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A kinetic-energy budget of the winter storm "Klaus" (24th of January 2009)

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The European wind storm "Klaus" led to large damages and disasters in the southwest of France and the northern part of Spain in January 24 2009, killing 6 people in France and 17 in Spain. Its strength was particularly unusual with exceptional gusts reaching 45 m/s along the French Atlantic coast. The aim of our study is more precisely to analyze the formation of the storm and its associated strong wind speeds in the low levels of the troposphere by making a kinetic-energy budget. The data used in our study is from the operational analysis of the 4DVAR Météo-France system.

The dynamical properties of "Klaus" are first compared with those of "Martin", the previous strongest storm that hit the southwestern region of France in December 27 1999. The timing of the baroclinic interaction with the upper levels is shown to be very different between the two storms. Then, a detailed kinetic-energy budget of "Klaus" is made by decomposing the flow into a high- and a low-frequency part. The redistribution of high-frequency kinetic energy by the horizontal ageostrophic geopotential fluxes south of the cyclone center is one of the key feature of "Klaus". This term could explain the quite late formation of strong gusts almost 18 hours after the mature phase of the baroclinic interaction. Finally, a comparison with the kinetic-energy budget of an idealized surface cyclone is made in the context of the two-layer model to better understand the physical processes associated with the ageostrophic geopotential fluxes.