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Instationarity of the increment distribution of boundary layer wind speed

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The distribution of boundary layer wind speed increments can be understood as a superposition of Gaussian distributions whose variances are of a log-normal distribution (Castaing's hypothesis [1]). Experimental data gathered in the boundary layer were examined. Motivated by the instationarity of atmospheric winds we compared the increment statistics approach with the superstatistical approach introduced by Beck in [2]. The latter is capable of transforming the instationary increment series into a (quasi) stationary increment volatility series. On subsets smaller than a large time scale (hours) we found that this volatility series is stationary and of a log-normal distribution which is in accordance with Castaing's hypothesis. However, over the time of a day the increment volatility shifts smoothly from one stationary state into another. Studying this dynamics helps us to improve the prediction of wind speed increments playing an important role for wind gust prediction.

References

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[2] C. Beck, E.G.D. Cohen, and H.L. Swinney, *From time series to superstatistics*, Phys. Rev. E, **72** (2005), 056133