



Studies on the dynamical and microphysical origin of the mesospheric CO₂ clouds on Mars

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The recent climatology established with datasets on high-altitude CO₂ cloud observations (Montmessin et al. 2006 ; Montmessin et al. 2007; Clancy et al., 2007; Inada et al. 2007; Scholten et al. 2010; Määttänen et al. 2010; McConnochie et al. 2010) reveal distinct classes of these clouds: equatorial pre- and post-aphelion clouds, and midlatitude autumn clouds. The near-equatorial clouds form mostly in a longitudinal corridor between -120°E and 30°E, in a latitude belt of +/-20°N. The midlatitude clouds are mainly observed on the northern hemisphere with two observations in the south. Observations of mesospheric CO₂ clouds by SPICAM (Montmessin et al. 2006), OMEGA and HRSC (Montmessin et al. 2007; Määttänen et al. 2010, Scholten et al. 2010) show very different cloud characteristics in altitude and particle size. We have compared the overall CO₂ cloud dataset to the LMD Mars Global Climate Model predictions (MGCM, Forget et al. 1999, Gonzalez-Galindo et al. 2009). We have analyzed the LMD MGCM temperature and wind fields for the seasons and locations of CO₂ cloud formation to understand why the atmosphere is the coldest at this time and certain altitudes and locations, what are the underlying mechanisms, and does the model do well in predicting the mesospheric state. The nighttime observations of high-altitude hazes by SPICAM (Montmessin et al. 2006) show very different cloud properties compared to the daytime clouds (Montmessin et al. 2007, Määttänen et al. 2010). During nighttime the clouds form at higher altitudes (90-100 km), they are optically thinner, and the observed particle sizes are smaller. We will discuss the possible microphysical origins of the differences in cloud properties. Some of the OMEGA clouds have the appearance of a cumuliform cloud, suggesting a convective formation mechanism. We will evaluate the possibility of mesospheric convection on Mars based on OMEGA and SPICAM observations.

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