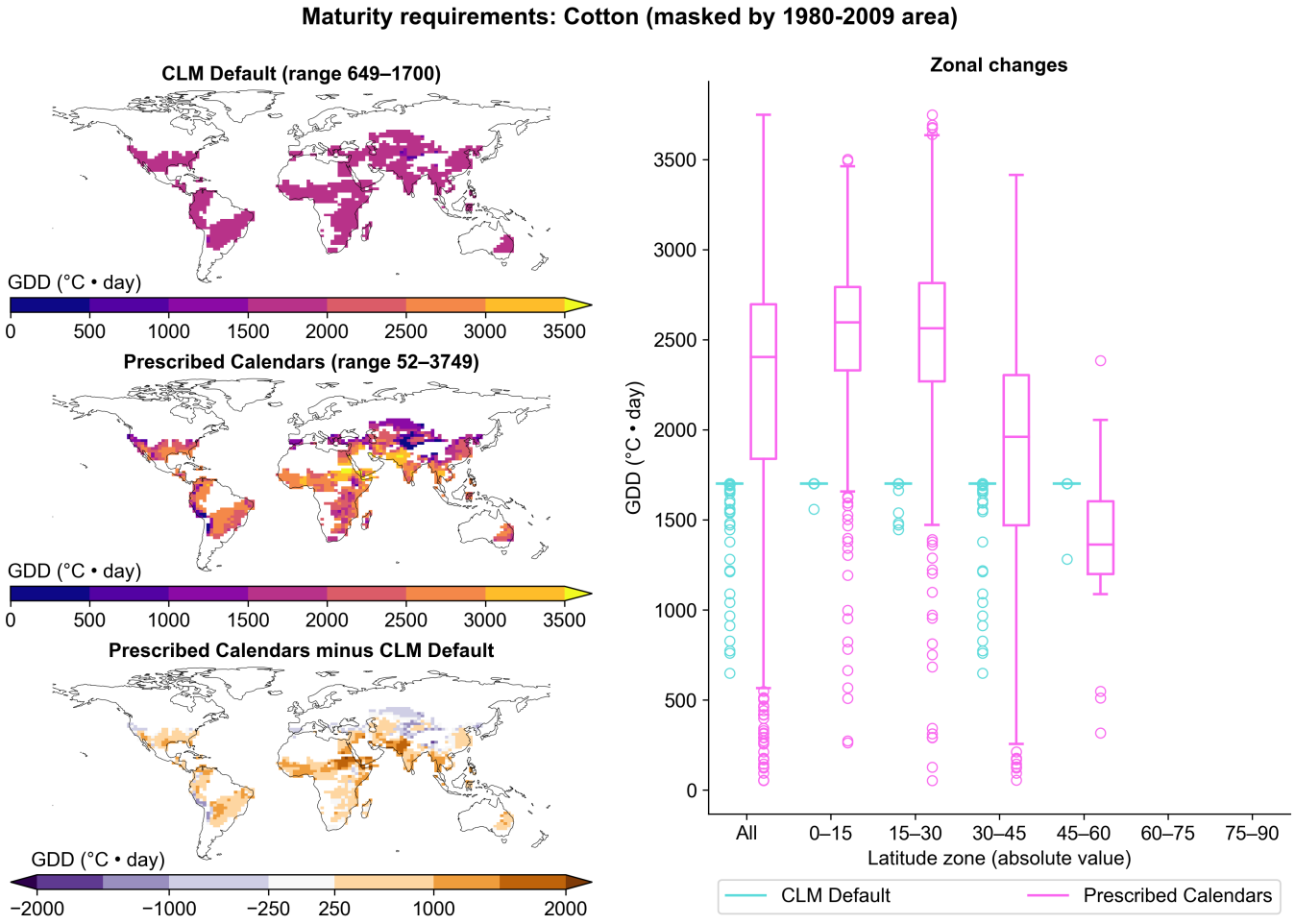
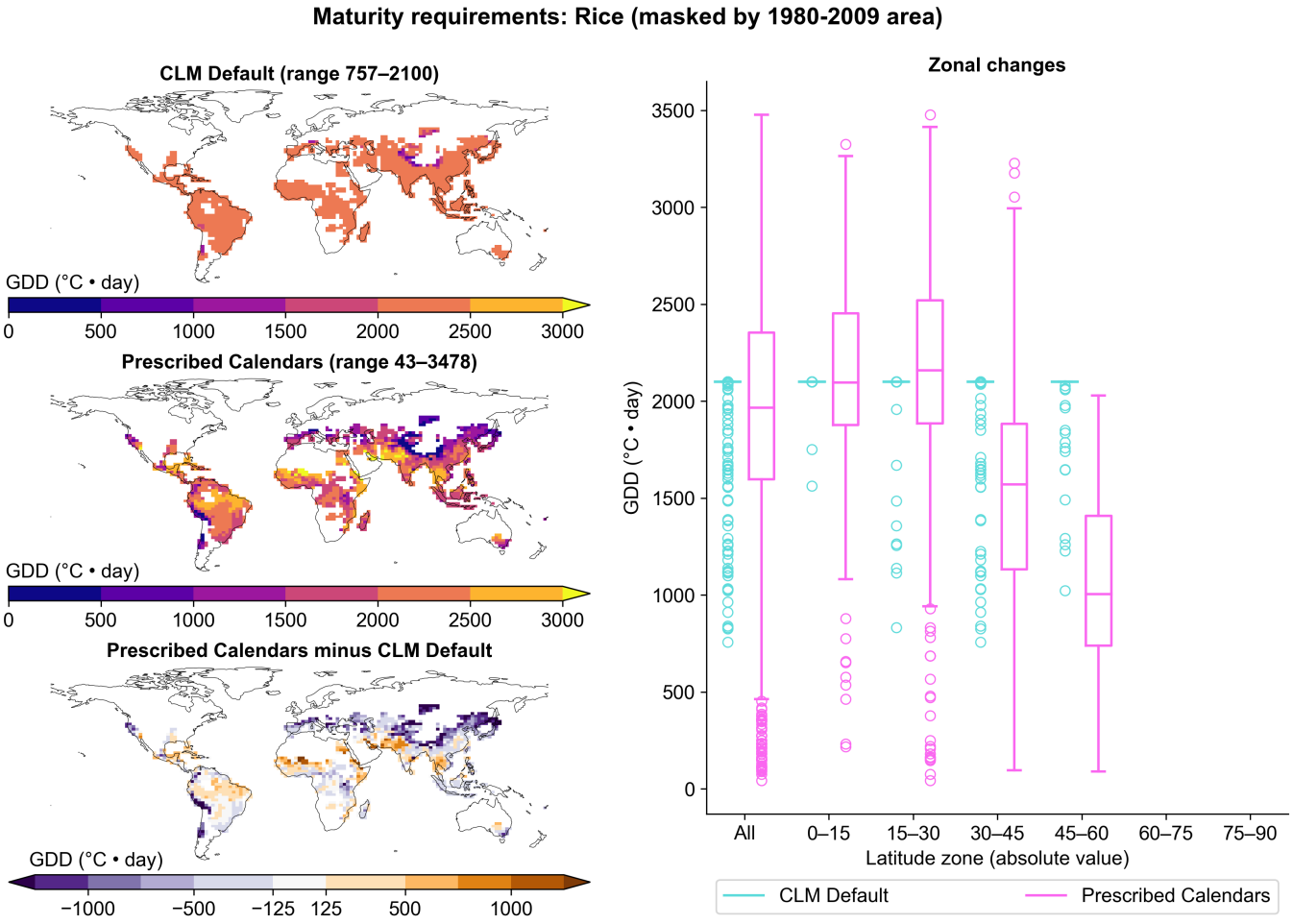


Figure S17. Maturity requirements for cotton (area-weighted average of rainfed and irrigated). Box plots compare, at different latitude zones, distributions of maturity requirements for CLM Default (cyan) and Prescribed