Radiative properties of different configurations of mixed-phase clouds

Clouds are made of ice crystals at temperatures below -40°C and of liquid cloud droplets at temperatures greater than 0°C. Between these two thresholds, clouds can be either only liquid, only ice, or a mixture of both phase. Radiative properties of clouds enable space-based intruments to retrieve cloud physical and optical properties, such as cloud droplet effective radius and cloud optical depth. Cloud radiative properties are impacted by the cloud phase, but unfortunately satellite algorithms only consider liquid and ice clouds and do not retrieve properties for mixed-phase clouds.

Figure 1 shows the radiative properties evolution of mixed-phase clouds with different ice fractions when cloud droplets and ice crystals are uniformly mixed. These have been simulated with the radiative transfer model SBDART. The bachelor student will simulate different layouts of mixed phase clouds and study how these potentially impact radiative properties of clouds and the results of algorithms for space-based instruments.

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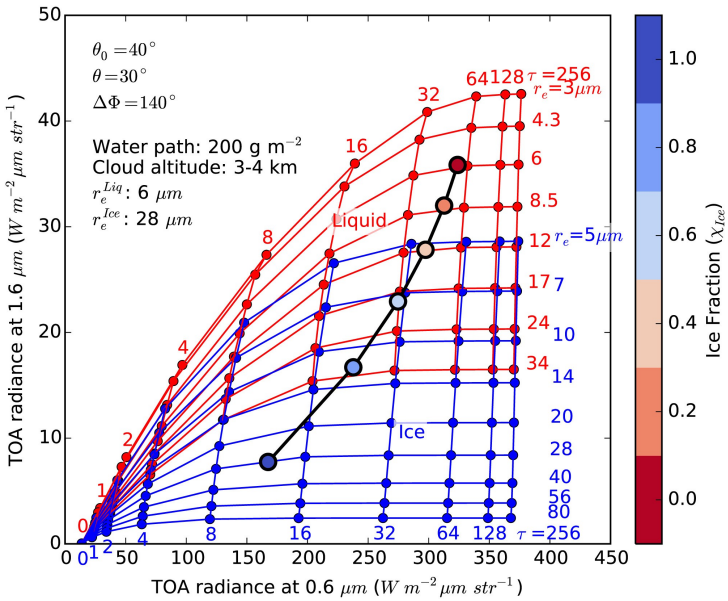

Figure 1: Nakajima & King diagram considering the radiances at 1.6 and 0.6 micrometer for ice and liquid clouds inferred from radiative transfer simulations. The colored dots represent the radiance for a cloud for which different ice fractions are prescribed considering a uniformly mixed-phase clouds (see color bar). (From Coopman et al., 2019)