

# Squalls with a hurricane wind in Moscow

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The results of measurements of wind speed by an ultrasonic anemometer (50 Hz) during the strongest squalls in Moscow on 29 May, 2017 and 21 April, 2018 at the Physics Faculty of the Lomonosov Moscow State University (PF MSU) on the Vorob'evy (Leninskie) Gory (55°42'00.28" N, 37°31'45.30" E) at an altitude of 50 m above the surface are analyzed.

Figure 1 shows variations of the zonally (U) and meridionally (V) oriented components of the wind, as well as the vertical velocity (W) components during 3 hours (14-17) on 29.05.2017 from measurements at PF MSU. The strongest squall with a wind of hurricane strength (more than 32 m/s) was registered at 15:39.

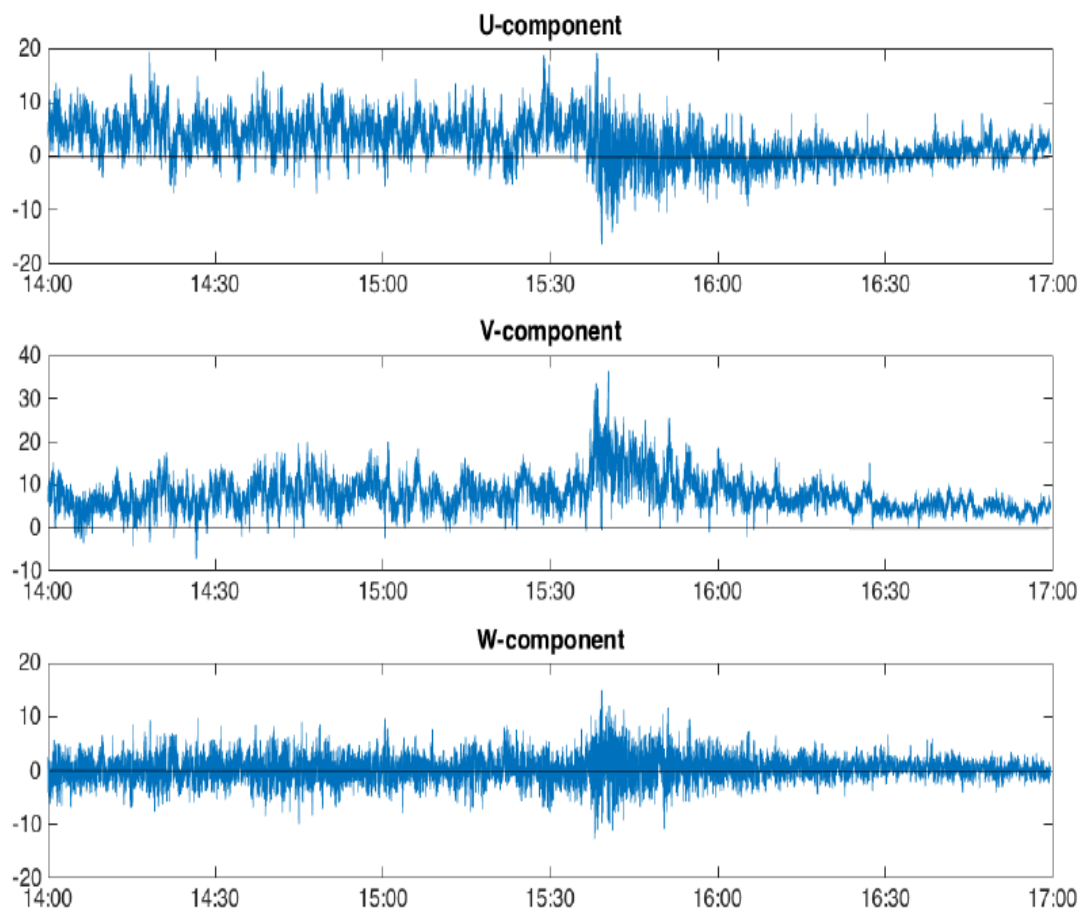


Fig. 1. Variations of the zonally (U) and meridionally (V) oriented components of the wind (m/s), as well as the vertical velocity (W) components during 3 hours (14-17) on 29.05.2017 from measurements at PF MSU.