Calendars (pink). Boxes' central lines are medians, box edges are 25th and 75th percentiles, and whiskers extend to the minimum and maximum of the data excluding any outliers (points outside the median ± 1.5 times the interquartile range; circles). Equivalent of Fig. 4 in main text (spring wheat).



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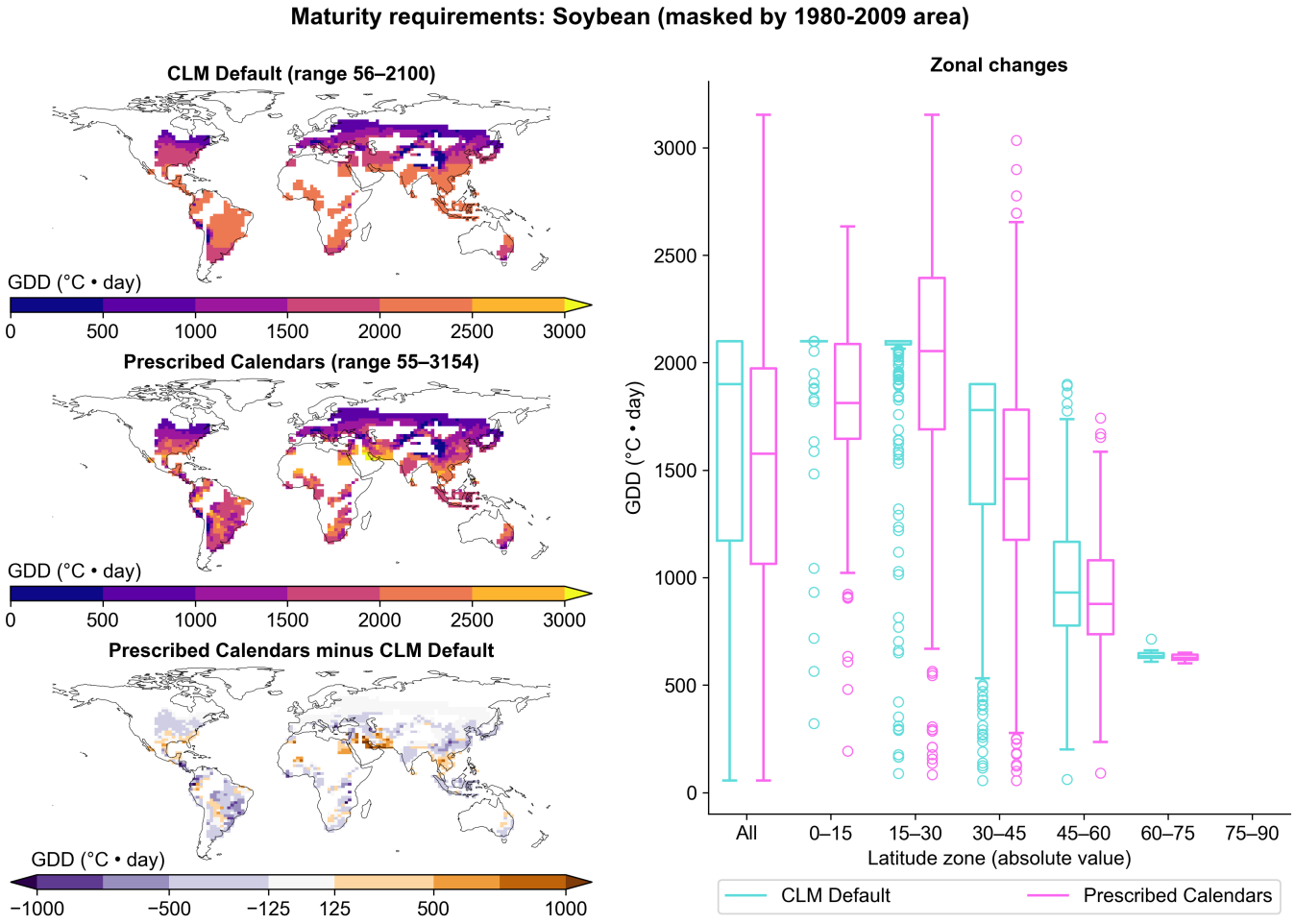

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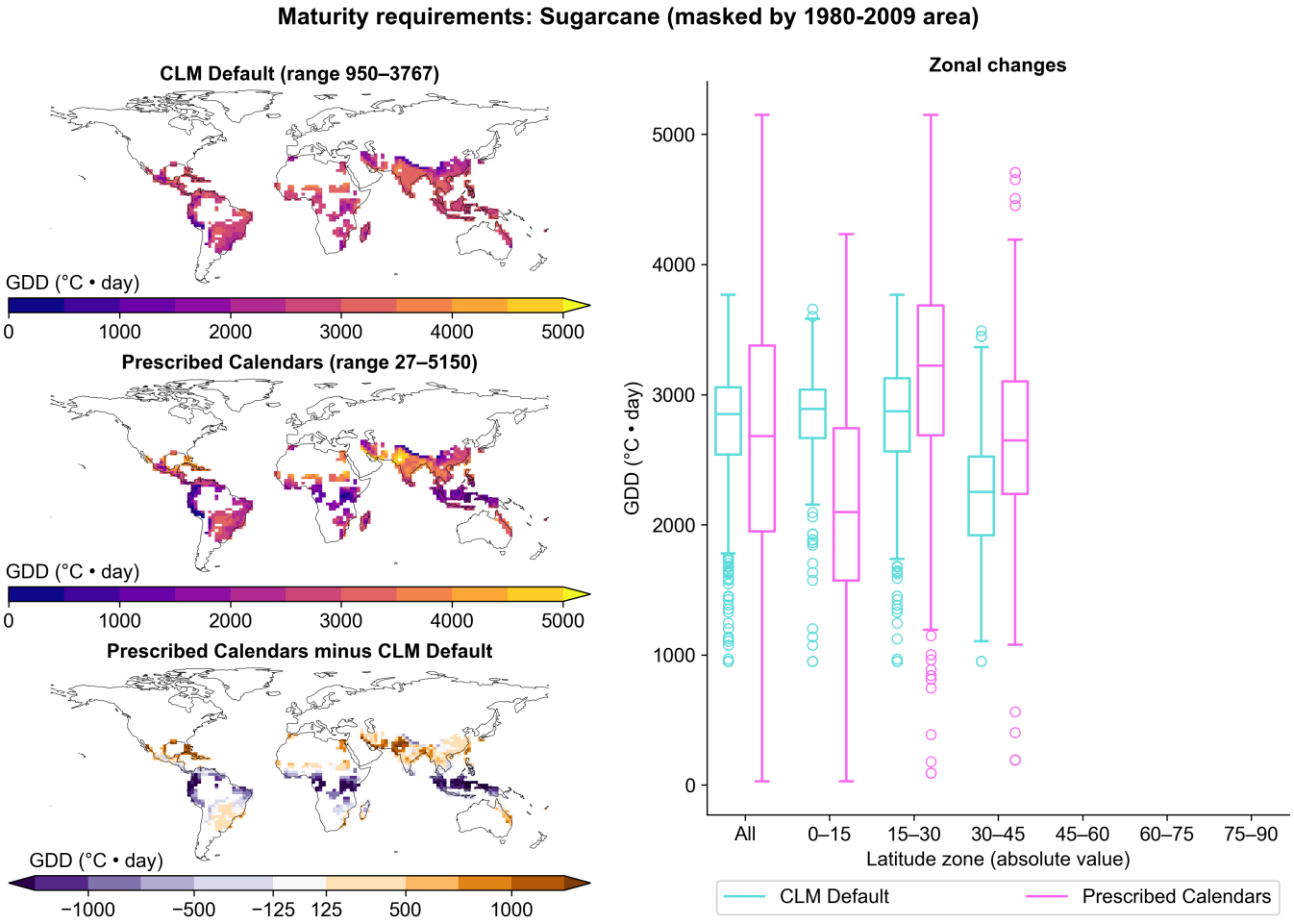

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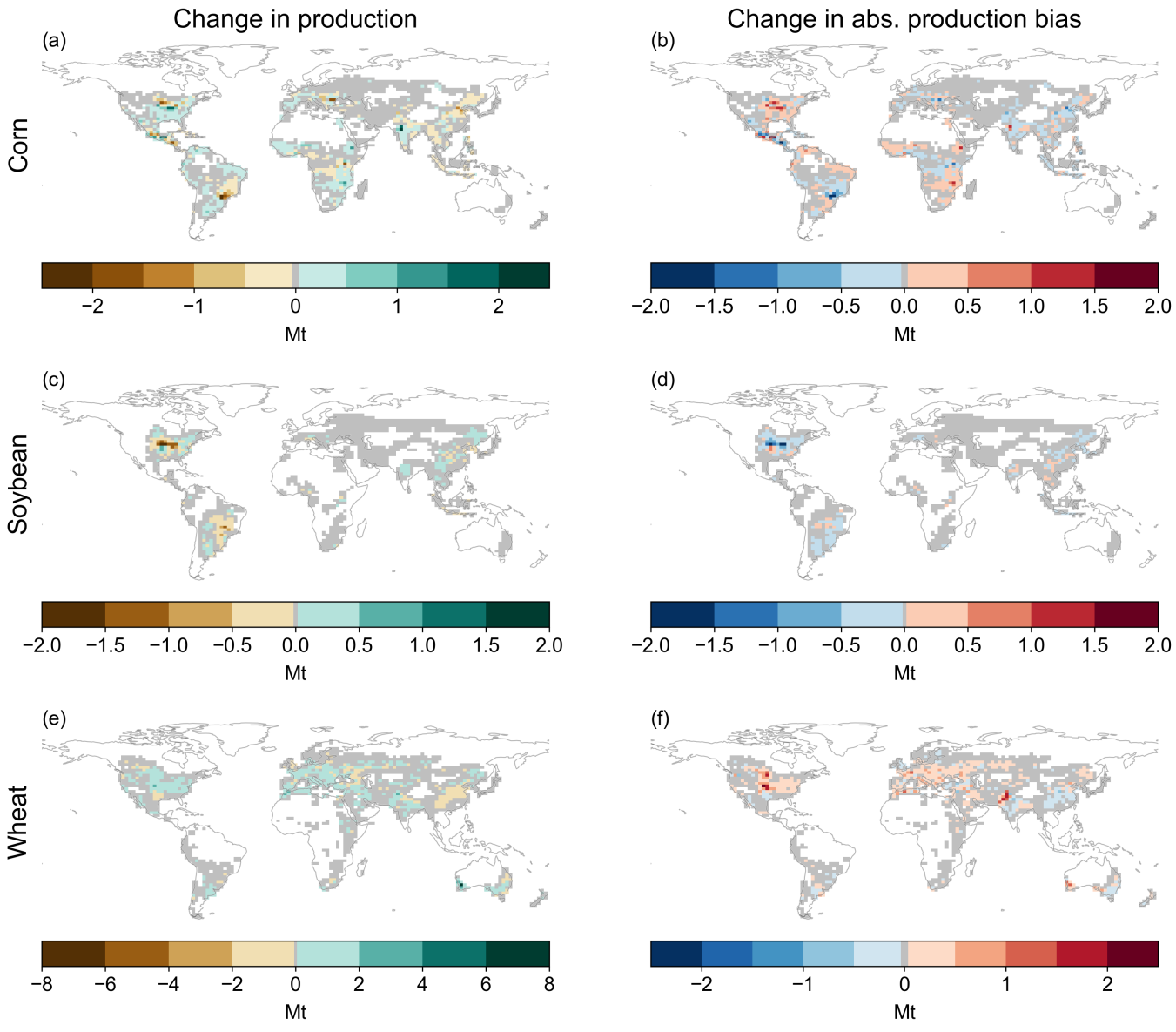


Figure S21. Spatial distribution of mean (1980–2009) difference (Prescribed Calendars minus CLM Default) in (a, c, e) production and (b, d, f) absolute production bias relative to EarthStat for corn, soybean, and spring wheat. Corresponds to Fig. 6 in main text (cotton, rice, and sugarcane); see that figure's caption for more details.

