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Observations of the Atmospheric Boundary Layer Across the Land-Sea Transition Zone Using an Elastic Scanning Lidar

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In the case of uneven terrain, atmospheric effects in the land-sea transition zone are numerous and diverse due to frequent changes in the wind direction and different effects of the heat flux on the sea and land surface. Such a case is the coastal region of the northernmost part of the Adriatic sea. Behind the coastal line the terrain rapidly rises to a Karst plateau (about 300 m a.s.l.), falls into the Vipava valley (60 m a.s.l.) and rises again to a mountainous region with maximum altitudes at about 1500 m a.s.l.

To obtain complete meteorological status of the atmosphere in this region, a series of remote sensing experiments of the atmospheric boundary layer (ABL) across the land–sea transition zone were performed on 1 July 2009 using an elastic scattering lidar. The lidar system, which has vertical scanning and long-range detection functionality, was located at Otlica observatory in Slovenia, within 30 km of the coastal line and at an elevation of 945 m a.s.l.

The atmosphere was scanned for elevation angles between 0° and 20° and the lidar data was processed into Cartesian 2-dimensional range-height-indicator plots with a spatial resolution of 50 m in both coordinates. Each pixel of the plot represents the weighted logarithm range-squared-corrected signal at that position and contains all the atmospheric information. Assuming horizontal atmospheric homogeneity, the optical depth, the extinction coefficients and the height of the ABL were calculated.

The increase of the lidar detection range and the steepening of the optical depth profiles with time were observed, showing that on average the extinction coefficients in the ABL were decreasing during the experiment. The height of the ABL changed from 1.8 km to 0.55 km in about 3 hours. Rapid drop of the ABL height indicates highly variable atmospheric conditions in the land-sea transition zone and the adjacent mountainous region.