

Observations of atmospheric structures in the Vipava valley based on Lidar data

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Located between the Trnovski gozd (1500 m a.s.l.) barrier and Karst (500 m a.s.l.) plateau, Vipava valley (100 m a.s.l.) is a natural laboratory for studies of strong, gusty North-East Bora winds. Being just 30 km away from the coastal line, the weather in the valley is affected by both the sub-mediterranean and sub-alpine climate, leading to abrupt weather changes within the valley. Due to its orography, there are only three prevailing wind directions (North-East, South-East and South-West), which were found to give rise to specific types of atmospheric structures, presented in this contribution.

Atmospheric properties were measured at the floor of the Vipava valley, using twelve ultrasonic anemometers, two GPS ionospheric monitors, two meteorological stations and an infra-red Mie-scattering lidar operating at 1064 nm at Ajdovščina. These devices yielded continuous data on wind speed and direction, average absolute humidity within the valley, relative humidity, pressure and temperature. Lidar provided high temporal and spatial resolution backscatter data on aerosols, which were used as tracers for atmospheric flows. Selected time periods in 2015, when lidar data was available, were classified according to wind speed and direction in the valley and investigated in detail, in particular in term of appearance of atmospheric structures.

In periods with low wind speeds (predominantly from South-West), vertical evolution of the planetary boundary layer (PBL) was found to be governed by solar radiation and clouds. In such conditions typical daily variations in PBL height with vertical mixing due to convection were observed. Periods with strong or moderate wind mainly correspond to Bora. Due to the airflow over the Trnovski gozd barrier in Bora cases, convection within the PBL was found to be much weaker due to strong turbulence close to the ground, which inhibited the mixing through the entire PBL. Above the PBL, gravity waves were observed. Periods with moderate South-East winds were also investigated, but no distinct atmospheric features were found.