

Application of the ERA-Interim reanalysis to the energetics of a subtropical ‘hybrid’ low

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We have examined, with the ERA-Interim reanalysis dataset, new aspects of the genesis and partial tropical transition of a rare hybrid subtropical cyclone on the eastern Australian coast. The genesis mechanisms of ‘Duck’ (March 2001) were remarkably similar to the first South Atlantic hurricane (March 2004) (Pezza and Simmonds 2005). Lorenz energetics (Lorenz 1967) have been used in a number of analyses of intense cyclonic systems (e.g., Veiga et al. 2008, Pezza et al. 2010), and the approach is proving to be of immense value. We report here on an investigation which uses the Lorenz energetics method to diagnose the evolution of Duck.

Figure 1 shows the brightness temperatures in the developing phase of ‘Duck’ (at 0132 UTC 7 March 2001) just prior to the time it made its landfall. The image conveys the intensity of the system as well as the complex environmental conditions in which it was situated. Duck was a rare westward-propagating low which had a hybrid thermal structure partially driven by upper level baroclinicity and partially driven by tropical processes in association with strong surface heat fluxes. A broad range of properties of Duck were calculated during its lifetime using the cyclone tracking scheme of Simmonds and Rudeva (2012).

The environmental energetics analysis we have performed shows it was associated with a sharp barotropic conversion maxima just prior to the genesis, while a weaker peak occurred at the time the system first acquired an upper level warm core. The landfall was coincident with baroclinic conversions associated with thermal dissipation inland. Overall, the conversions during the developing phase were modest and not exclusively barotropic, explaining why the cyclone did not attain hurricane status although it had formed under similar conditions as the South Atlantic hurricane Catarina. The energetic analyses we undertook were conducted over multiple domains, and each revealed special insights into the relative influence of the various forcings. More details of these analyses can be found in Pezza et al. (2014).

References

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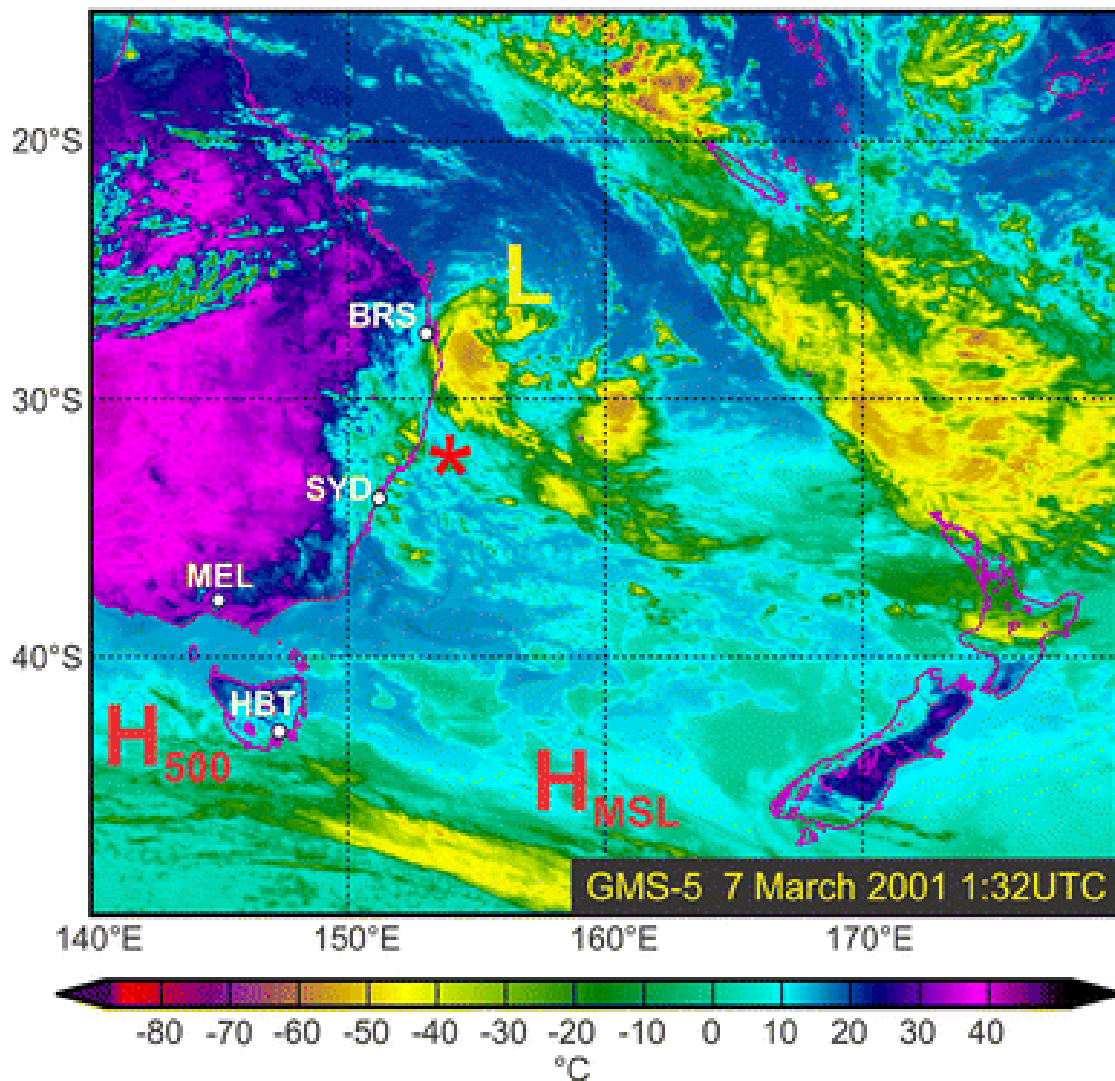


Figure 1: Brightness temperatures from GMS-5 image (over eastern Australia and the Tasman Sea) in the developing phase of ‘Duck’ (indicated with a yellow ‘L’) prior to landfall at 0132 UTC 7 March 2001.