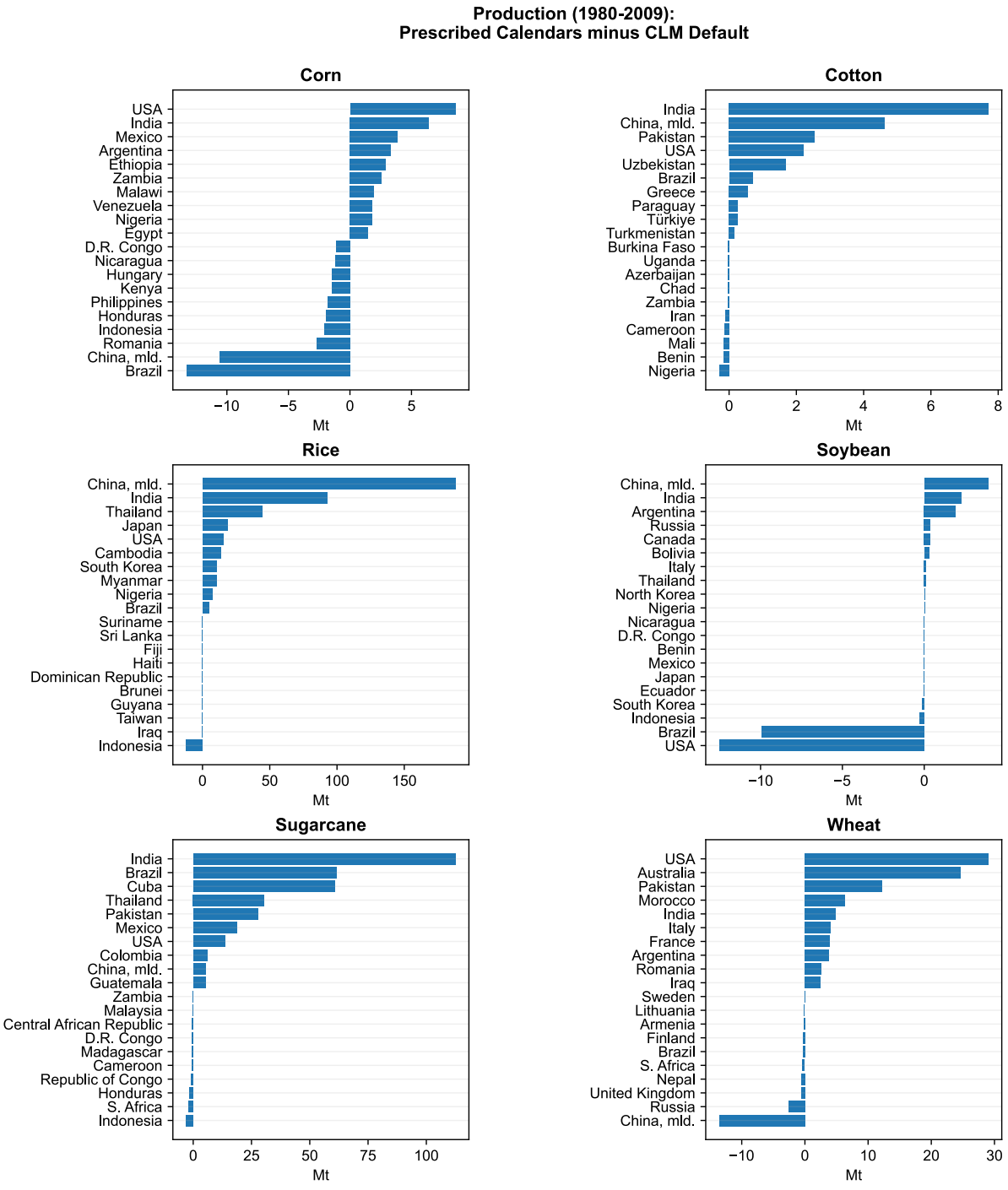
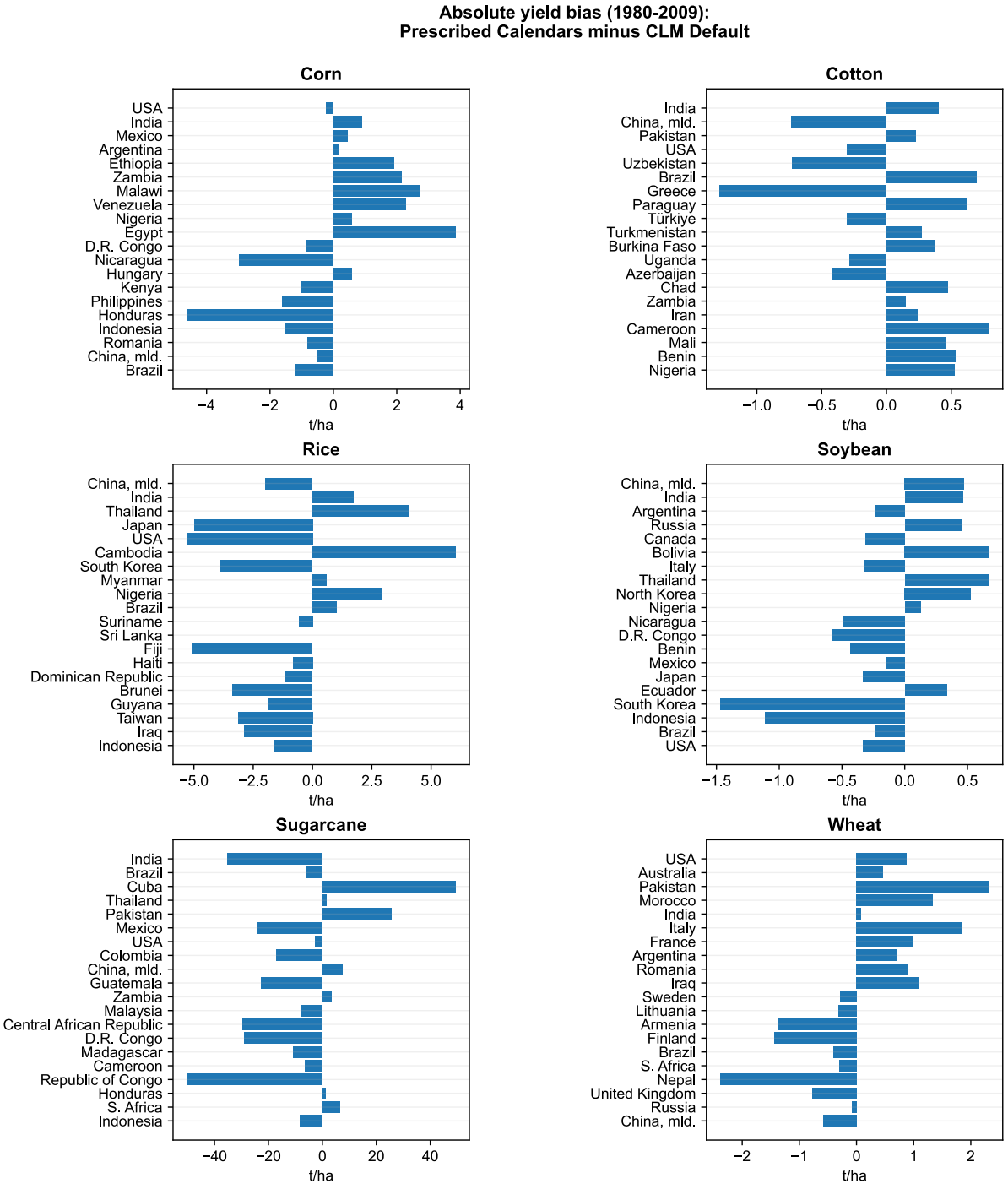


Figure S22. Countries contributing the most to change in mean 1980–2009 production of each crop when moving from CLM Default to Prescribed Calendars. Plots show the 10 most positive (production higher in Prescribed Calendars) and negative (production higher in CLM Default) countries.



