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A physically-based classification of Australian east coast cyclones

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The subtropical east coast region of Australia is characterized by the frequent occurrence of low pressure systems, known as east coast lows (ECLs). While the term "east coast" low refers to a broad classification of events, it has been shown that different ECLs can have substantial differences in their nature, being dominated by baroclinic and barotropic processes in different degrees, due to influences from both the tropics and the extra-tropics.

Here, after briefly discussing some selected cases studies representative of the differences in the ECL spectrum, we use two different diagnostics, the cyclone phase space and the limited area atmosphere energetics, to obtain a physically-based classification of east coast lows formation and intensification.

By focusing on the storms full three-dimensional structure we show that ECLs can be divided in three classes, according to their cold/warm/hybrid core nature, and that each of such classes exhibits distinct features in the genesis seasonal cycle and geographical pattern. In addition, we show that the signature in atmosphere energy conversions is linked both to the cyclone intensity – with explosively deepening ECLs associated with the strongest signal – and to the cyclone structure – with the influence of barotropic processes well visible in warm core cyclones.

The analysis will be extended to long-term series of storms detected in climate projections, in order to provide a physical interpretation of the changing statistics of ECLs. Moreover, we argue that the methodology outlined here, could provide insight in the study of cyclones in other basins characterized by the interplay of tropical and extra-tropical dynamics.