Variability of Frost Cover in Abalos Mensa. P.B. James[1], W.M. Calvin[2], P.C. Thomas[3], and B.P. Cantor[4], [1]Space Science Institute, 4750 Walnut St., Boulder, CO, 80301, pjames@cableone.net, [2]University of Nevada, Department of Geological Science, Reno, NV 89557, [3]Space Science Bldg.,Cornell University, Ithaca, N.Y.14853, [4]Malin Space Science Systems, San Diego, CA 92121.

Cantor et al. (2010) used MARCI images to describe the seasonal behaviors of features near the periphery of the RNPC in MY29. Their study focused on Shackleton's Grooves, the part of Gemini Scopuli near 300° W (60° E), and Abalos Mensa, a small outlier of bright frost at 80.8 N 72 W. The MARCI data revealed that the recession of these features continued until near solstice, when the bright frost vanished. After solstice both regions gradually brightened until the residual cap appearance after L_s=114° was much like that at L_s=75°. A similar seasonal behavior also occurred in MY30.

The seasonal behavior described above varies from year to year. There is an extensive record of observations of Abalos Mensa comparable in resolution to MARCI images dating back to Viking. Although the bright frost disappeared in MY29 and 30, recent images from MY31 show the frost visible, though at subdued contrast, throughout the Ls = 90° to 105° period (Figure 1). The historical data suggest that the seasonal behavior seen in MY29 is observed in roughly half of the years, while in the rest surface frost remains visible through the period.

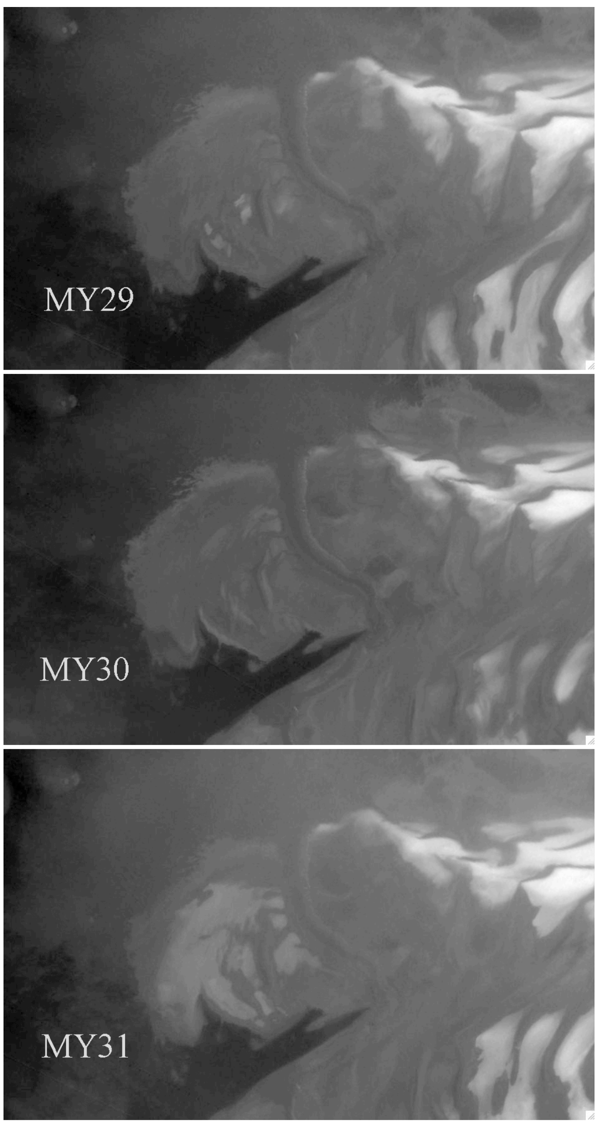

Figure 1: Abalos Mensa art Ls =93° in MY29-31.