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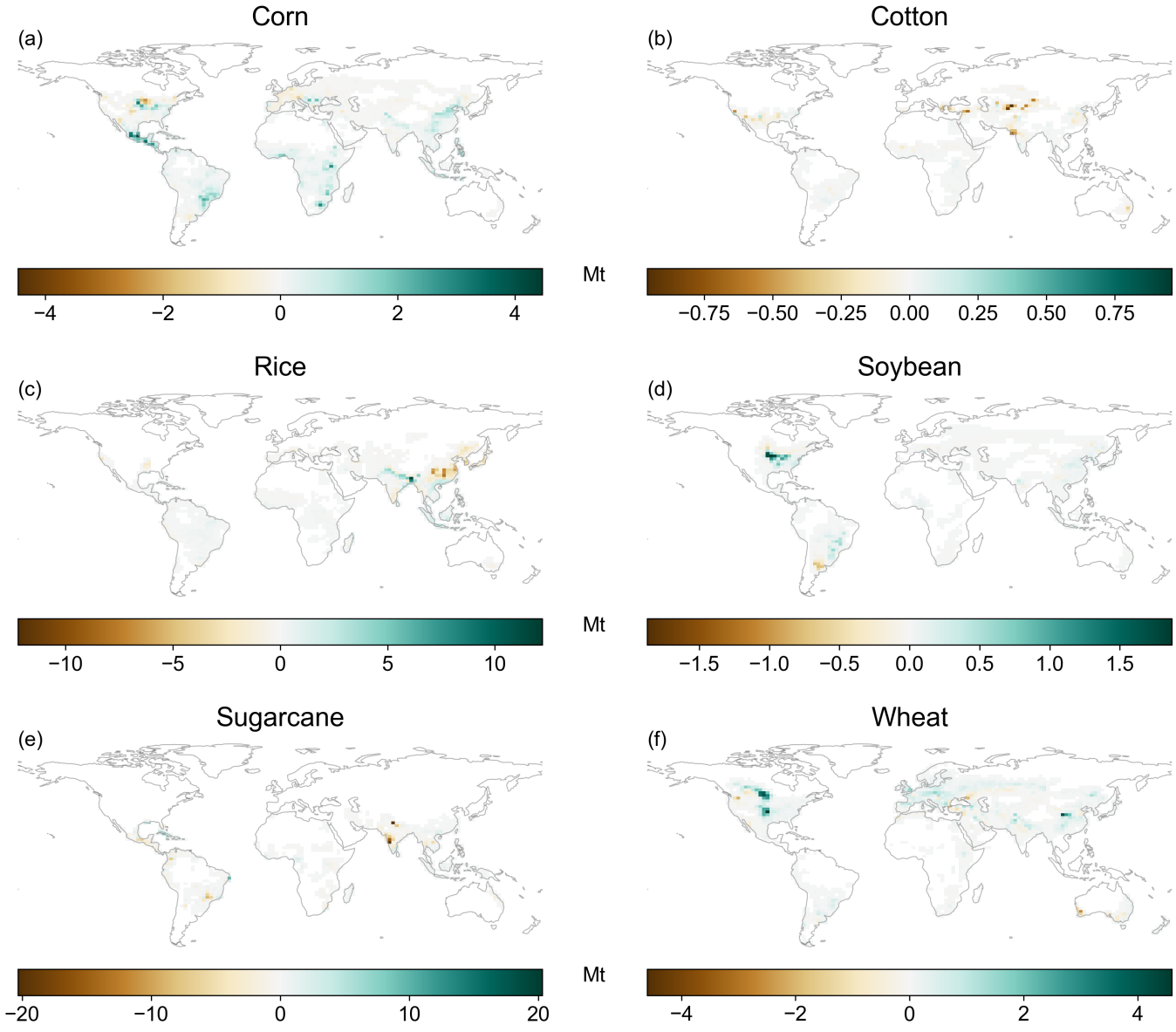
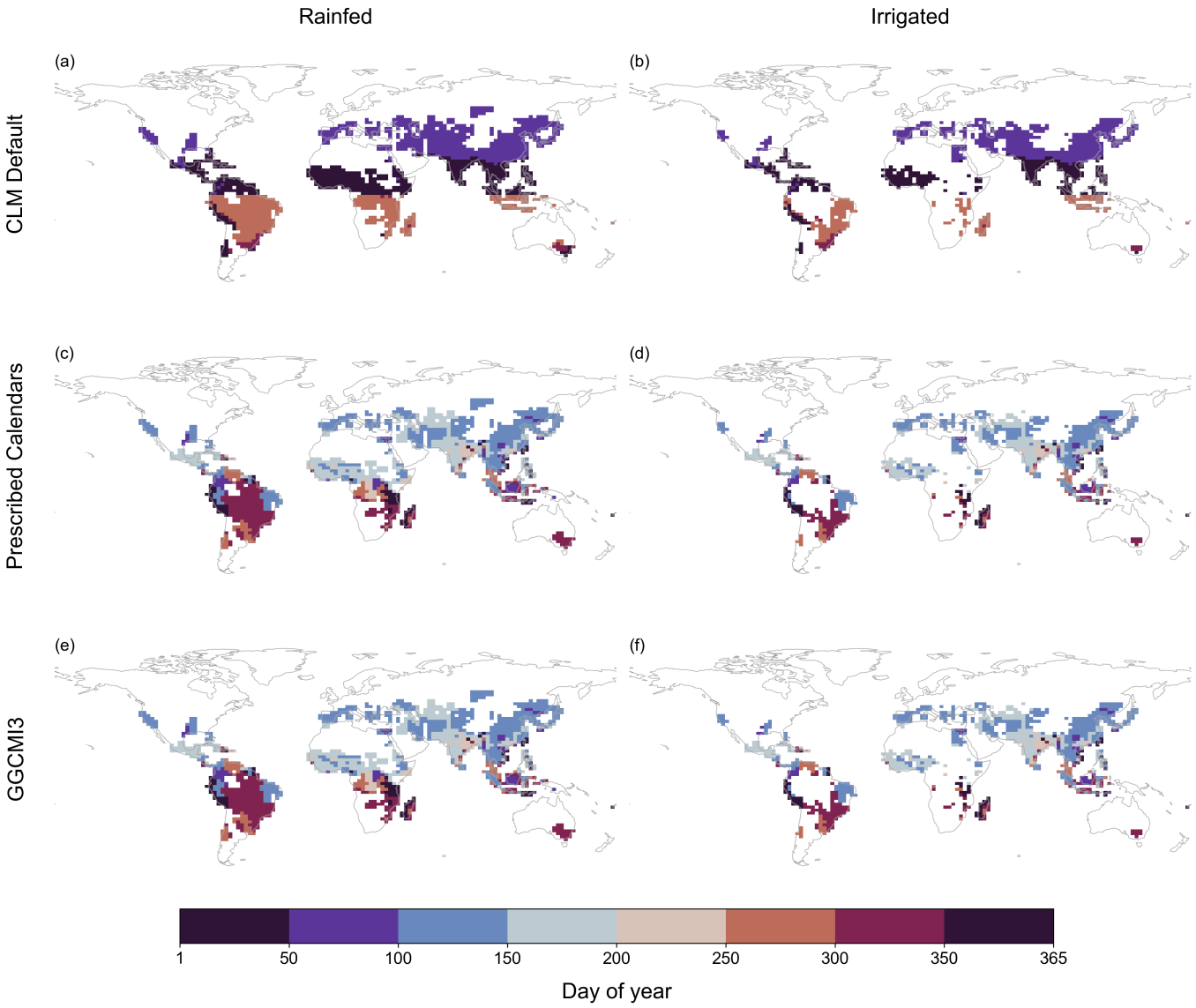


Figure S24. Bias of CLM Default mean 1980–2009 production relative to EarthStat. Positive values indicate overestimates in CLM Default.



