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Noctilucent clouds and the mesospheric water vapour: the past decade

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Abstract. The topic of this paper is the sensitivity of the brightness of noctilucent clouds (NLC) on the ambient water vapour mixing ratio f(H_2O). Firstly, we use state-of-the-art models of NLC layer formation to predict NLC brightness changes in response to changes in the 80km mixing ratio f (H_2O) for the two cases of ground-based 532nm lidar observations at 69° N and for hemispheric satellite SBUV observations at 252nm wavelength. In this study, we include a re-evaluation of the sensitivity of NLC brightness to changes in solar Lyman α flux. Secondly, we review observations of episodic changes in f(H_2O) and those in NLC brightness, the former being available since 1992, the latter since 1979. To this review, we add a new series of observations of f(H_2O), performed in the Arctic summer at the ALOMAR observatory. The episodic change exhibited by the Arctic summer means of f(H_2O) turns out to be quite different from all those derived from annual means of f(H_2O). The latter indicate that since 1996 a significant reduction of annually averaged upper mesospheric water vapour has occurred at low, mid, and high latitudes. These decreases of f(H_2O) have been observed over the same time period in which a slow increase of SBUV NLC albedo has occurred. From this scenario and additional arguments we conclude that the cause for the observed long-term increase in NLC albedo remains to be identified. We close with comments on the very different character of decadal variations in NLC brightness and occurrence rate.

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