# Supporting Information

## Davin et al. 10.1073/pnas.1317323111

### SI Text

**No-Till Farming.** Since the rise of agriculture, tillage has been widely adopted throughout the world as a way to prepare the soil before crop planting. However, starting in the 1950s, practices aiming at reducing or suppressing tillage (no-till) have been progressively introduced to address agricultural sustainability issues (1). In no-till systems, harvest residues are not mixed with the top soil by tillage, thus resulting in a protective mulch at the surface reducing soil erosion and soil water losses (2). Other advantages may include reduction in fuel consumption, increased biological activity and soil fertility, and improved water infiltration capacity (1, 3), whereas a potential disadvantage of no-till farming is the increased dependence on herbicides (4).

No-till farming was first experimented with in the United States as a reaction to the mid-1930 "dust bowl" event and as a way to tackle soil erosion (1). Its adoption in North America as well as South America has been relatively rapid. Today, South and North America together represent about 85% of the total area under no-till farming in the world, whereas its adoption is still low in Europe (less than 2% of the world area under no-till farming) (3).

No-till management is also seen as a possible strategy for mitigating greenhouse gas emissions from agricultural land, because switching from conventional to no-till systems may provide a mechanism to sequester carbon in agricultural soils (1, 5, 6). In addition, conversion to no-till management tends to reduce fuel consumption and thus direct $CO_2$ emissions due to the suppression of the tillage operation (7, 8). A recent synthesis indicates that most existing studies, spanning a wide range of climate and soil-type conditions, show reduced $CO_2$ emissions following the adoption of no-till farming (6). However, there are still uncertainties concerning the Soil Organic Carbon (SOC) response to no-till. Some studies have suggested that the SOC sequestration potential of no-till may be lower than previously thought (9, 10). Moreover, some studies point to a large site-to-site variability in the SOC response, either interpreted as soil type-dependent (11) or related to the variability of the crop production response (10). In some cases, this large variability prevents the identification of a significant difference between no-till management and conventional tillage in terms of SOC sequestration (11, 12). Finally, even larger uncertainties remain concerning the effect of no-till on $N_2O$ and $CH_4$ emissions (6, 9).

**Role of Local Versus Large-Scale Feedbacks.** The perturbation imposed in our simulations is applied over all cropland areas in Europe (*Materials and Methods*). Although this relatively widespread perturbation may induce large-scale impacts, we note that the simulated local response to crop residue management is dominated by local rather than large-scale processes.

The mean change in daily maximum temperature for the 5% warmest days in summer (July–August) is −1.24 K for grid cells with more than 60% of cropland in experiment NOTILL compared with the control experiment (CTL). Over grid cells without cropland the mean change is only of −0.21 K (less than 20% of the change occurring over cropland areas). This indicates a relatively small impact on remote areas not directly affected by local forcing change. Therefore, we argue that the local temperature in our simulations is largely responding to local forcings and subsequent local feedbacks rather than to large-scale changes (whose effect may still be of the order of 20%). The relatively minor role of large-scale feedbacks in our simulations can be explained by the use of prescribed boundary conditions which strongly constrain the large-scale features in our regional model, in contrast to global models. Indeed, Regional Climate Models (RCMs) are by construction designed to simulate the effect of local processes and feedbacks under constrained large-scale conditions.

Based on this analysis, we conclude that it is justified to interpret the analyzed temperature anomalies as being mainly driven by local land management changes.

