EMS Annual Meeting Abstracts
Vol. 10, EMS2013-778-1, 2013
13th EMS / 11th ECAM


# Numerical evolution of cold air pooling processes in complex terrain

P Burns (1) and C Chemel (2)

(1) Centre for Atmospheric & Instrumentation Research (CAIR), University of Hertfordshire, Hatfield, UK (p.burns@herts.ac.uk), (2) National Centre for Atmospheric Science (NCAS), Centre for Atmospheric & Instrumentation Research (CAIR), University of Hertfordshire, Hatfield, UK (c.chemel@herts.ac.uk)

Elucidating cold air pooling processes forms part of the long-standing problem of parameterising the effects of complex terrain in larger-scale models. The Weather Research and Forecasting model has been setup and run at high resolution over an idealised alpine-valley domain of order 10 km, to investigate the four dimensional variation of key cold air pooling drivers, under de-coupled stable conditions. Model results indicate that downslope flow characteristics are sensitive to model grid resolution, and a convergence of solutions enables a strategic model grid resolution selection. Three regimes of long-wave radiative flux divergence contribution, $C_{\mathrm{rad}}$, to total average valley-atmosphere cooling have been identified. Starting about one hour before sunset, there is first a 40 min period of $C_{\mathrm{rad}}$ dominance, as the flow initiates and when the other energy balance terms generally sum to a heating contribution. A period of instability follows, lasting for approximately one hour. Finally, there is a gradual reduction of $C_{\mathrm{rad}}$ over a period of 380 min from 60 % to a final contribution of 32 %. The simulation average $C_{\mathrm{rad}}$ is close to 50 %, but is 38 % for the period of gradual decline, with maximum and minimum values, occurring at the start and close to the end of the simulation, of 233 and 16 %, respectively. The $C_{\mathrm{rad}}$ values for the final period and its average contribution are in the range of values reported in the literature. The contribution of the other energy balance terms will be discussed, together with the dependency on model resolution, atmospheric stability and terrain shape.