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Modelling of NLC particle history with LIMA/ICE

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We investigate the development of mesospheric ice particles using the Lagrangian MLT region model LIMA/ICE. We employ LIMA/ICE to provide a number of modeled NLC events which are then scanned for large ice particles. We trace these particles from nucleation until evaporation which results in an ensemble of particle trajectories from different ice events. These are then used to generate statistical data for NLC particle history. To validate our measurements we have compared the wind fields generated by LIMA to radar measurements and found reasonable agreement at polar latitudes. In general, ice particles nucleate in the mesopause region and grow very slowly: it takes approximately 1-3 days from the start of nucleation before they are large enough to be observable as NLC particles. At that time they have grown sufficiently large to sediment to $\sim$84 km, where the much higher concentration of available water vapor greatly accelerates particle growth. This in turn speeds up sedimentation. The NLC particles therefore achieve their maximum size shortly before they sediment to sub-saturated altitudes and evaporate. NLC particle nucleation is occurring not uniformly but in bursts in highly supersaturated areas. We also observe periodic behavior in the growth process as ice particles pass through atmospheric tides. The wind patterns in LIMA are rather stable which results in high spatial cohesion of the backtraced particle ensemble. Significant cloud dispersion only takes place in the zonal (and not in the meridional) direction. Our study shows time constants of about 1-3 days for the total lifetime of NLC, but the major characteristics (for example brightness) are formed within the last $\sim$4-6 hours. This implies that ice clouds observed at a single station, for example by our lidar at ALOMAR (69°N) in Northern Norway, are mainly determined by background conditions at similar latitudes and longitudes.