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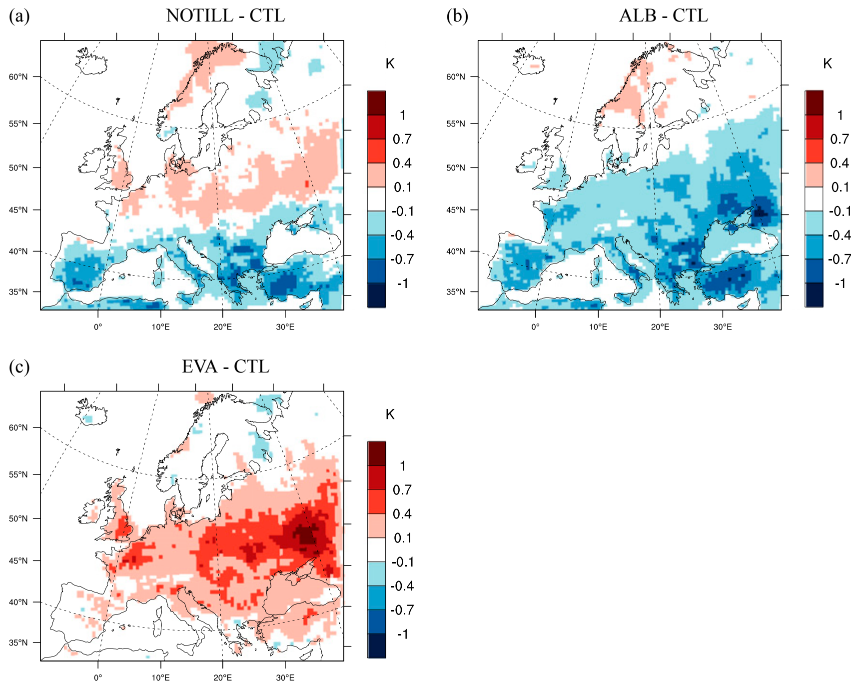


**Fig. S1.** Mean summer (July–August) change in 2-m temperature for experiments NOTILL (*A*), surface albedo (ALB) (*B*), and soil resistance (EVA) (*C*) in reference to CTL.

