Geophysical Research Abstracts
Vol. 13, EGU2011-4132, 2011
EGU General Assembly 2011
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Interhemispheric comparison of stratospheric effects on mesospheric ice layers

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Ice layers in the summer mesosphere at middle and polar latitudes frequently called 'noctilucent clouds' (NLC) or 'polar mesosphere clouds'(PMC) are considered to be sensitive indicators of long term changes in the middle atmosphere. We present a summary of long term observations from the ground and from satellites and compare with results from the LIMA model (Leibniz Institute Middle Atmosphere Model). LIMA nicely reproduces mean conditions of the summer mesopause region and also mean characteristics of ice layers. LIMA nudges to ECMWF data in the troposphere and lower stratosphere which influences the background conditions in the mesosphere and thereby the morphology of ice clouds. To improve comparison with satellite measurements (SBUV) we have recently included a calculation of albedo distributions from the ice clouds in LIMA. We compare these albedos with SBUV data. For trend analysis we use nearly 50 years of LIMA simulations of ice clouds in the northern and southern hemisphere, again using ECMWF data in the lower part of the model. Trace gas concentrations are kept constant except for water vapor which is modified by variable solar radiation. Long term trends in temperatures and ice layer parameters are observed in the mesosphere, consistent with observations. As will be shown these trends mainly originate in the stratosphere. We have recently expanded our analysis to a comparison of northern (NH) and southern hemisphere (SH). Trends of ice cloud parameters are generally smaller in the southern compared to the northern hemisphere, consistent with observations. Trends in background conditions have counteracting effects on NLC: temperature trends would suggest stronger ice increase in the SH, water vapor trends a weaker increase. Larger trends in NLC brightness or occurrence rates are not necessarily associated with larger (more negative) temperature trends. They can also be caused by larger trends of water vapor caused by larger freeze drying, which in turn can be caused by generally lower temperatures and/or more background water. Trends of NLC brightness and occurrence rates decrease with decreasing latitude in both hemispheres. The latitudinal variation of these trends is primarily determined by water vapor trends. Trends in NLC altitudes are generally small. Stratospheric temperature trends vary differently with altitude in the NH and SH, but add up to similar trends at mesospheric cloud heights. We compare LIMA results LIMA regarding solar cycle variations and trends with lidar observations of NLC and with satellite measurements in both hemispheres.