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High resolved properties of noctilucent clouds derived from a multi-annual data set above ALOMAR

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Noctilucent clouds (NLC) occur regularly from the beginning of June to the middle of August above the ALOMAR research station in Northern Norway (69N). We report on observations obtained with the ALOMAR Rayleigh/Mie/Raman (RMR) lidar from 1997 to 2005. Using the primary wavelength of the lidar at 532 nm we have observed NLC signatures covering all local times even during highest solar background conditions. From the vertically resolved volume backscatter coefficient (VBC) of the NLC particles, cloud parameters like brightness, altitude, and vertical extension are derived. The year-to-year variation of the NLC occurrence, the ratio of NLC to total measurement time, shows for bright clouds a modulation by solar activity while weak clouds steadily reoccur. Investigations of the local time dependencies of cloud occurrence, brightness, and altitude yield a remarkable persistence concerning diurnal and semidiurnal variations, which allows to conclude that NLC above ALOMAR are significantly affected by atmospheric tides in temperature and/or wind. For bright cloud events, we extend our observations by using the backscatter from NLC particles at all three wavelengths emitted by the lidar. The wavelengths are widely separated, from the infrared (1064 nm) over the visible (532 nm) into the ultraviolet (355 nm) spectral range, which allows to study the sizes of the NLC particles by analyzing the three parameters number density, median radius and width of a monomodal size distribution. The strong variations of the NLC on temporal and spatial scales are investigated in a case study where we use further instrumental observations from ALOMAR and data of the LIMA 3d GCM nudged to ECMWF data in the lower ($<$35km) altitude region.