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Biogeophysical benefits of no-till agriculture for mitigating heat wave impacts

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Changes in agricultural practices are considered a possible option to mitigate climate change[1]. In particular, reducing or suppressing tillage (no-till) may have the potential to sequester carbon in soils, which could help slow global warming[1]. On the other hand, such practices also have a direct effect on regional climate by altering the physical properties of the land surface[2]. These biogeophysical effects, however, are still poorly known.

Here we show that no-till management increases the surface albedo of croplands in summer and that the resulting cooling effect is amplified during hot extremes, thus attenuating peak temperatures reached during heatwaves. Using a regional climate model accounting for the observed effects of no-till farming on surface albedo, as well as possible reductions in soil evaporation, we investigate the potential consequences of a full conversion to no-till agriculture in Europe. We find that the summer cooling from cropland albedo increase is strongly amplified during hot summer days, when surface albedo has more impact on the Earth's radiative balance due to clear-sky conditions. The reduced evaporation associated with the crop residue cover tends to counteract the albedo-induced cooling, but during hot days the albedo effect is the dominating factor. For heatwave summer days the local cooling effect gained from no-till practice is of the order of 2 degrees. The identified asymmetric impact of surface albedo change on summer temperature opens new avenues for climate engineering measures targeting high impact events rather than mean climate properties.

References:

[1] Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko (2007): Agriculture. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[2] Lobell, D. B., G. Bala, and P. B. Duffy (2006), Biogeophysical impacts of cropland management changes on climate , Geophys. Res. Lett. , 33 , L06708, doi:10.1029/2005GL025492.