Cirrus climatology at mid-latitude observed with Lidar

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Systematic cirrus lidar measurements during night-time have been performed since 1994 in the south of France. Morphologic parameters have been derived and permit to make a climatology including sub-visible clouds. Because different types of cloud behavior can be noted from a simple visual inspection, some independent statistical classes have been performed. The successive use of Principal Component Analysis, Cluster Methods and Linear Discriminant Analysis allows us to identify tree cirrus classes. The absolute geometric height and the thickness are found to be the main discriminant variables. One class corresponds to thin clouds around the local tropopause. Some cases are found to be unambiguously located above the local dynamical tropopause, according to high-resolution PV advection calculations. The highest cloud detected is observed inside air masses that originate from the subtropical regions that are then transported rapidly to mid-latitudes through isentropic transport. The details of the air mass history are described with a 3D trajectory model.