Wavelet analysis revealed cyclic features in wind variations - with typical periods of about 40 minutes, 15-20 minutes and shorter-period variations (with a period about 4 minutes or less). A qualitative change in the spectral structure of the wind

dynamics after a strongest squall of about 15:39 has been noted. In particular, after the squall there were no significant short-period wind fluctuations (with a period of several minutes). After the squall, relaxation oscillations for the wind were noted. Cross-wavelet analysis of mutual variations of different wind components revealed a significant change in their coherence after a strongest squall.

Figure 2 shows local coherence of U- and V-components for three hours (14-17) on 29.05.2017 from measurements at PF MSU. According to Fig. 1, a strong squall at 15.39 initiated a chain of coherent variations of the U and V wind speed components with increasing characteristic period. These variations are characterized by positive correlation. It should be noted the manifestation of significant coherence for variations of U and V components with periods about 20-30 minutes about an hour before the record squall in 15:39. These variations are characterized by negative correlation. Significant coherence of U and V variations with periods of about half an hour was manifested long enough (at least two hours). According to the results obtained, one can expect some possibilities of prognostic significance in assessing the risk of extreme squalls.

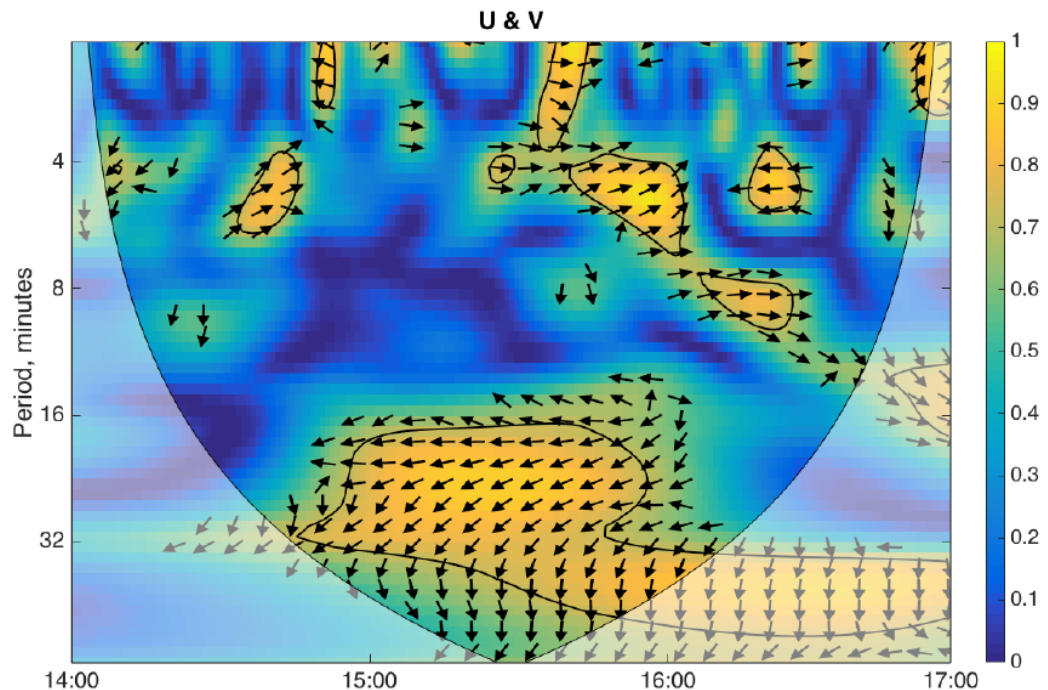


Fig. 2. Local coherence of U- and V-components for three hours (14-17) on 29.05.2017 from measurements at PF MSU.

Similar measurements were made on April 21, 2018, when during the strongest squall (at 17:04) a wind of hurricane strength was also registered. As in May 2017, the extreme wind in Moscow in April 2018 was associated with the atmospheric front. The strongest squalls marked in the spring of 2017 and 2018 are very unusual and rare in the Moscow region. The recurrence of such strong squalls within one year is unique.