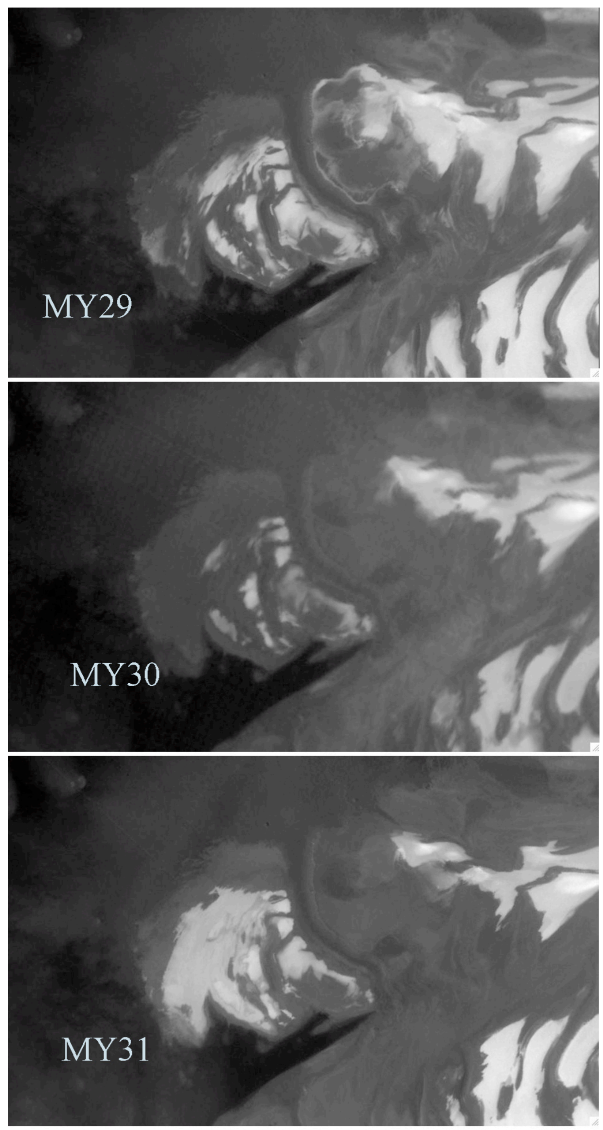

Figure 2: Abalos at Ls=119° (115° in MY31).

The distribution of bright frost on Abalos in mid summer is also variable. MARCI and MOC images from MY 24 to MY 30 suggested that there was a monotonic loss of frost cover from Abalos during that period; however, a Viking image from MY13 showed that the trend did not extrapolate that far into the past. During the current year the frost cover has returned to a maximal coverage similar to that in MY24 (Figure 2).

The most obvious explanation for the disappearance of the bright features after the loss of CO_2 in MY29 and 30 is sublimation of a thin coating of bright, possibly fine grain water ice. The reappearance of the features could then ascribed to recondensation of water vapor on the surface. This is consistent with the fact that the very dark areas adjacent to Abalos are major sources for water vapor, which peaks after solstice. However, the insolation does not decrease much after solstice because the effect of incidence angle change is canceled by the effect of decreasing distance to the sun after aphelion. It seems unlikely that the insolation would be sufficient to sublime the relatively high albedo layer before solstice but would allow condensation on the darker, therefore warmer layer after solstice.

Although dust activity is prevalent near Abalos during the period before solstice, it is greatly reduced after summer solstice. Therefore, atmospheric dust obscuration per se can't account for the disappearance and subsequent reappearance of the bright frost. Precipitation of a small amount of atmospheric dust on the bright surface with subsequent removal by katabatic winds is an alternative way that dust could affect the albedo of the ice deposits. Only a few microns of precipitated dust would be necessary to obscure the bright ice beneath. Variability of dust activity in late spring and of precipitated dust could explain the observed variation of seasonal behavior. Unfortunately, neither the sublimation / condensation model nor the dust layer model for the disappearance / reappearance of the bright frost features adequately explains the interannual variability without invoking different initial conditions each year imposed during condensation of water and dust on the surface.

References: [1] Cantor, B.A., Calvin, W.M., and James,P.B. (2010). *Icarus* **208**, 61-82.