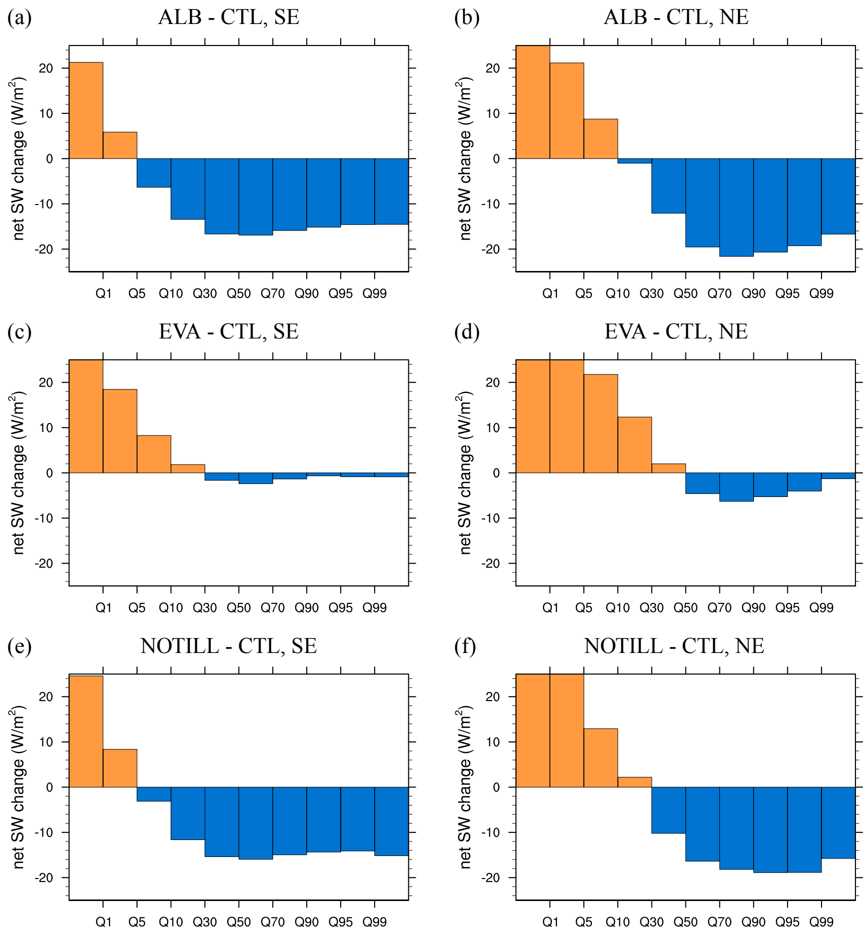


**Fig. S2.** Change in surface net shortwave radiation for experiments ALB (*A* and *B*), EVA (*C* and *D*), and NOTILL (*E* and *F*) in reference to experiment CTL for different quantiles of the daily maximum temperature distribution. Differences are calculated at each grid point with more than 60% of cropland and for each summer day (within July–August) over the period 1986–2009. Differences are then averaged for each quantile of daily maximum temperature defined based on experiment CTL. SE, southern Europe (below 45°N); NE, northern Europe (Above 45°N).

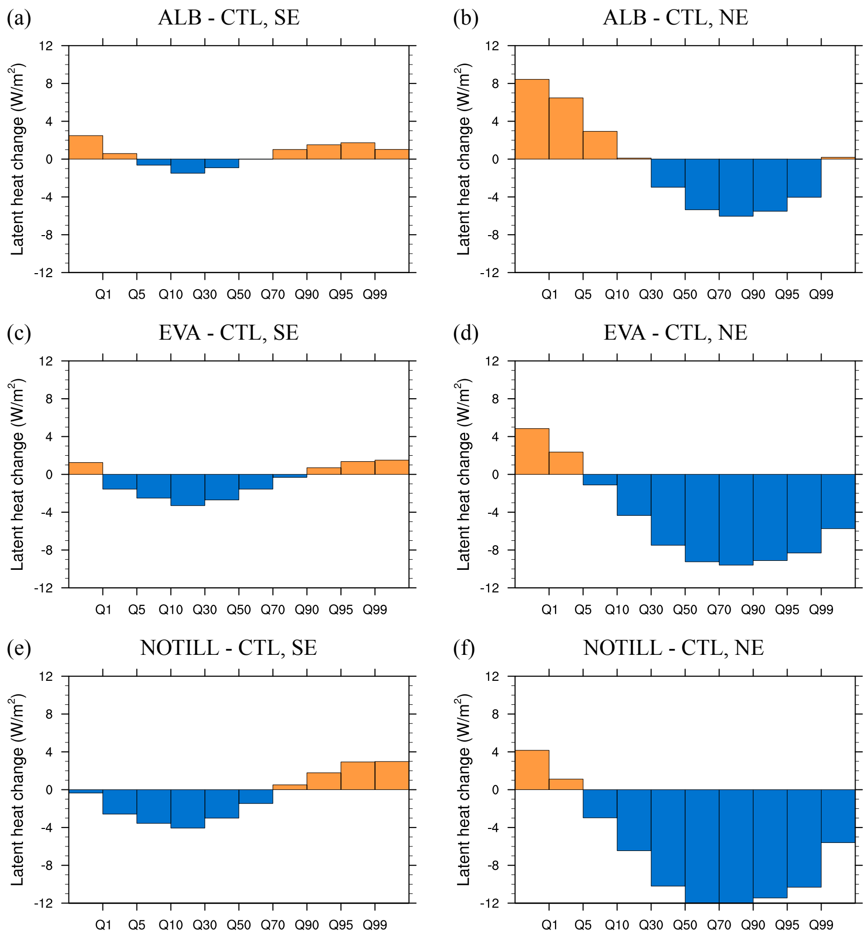


**Fig. S3.** Change in surface latent heat flux for experiments ALB (*A* and *B*), EVA (*C* and *D*), and NOTILL (*E* and *F*) in reference to experiment CTL for different quantiles of the daily maximum temperature distribution. Differences are calculated at each grid point with more than 60% of cropland and for each summer day (within July–August) over the period 1986–2009. Differences are then averaged for each quantile of daily maximum temperature defined based on experiment CTL. NE, northern Europe (Above 45°N); SE, southern Europe (below 45°N).