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On the observation of very bright and abundant Noctilucent Clouds at Kühlungsborn/Germany (54°N, 12°E) in June 2019

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Noctilucent Clouds (NLC) are observed since 1997 by a RMR lidar at a mid-latitude site at Kühlungsborn/Germany (54°N, 12°E). In June 2019, we detected the brightest NLC so far, having a backscatter coefficient at 532 nm of $\sim 50 \cdot 10^{-10}$ /m/sr, while $2.5 \cdot 10^{-10}$ /m/sr is a typical value at this location. Another three NLC in that period reached a backscatter coefficient of more than $20 \cdot 10^{-10}$ /m/sr. These strong NLC allow, e.g., for high-resolved studies with temporal resolution of 10 seconds and vertical resolution of 45 m. We will show examples of high-frequency oscillations in our data that cannot be found with typical integration times of several minutes. The period in June 2019 was not only unique in terms of NLC brightness, but also regarding NLC occurrence. While the all-year average is ~ 6 %, the occurrence rate in 2019 was 13 % and, and 20% if we consider June only. In the past, we found an anti-correlation between solar activity and NLC occurrence: Increasing solar UV radiation results in enhanced radiative heating and photolytic water vapor destruction. However, the high number of NLC in 2019 can only partly be explained by solar activity, even if the Lyman-alpha flux was slightly lower compared to previous years. TIMED/SABER monthly averaged temperature profiles showed an unusual low mesopause in June 2019, related to lower-than-average temperatures below 83 km. We claim that this as the main reason for the comparatively frequent and bright NLC. At the same time, meridional wind data of our nearby meteor radar show only weak southward winds and even a wind reversal at 93 km, which is not typical for the season. We will discuss potential reasons for the strange dynamical situation. We note that the weather dependent lidar observations are in good agreement with the radar observations of ice particles, so-called Mesospheric Summer Echoes (MSE). Co-located radar observations also showed unusually large occurrence rates of MSE in June 2019 as well as the occasion of many MSE below 83 km altitude.