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Two tornado events in Germany: Ingredients-based approach and cell merging

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During May 5th, 2015 and September 4th, 2016 (hereinafter referred to as “the 5th” and “the 4th”) the general synoptic weather pattern over Germany was optimal for the development of severe thunderstorms. On each of the two days an eastward moving cold front replaced a modestly unstable prefrontal air mass with dry and stable postfrontal air from the west. Both days also featured a long-lasting favorable spatiotemporal overlap of ingredients like strong shear and moderate instability. However, in the end only small time-frames occurred where thunderstorms were able to produce tornadoes.

The poster highlights different topics. The first focus resides on the overall synoptic and mesoscale conditions which resulted in tornadic thunderstorms over Mecklenburg in northern Germany during the evening hours of the 5th and amongst others over east Thuringia during the evening hours of the 4th. With the ingredients-based methodology we highlight the favorable environment for organized convection on both days. Another point of interest will be to analyze which changes in the mesoscale environment induced the short window of opportunity for thunderstorms to become tornadic in both events. Did signs in the surface and remote sensing data as well as the local area models (ICON-EU and Cosmo-DE, -EPS) exist which indicated an increasing tendency for the organization of thunderstorms during the near term forecast?

Another focus resides on the event of the 5th, when a thunderstorm ahead of the eastward moving cold front merged with the line of storms that came along with the cold front. The following questions arise: What caused the development of the supercell and its fast intensification during the phase of merging with the cold front? What in turn caused the storm to become tornadic and how did the incoming line of thunderstorms influence this change in intensity? Cell merging is a term which is used in different contexts. On the one hand, it describes the merging of separate radar signatures (Lee et al. 2006), on the other hand the fusion of updrafts (Westcott 1994). In general, this process is often associated with storm intensification and in some cases it also results in an enhanced probability for tornado development. This exactly happened during the event of the 5th as low- and mid-level rotation ramped up with subsequent tornado reports.

The purpose of the poster is to sensitize forecasters to the ingredients for the explosive development of thunderstorms and that mesoscale impacts like cell merging could result in rapid storm organization.

References:
Lee, B.D., B.F. Jewett and R.B. Wilhelmson, 2006: The 19 April 1996 Illinois tornado outbreak. Part II: Cell mergers and associated tornado incidence. Wea. Forecasting, 21, 449-464.

Westcott, N., 1994: Merging of convective clouds: Cloud initiation, bridging and subsequent growth. Mon. Wea. Rev., 122, 780-790