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SUPPLEMENTARY INFORMATION
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Effects of double cropping on summer climate of the North China Plain and neighbouring regions

Simulated temperatures

The differences in the magnitude between the simulation and the observation may be related to model errors, especially in the formulations for representing soil/plant processes and/or realistic environmental conditions, to comparing point observations against model grid data that represent average values over a large area (54 km × 54 km), or to both. In addition to different magnitudes of temperature sensitivity between observation and model, we briefly mention about the differences of temperature between SCR and DCR in model experiments that are not addressed in the observations. In model simulations, the mean temperature is higher at the DCR stations than at the SCR stations. This regional temperature differences is mainly explained by the discrepancy between the model terrain and the true terrain. Whereas the true terrain elevations averaged for the SCR and DCR stations are similar, the mean elevation is much higher for the SCR stations than the DCR stations in the model terrain by 156 m. The mean elevation difference between the SCR and DCR stations may have caused the mean temperature difference between the SCR and DCR stations in Fig. 3. As shown in Fig. 3, the mean temperature differences between the SCR and DCR stations remain similar in both CTR and EXP.

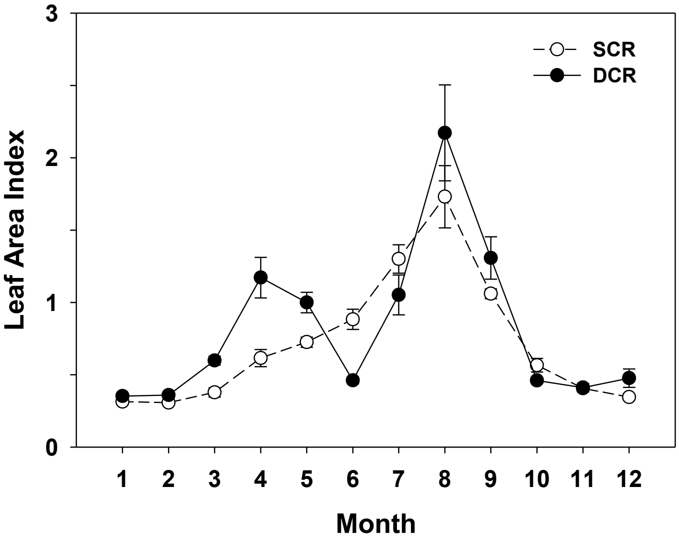
Simulated East Asian summer monsoon

We briefly examine model performance in terms of pattern correlations of the mean rainfall between GPCP and the simulation over the region indicated with the white box (25°–45°N and 105°–135°E) in Supplementary Fig. 2. We also include seasonal variations in the observed and simulated precipitation within the white box. All three coefficients of pattern correlations are statistically significant at the 99% confidence level, indicating that the simulation explains the mean spatial pattern of summer rainfall and monsoon over East Asia well. Also, the seasonal variations in the mean rainfall show statistically significant correlations (at the 99% confidence level). The above comparisons suggest that the simulation captures the seasonal evolution of the monsoon rainfall over the target region well.

Supplementary Figure lists

Supplementary Figure 1 | Composited annual cycle of observed leaf area index (LAI) for the period 1982–2005, over SCRs and DCRs.

Supplementary Figure 2 | Precipitation and circulation patterns during the inter-cropping period: (a–c) observed precipitation (and wind at 850 hPa) climatology, composite of precipitation in strong EASM years, and composite anomalies of precipitation in weak EASM years; (d–f) simulated precipitation (and wind at 850 hPa) climatology, composite of precipitation in strong EASM years, and composite anomalies of precipitation in weak EASM years; (g–i) seasonal variations in the observed and simulated precipitation within the white boxes (25°−45°N and 105°−135°E).



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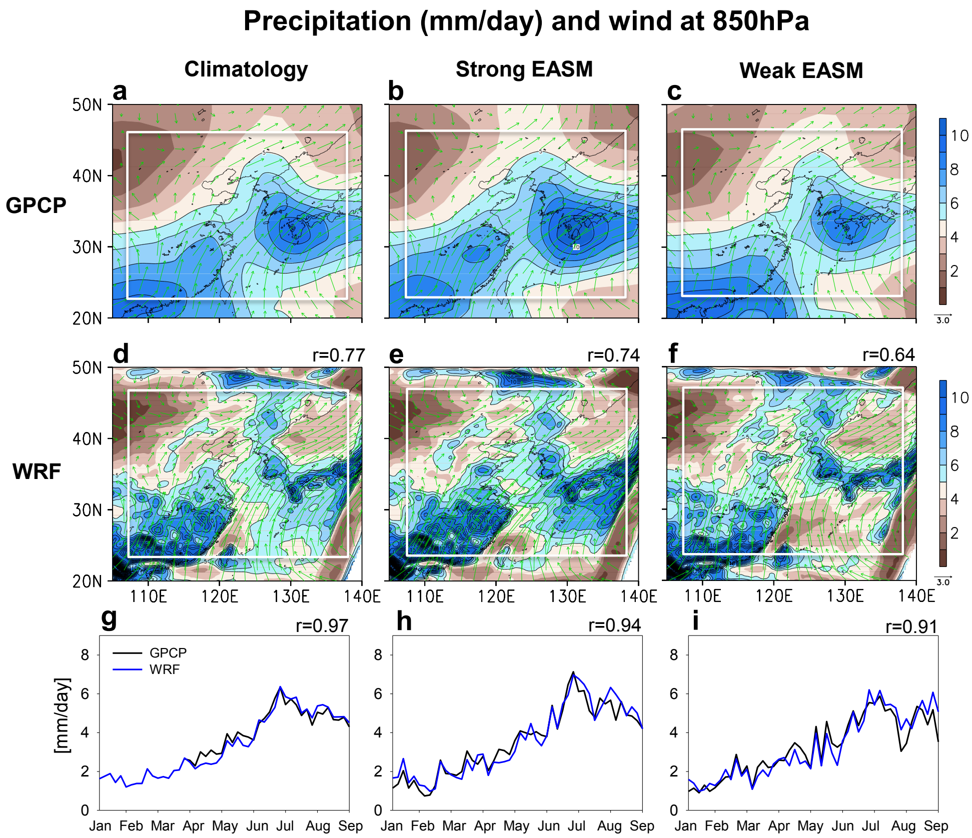

Supplementary Figure 2. Precipitation and circulation patterns during the inter-cropping period: (a–c) Observed precipitation (and wind at 850hpa) climatology, composite of precipitation in strong EASM years, and composite anomalies of precipitation in weak EASM years; (d–f) Simulated precipitation (and wind at 850hpa) climatology, composite of precipitation in strong EASM years, and composite anomalies of precipitation in weak EASM years; (g-i) Seasonal variations in the observed and simulated precipitation within the white boxes. (25°–45°N and 105°–135°E).