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A physically-based robust definition of convectively generated density currents : detection and characterization in convection-permitting simulations

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In this paper, a conceptual model to dene density currents is proposed. Based on theory, observations and modelling studies, we dene convective density currents as 3D coherent structures with an anomalously cold core, an adjacent wind gust and two vertical layers: a well-mixed one near the surface and a stratied one above. With this definition, a methodology to identify and label individual density currents in convection permitting simulations is designed. The method is illustrated through its application to four distinct cloud scenes issued from a convetion-permitting simulation. From this methodology, new dynamic, thermodynamic and geometric features related to the density currents imprint on the Planetary Boundary Layer are revealed. The method is found to be i) robust in time, ii) relevant in distinct convective regimes, iii) relevant in land and oceanic situations and iv) adapted to both Cloud Resolving Models and Large Eddy Simulations. It also provides proxies such as the number, the spatial coverage, the mean radius and the mean velocity of density currents, from which a detailed analysis of their role in convection life-cycle and spatial organization could be performed in the near future.