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Observed land effects on characteristics of organised convection

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Characteristics of the land surface affect cloud development and growth through changes in heating and moistening of the lower troposphere, affecting convective stability and inducing mesoscale circulations in areas of differential heating. Our understanding of the degree to which the land surface may affect and spatio-temporally structure organised convection is still limited and predominantly based on idealised modelling. Focusing on West African mesoscale convective systems (MCSs) and using a combination of satellite observations and reanalysis data, we illustrate how mature, propagating MCSs exhibit surprisingly strong soil moisture sensitivity in intensity and extent. MCSs intensify as they propagate over drier soils on scales of the order of 200 km and upwards. At these scales, perturbed horizontal temperature gradients in the planetary boundary layer provide favourable conditions for MCS intensification through focusing moisture convergence within the West African Monsoon, and through enhanced wind shear, which helps to organise convection.
At the same time, we find that soil moisture patterns left behind by preceding MCSs can pose an important constraint on subsequent organised convection. Such land-storm feedbacks have implications for predictions of organised convection on time scales of hours to days, but may similarly contribute to increasing storm extent in the climate change context.

Primary authors: KLEIN, Cornelia (UK Centre for Ecology and Hydrology | University of Innsbruck, Austria); TAYLOR, Chris (UK Centre for Ecology and Hydrology); ANDERSON, Seonaid (UK Centre for Ecology and Hydrology)

Presenter: KLEIN, Cornelia (UK Centre for Ecology and Hydrology | University of Innsbruck, Austria)

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