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Simulation of daytime convective initiation in the Sahel: an evaluation of numerical weather forecast models with satellite data

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Daytime convective initiation is a common feature over land. The study presented by Gounou et al. (same EGU AS1.16 session) highlighted the important role of mesoscale surface features in this phenomenon over the Sahel. It also provides a great observational database of convective initiation events, with several thousands of cases identified with satellite data. Here, this database is further used to evaluate the simulation of daytime convective initiation by numerical weather forecast models.

First, the environment of these cases has been documented with meteorological analyses. This includes the local vertical thermodynamic and dynamic structure, boundary-layer properties and convective indexes, as well as surface properties (analysed land surface temperature and soil moisture). The ECMWF, ARPEGE-Tropiques and AROME analyses have been considered. All these products point to a wide variety of atmospheric conditions associated with convective initiations.

Forecasting convective initiation from these analyses remains a challenge as explored in the present study. To this end, daily forecasts of the previously sampled observed cases have been systematically analysed. The development of convection in the forecasts is diagnosed with 3-h (when available) or 6-h cumulative rainfall fields simulated within one degree of the observed initiation, and the sensitivity to this threshold is considered.

In line with previous studies, convection appears to be initiated too early in several cases, especially with ARPEGE-Tropiques. However, for a number of cases, convection does not occur at all in the forecasts. This is particularly obvious for the ECMWF simulations which underestimate convection in the Sahel during the monsoon. Overall, convective initiations appear to be more sensitive to the atmospheric environment in the forecasts than in the observations.

Forecasts were also provided by AROME during the AMMA 2006 SOP over part of the region. The simulations were performed with a finer horizontal resolution (5 km instead of a few tens for the other models) but this does not significantly improve the forecast of convective initiation. On the other hand, the location of initiations appear to be related to simulated surface heterogeneities which do not coincides with observed ones. This will be illustrated for a few cases.