Arctic Versus Midlatitude Ice Clouds: Differences Revealed by Ground-Based Lidar and CALIPSO Probing

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ABSTRACT

The view of clouds provided by the CALIPSO lidar is highlighting new concerns about the basic natures of clouds on a global scale. Previously, our knowledge of clouds was dominated by midlatitude research, but it is becoming clear from the global CALIPSO dataset that the distribution and physical properties of various cloud types is strongly a function of latitude and geography. Currently under examination are the differences between high (i.e., cirrus) and midlevel (altostratus) ice clouds based on multi-year polarization lidar measurement programs from FARS in Salt lake City, Utah, and AFARS (the *Arctic* Facility for Atmospheric Remote Sensing) in Fairbanks, Alaska. Although the average monthly cloud base and top temperatures of cirrus (defined as cloud top temperatures <-40°C and optical depths <~3.0 based on FARS research) are similar, the heights, pressures, and wind speeds/directions are in poor agreement. Of course, these discrepancies are a reflection of differences in tropopause heights (normally about 2-km lower at AFARS), and the weather patterns locally responsible for cirrus generation. A primary cause of the latter is the comparative lack of Arctic jet stream systems for much of the year, versus midlatitudes. Major differences are also indicated in the frequency and properties of midlevel altostratus ice clouds, which at high latitudes often are optically thin or even subvisual particularly during the winter season. Another fundamental difference appears to be the mesoscale organization of ice clouds in the Arctic as revealed by CALIPSO data, versus the synoptic-scale organizations at midlatitudes. We will provide and compare ice cloud climatologies from FARS and AFARS and discuss the implications for the improved global characterization of ice clouds, including those of the tropics from earlier CALIPSO research.