



Wind velocity and turbulence measurements in tall masts in Estonia

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A unique test site for atmospheric studies, consisting of two tall masts at a distance of 43 km from each other, is operating in South-East Estonia since 2014. The Järvelja mast ($58^{\circ}05'50''\text{N}$, $26^{\circ}40'41''\text{E}$, mast foot 35 m a.s.l.) is situated in a flat, mostly forested landscape (canopy height 20 – 40 m) and equipped with sonic anemometers at 30, 50, 70, 90 and 110 m height from the ground. The Valgjärve TV-mast ($58^{\circ}16'38''\text{N}$, $27^{\circ}18'35''\text{E}$, mast foot 180 m a.s.l.) is situated in a hilly rural landscape with forest patches, on top of the highest hill at that location, the sonic anemometers initially placed at heights of 30, 50, 110 and 200 meters, since 2016 the 50 m height replaced by 10 m. Thus, these two masts are located almost in the same site in synoptic scale. They show different wind speed and turbulence profiles due to the different landscape at the mast foot. Indeed, the average wind speed at a height of 110 meter was found 7.1 and 5.7 ms^{-1} at Valgjärve and Järvelja sites respectively – difference in energy density is roughly 1.5 times at 110 m and even bigger at lower levels. An interesting feature is the distribution of wind speeds at the 70 m level in Järvelja. At this height, about twice as high as the forest canopy, the histogram was found to be rather flat and it was therefore sharply different from the nearly log-normal distribution found at the other heights of Järvelja and at all the heights of Valgjärve. On average, the share of turbulent kinetic energy (TKE) of one-second fluctuations in total kinetic energy was found 1-1.5% at 50 m height at Valgjärve. TKE at 30-minute base is 13% at 50 m, decreasing to 5% at 200 m.