EMS Annual Meeting Abstracts
Vol. 16, EMS2019-264, 2019

Influence of topography in the Atmospheric Boundary Layer of the Pannonian Basin.

Joan Cuxart (1), Blazenka Matjacic (2), and Maja Telisman-Prtenjak (3)

(1) University of the Balearic Islands, Physics, Palma de Mallorca, Spain (joan.cuxart@uib.cat), (2) Meteorological and Hydrological Service, Zagreb, Croatia (blaza@cirus.dhz.hr), (3) Faculty of Science, University of Zagreb, Zagreb, Croatia (telisman@irb.hr)

The Pannonian Basin is a large nearly flat area surrounded by mountain ranges (Dynarides, Eastern Alps and Carpathians) that create an almost closed region crossed by the Danube river. The areas located in the central part of the extense Alfold plain are at distances ranging from the external mountains ranges larger than 150 km. These central areas are flat covered mostly by large agricultural fields and they would be expected to be ideal for the study of the Atmospheric Boundary Layer (ABL) over flat surfaces far from any major topographic feature or from the seaside.

However in this presentation we will show how the topography influences the mesoscale organization of the ABL within the Pannonian basin in two ways. On one hand, ECMWF analysis pressure fields show that in the presence of a high pressure system over the Basin, the relative position of lower pressure areas outside the basin channels the air at low levels along the very shallow valleys towards those areas, even if locally the pressure gradient is very weak. These along- valley flows have the shape of low-level jets and enhance the transport by shear turbulence resulting in less stably stratified conditions than expected in absence of a significant regional pressure gradient. The relative position of the lower pressure areas may generate cyclonic or anticyclonic circulations at the scale of the whole basin. In central areas such as Alfold, this mechanism may explain the large variability of the wind direction in clear and not windy nights.

On the other hand, at the flat foothill areas of the basin, the ABL structure depends on the plain-mountain interaction, that may extend for several tens of kilometers over the plain. In the daytime the illuminated mountain slopes will generate upslope flows and in the nighttime the downslope flows will progress over the plain. A high-resolution mesoscale simulation for two consecutive nights over the larger Zagreb area, which comprises the 1000-m high Medvenica mountain range, the city at its foothills and the Velika Gorica airport 10 km away near the Sava river, shows that depending on the ABL configuration, the nocturnal downslope flow may progress over the plain, enhancing mixing and generating deeper and less stable surface thermal inversions often with fog, while in other cases the flow is stopped over the city, allowing the thermal inversion at the airport to be very stable and thin, favoring freezing episodes in winter and shallow fog events.