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The European Storm Kyrill in January 2007: Synoptic Evolution, Meteorological Impacts and Some Considerations with Respect to Climate Change

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The synoptic evolution and some meteorological impacts of the European winter storm Kyrill that swept across Western, Central, and Eastern Europe between 17 and 19 January 2007 are investigated. The ferocity and large storm damage associated with Kyrill is explained based on synoptic and mesoscale environmental storm features, as well as on comparisons to previous storms. Kyrill appeared on weather maps over the U.S. state of Arkansas about four days before it hit Europe. It underwent an explosive intensification over the western North Atlantic Ocean while crossing a very intense zonal polar jet stream. A superposition of several favourable meteorological conditions west of the British Isles caused a further deepening of the storm when it started to affect Western Europe. Evidence is provided that a favourable alignment of three polar jet streaks and a dry air intrusion over the occlusion and cold fronts were causal factors in maintaining Kyrill's low pressure very far into Eastern Europe.

Kyrill, like many other strong European winter storms, was embedded in a pre-existing, anomalously wide, north-south surface pressure gradient field. In addition to the range of gusts that might be expected from the synoptic-scale pressure field, mesoscale features associated with convective overturning at the cold front are suggested as the likely causes for the extremely damaging peak gusts observed at many lowland stations during the passage of Kyrill's cold front. Compared to other storms, Kyrill was by far not the most intense system in terms of core pressure and circulation anomaly. However, the system run into a pre-existing strong MSLP gradient located over Central Europe which extended into Eastern Europe. This fact is considered determinant for the anomalously large area affected by Kyrill.

Additionally, considerations of windiness in climate change simulations using two state-of-the-art regional climate models driven by ECHAM5 indicate that not only Central, but also eastern Central Europe may be affected by higher surface wind speeds at the end of the 21st century. These changes are partially associated with the increased pressure gradient over Europe which is identified in the ECHAM5 simulations. Thus, with respect to the area affected, as well as to the synoptic and mesoscale storm features, it is proposed that Kyrill may serve as an interesting study case to assess future storm impacts.