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The properties of noctilucent clouds during one solar cycle above ALOMAR.

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Noctilucent clouds (NLC) are the visible manifestation of icy particles persistently present in the polar summer Mesopause region. Their formation is a rather complicated physical process depending on atmospheric background parameters, such as temperature and water vapor, which are hardly to measure directly at the altitudes of interest. This makes NLC an attractive tracer for dynamic processes in the atmosphere. Cloud parameters show variabilities at different time scales, ranging from minutes to decades, including tidal and solar cycle variations. Between 1997 and 2008 NLC have been observed by the ALOMAR Rayleigh/Mie/Raman (RMR) lidar in Northern Norway at 69N, 16E. During a total of 3657 measurement hours, being well distributed over the 12 years, season and local time, NLC were detected for 1457 hours, which is the largest NLC data base acquired by lidar.

NLC occurrence, altitude as well as brightness show a remarkable persistence concerning diurnal and semidiurnal variations, which allows to conclude that NLC above ALOMAR are significantly controlled by atmospheric tides. From 1997 to 2007 the year-to-year occurrence frequency of strong NLC is anti-correlated to solar activity until 2004 and decreases monotonously thereafter. The water content of the clouds is unchanged or even decreasing after 2004. Considering the entire 11 year period there is no significant anti-correlation between the occurrence of strong clouds and solar activity. The mean NLC altitudes are 83.2km +-20m and 82.5km +-30m for all clouds and strong clouds, respectively. Todayś cloud altitudes differ by only a few hundred meters from observations approx. 115 years ago (82.1km). Taking into account current geophysical cloud altitude variability of approx. 1km, the mean NLC altitude appears to be unchanged. This behavior falls short of an expected altitude decrease of more than 2km following from temperature trends calculated by current global atmosphere models.