EMS Annual Meeting Abstracts
Vol. 13, EMS2016-653, 2016
16th EMS / 11th ECAC


# Investigation of the diurnal wind system in the Alpine Adige Valley.

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The Adige Valley is one of the main corridors connecting the Po Plain with the inner Alps. It displays a gradually sloping floor along the 150 km path connecting the valley outlet into the plain, near the city of Verona, to the upper valley at Merano. Several weather stations and a wind profiler are operated along the Adige Valley, providing regular measurements of the main atmospheric variables, such as air temperature, atmospheric pressure, global solar radiation, wind speed and direction. An analysis is performed on time series of these data for the years 2012-2014, based on a selection, by means of objective criteria, of days in which favorable weather conditions allowed a full development of valley winds. Although amplitude and phase of local wind strength turn out to be strongly affected by local topography and land cover, the typical cycle of diurnal up-valley winds - peaking in the afternoon - and nocturnal down-valley winds - weaker but persisting throughout the night - is clearly observed. This daily wind cycle is associated with a corresponding cycle of horizontal pressure distribution, as shown by the mean daily oscillation of surface-level pressure at the stations along the valley, from the plain (Verona) to the upper valley (Merano). The amplitude of the surface pressure cycle displays an increase in up-valley direction, with the smallest value in Verona and the largest in Merano, causing a daily periodic reversal of the pressure gradient. However, this behavior is locally altered by geometrical irregularities of the valley, which presents narrower and wider parts. In particular, a pressure counter-gradient is observed close to a larger basin, causing a local alteration in the traditional cycle of down- and up-valley winds. Moreover, it is found that also the presence of major urban areas, which affect the temperature field in the lower atmospheric layers, may alter the normal development of valley winds, with wind convergence over the city center during nighttime.
The analysis of the observational dataset provides a basis for a comprehensive understanding of the processes affecting the development and the main features of the valley winds in the Adige valley. However, as experimental data cannot give a complete spatial representation of the phenomena investigated, high-resolution numerical simulations with the WRF model are also performed to help the interpretation of the observed features. Results from the numerical simulations are analyzed and discussed to get more information on the processes affecting the development of the valley wind system, in particular on the aspects concerning temperature and pressure contrasts between different sections of the valley.