Geophysical Research Abstracts
Vol. 18, EGU2016-15472, 2016
EGU General Assembly 2016


# Diabatic processes and the evolution of two contrasting extratropical cyclones

Oscar Martinez-Alvarado (1,2), Suzanne Gray (2), and John Methven (2)

(1) National Centre for Atmospheric Science - Atmospheric Physics, United Kingdom (O.MartinezAlvarado@reading.ac.uk), (2) University of Reading, Department of Meteorology, Reading, United Kingdom

Two contrasting extratropical cyclones were observed over the United Kingdom during the summer 2012 field campaign of the DIAMET (DIAbatic influences on Mesoscale structures in ExtraTropical storms) project. The first cyclone, observed in July, was a shallow system typical of summer over west Europe while the second cyclone, observed in August, was a much deeper system which developed a potential vorticity (PV) tower. The evolution of these two cyclones was analysed and compared in terms of diabatic effects with respect to two aspects. The first aspect is the amount and distribution of heat produced during the development of each cyclone, measured by the cross-isentropic motion around the cyclone centre. The second aspect is the modification to the circulation around the cyclones' centres, measured by area-averaged isentropic vorticity. The contributions from individual diabatic processes, such as convection, cloud microphysics and radiation, to these two aspects is also considered. The cyclones were analysed via hindcast simulations with a research version of the Met Office Unified Model, enhanced with on-line tracers of diabatic changes of potential temperature and PV. A new methodology for the interpretation of these tracers was also implemented and used. The hindcast simulations were compared with the available dropsonde observations from the field campaign as well as operational analyses and radar rainfall rates. It is shown that, while boundary layer and turbulent mixing processes and cloud microphysics processes contributed to the development of both cyclones, the main differences between the cyclones in terms of diabatic effects could be attributed to differences in convective activity. It is also shown that the contribution from all these diabatic processes to changes in the circulation was modulated by the characteristics of advection around each cyclone in a highly nonlinear fashion. This research establishes a new framework for a systematic comparison of diabatic processes and their importance for the evolution of extratropical cyclones.