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Video

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Cold Pools in a Convection-Resolving Model

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The representation of moist convection (thunderstorm and rain showers) in climate models represents a major challenge, as this process is usually approximated due to the lack of appropriate computational resolution. Here we use a GPU-enabled regional climate model to conduct a 10-year long integration covering Europe.

The animation presents a day-long episode in July 2006 from the simulation featuring developing moist-convective cells and their associated cold pools. Cold-pools are formed by cold negatively-buoyant air, stemming from evaporation of falling hydrometeors. The associated downdrafts penetrate into the planetary boundary layer and locally enhance the variability of the moisture, temperature and wind fields.

Here we focus on a subdomain located over the Bavarian Forest. It corresponds to the black rectangle indicated at the beginning of the animation. On display are: On the upper-left-hand side precipitation rate [mm/h] and clouds, on the lower-left-hand side vertical wind at 900 hPa [m/s] and terrain contours [100 m contour], on the upper-right-hand side Temperature at 900 hPa [°C], and lower-left-hand side relative humidity at 900 hPa [%]. Please note that the jumping behavior of the clouds in the upper-left-hand panel is due to the visualization method used for clouds. It is based on a diagnostic field of the models radiation scheme, which itself is computed at a lower frequency than the frame rate of the animation.

The simulation uses a version of the Consortium for Small-Scale Modeling (COSMO v4.19) weather and climate model capable of running on heterogeneous hardware architectures. The simulation has been computed at the Swiss National Supercomputing Centre (CSCS) on 144 nodes of the Piz Daint supercomputer. Currently each node in this machine is equipped with an Intel SandyBridge CPU and a NVIDIA Tesla K20X GPU. The computational mesh employed here uses 1536x1536x60 grid points.