MAKING WATER ICE PERMANENT AT THE SOUTH POLE 25,000 YEARS AGO. F. Montmessin, R. M. Haberle, *NASA Ames Research Center, Moffett Field, CA 94035-1000, (fmontmessin@mail.arc.nasa.gov)*, F. Forget, *Laboratoire de Météorologie Dynamique/IPSL, Paris, France*.

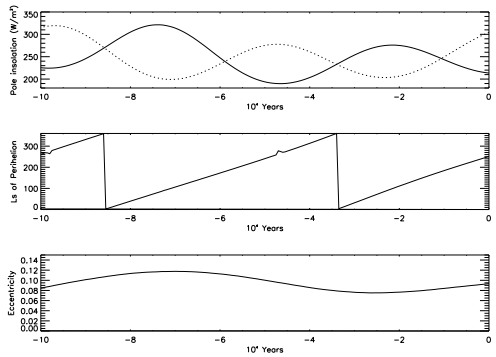

Figure 1: Upper Graph: Variation of insolation at the poles (north=bold, south=dotted) during the last 100 000 years. Middle Graph: Variation of of perihelion date (in solar longitude) for the same timeframe. Lower Graph: Same as above but for eccentricity.

Whereas most of studies on recent climate change adress the fate of water with changing obliquities, we would like to show how the precession cycle might as well affect the stability of the north polar cap on much faster timescales.

To do so, we use the General Circulation Model (GCM) developped at LMD (Paris/France) to explore the change in water cycle patterns induced by shifting perihelion date. The current value of $L_s \sim 250^o$ leads to a warmer southern summer than its northern counterpart. On the other hand 25 000 years ago, perihelion occured at the end of northern spring ($L_s \sim 70^o$), leading to a reversed situation (see Figure 1).

The energetic budget at the poles is a crucial factor modulating the stability of water ice at the surface of these regions. That the current location of the permanent cap at the north pole indeed results from the current orbital configuration is still subject to debate. First, is has been recently demonstrated that the south to north topographical slope applies a major component on the annual and zonal mean circulation, leading to preferred advection of volatiles into the northern hemisphere. Second, the aphelion cloud belt, which mean elevation coincides in theory with that of the returning branch of the overturning circulation, has been shown to curtail water mass transfer to the southern hemisphere. Without a similar cloud belt to affect the northward transport of humidity at perihelion season, the northern hemisphere posesses an additional mechanism to retain water. Added to the relatively lower summer insolation of the north pole, this combination of factors act to stabilize the presence of a permanent cap in the north.

With "reversed" perihelion however, topography becomes the only factor favoring northern hemisphere, a mechanism which therefore has to compete with an enhanced northern summer insolation. This specific case has been studied by means of our GCM, in which representations of major processes controling water cycle have been implemented. This study motivated by the will to highlight the potential dichotomy, in terms of water stability, between the poles. Not only this study on perihelion timing appears the most relevant to address this issue, but it also focuses on the most recent and most significant change of Mars climate.