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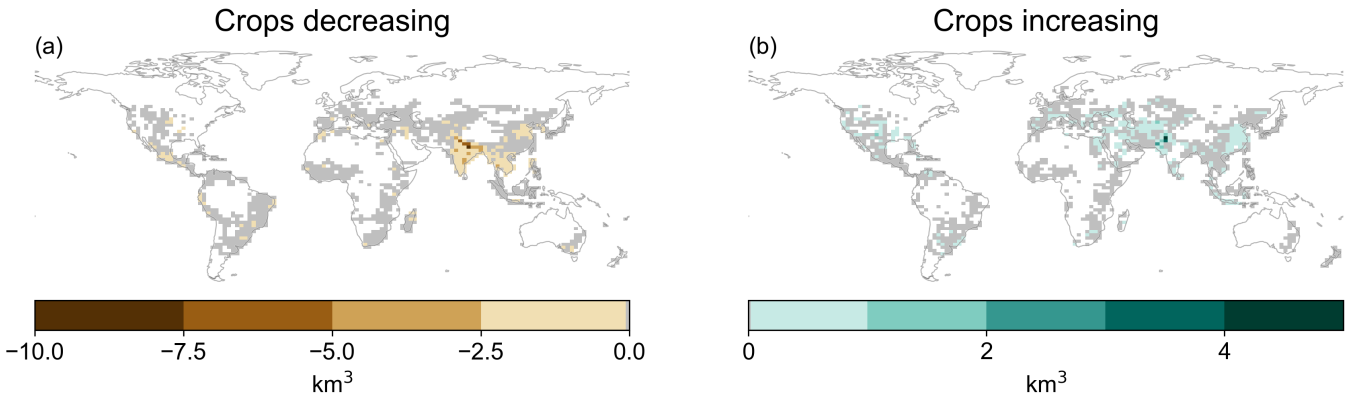

Figure S26. Global distribution of difference in mean annual irrigation demand among the six crops analyzed here, broken into positive and negative components. In each gridcell, the maps show the sum of all crops with (a) decreased and (b) increased irrigation demand under Prescribed Calendars. (See Fig. S27 for maps of individual crops.) Gray cells are those outside the top 95% of cumulative absolute values in each map. White cells in each map had no crop whose irrigation amount changed in the respective direction (i.e., no crop had decreasing [a] or increasing [b] irrigation).

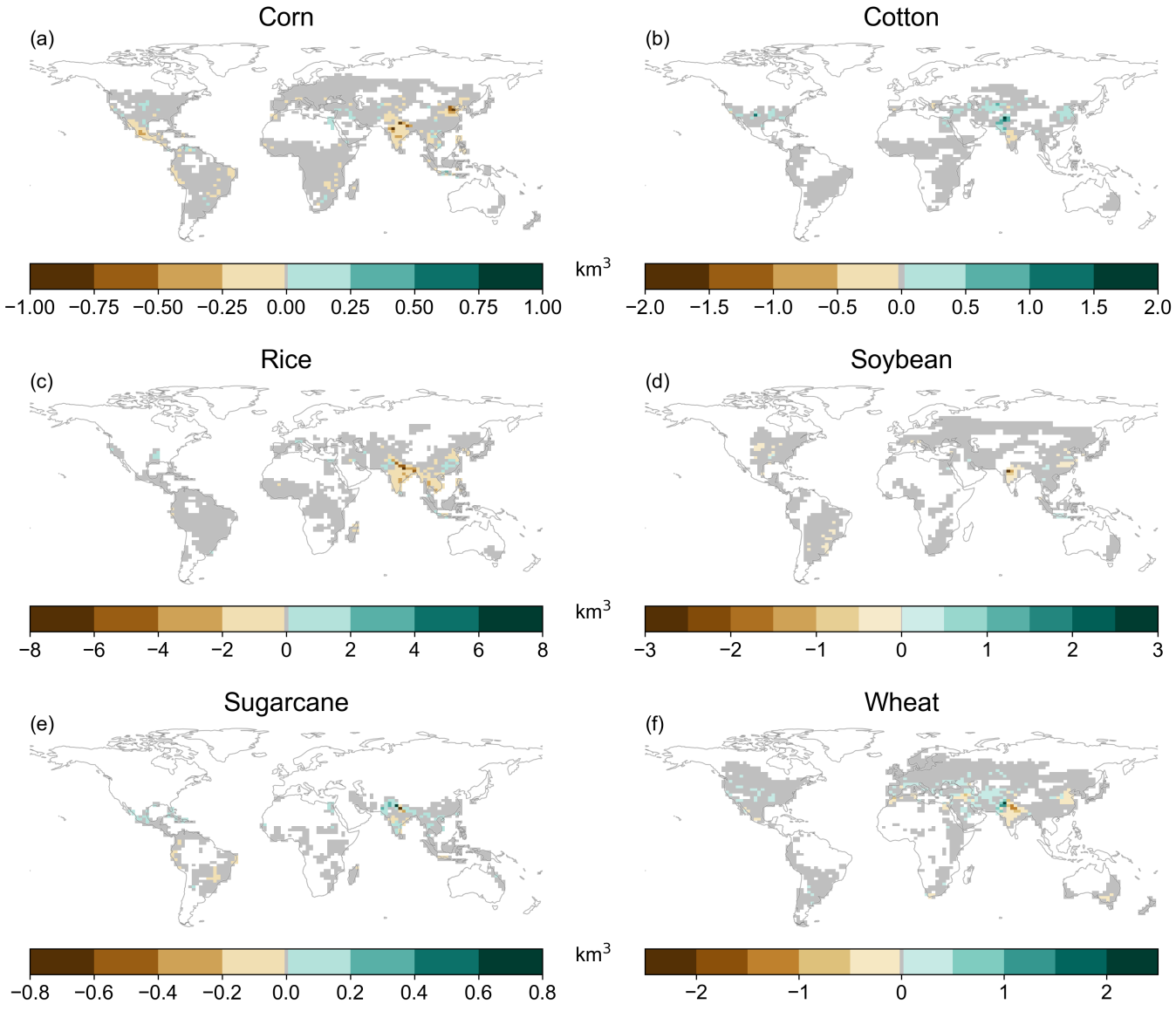

Figure S27. Global distribution of changes in mean annual irrigation demand (Prescribed Calendars minus CLM Default) among the six crops analyzed here. This is the crop-wise breakdown of Fig. 11 in the main text. Gray cells are those outside the top 95% of cumulative absolute values in each map.