High LMD GCM resolution modeling of the seasonal evolution of the martian northern permanent cap: comparison with Mars Express Omega observations. B. Levrard[1], F. Forget[2,3], F. Montmessin[3], B. Schmitt[4], S. Doute[4], Y. Langevin[5], F.Poulet[5], J. P. Bibring[5], B.Gondet[5] [1]Laboratoire des Sciences de la Terre, UCBL1/ENS Lyon, UMR 5570, 43 Boulevard du 11 Novembre 1918, 69622 Villeurbanne Cedex, France; blevrard@ens-lyon.fr, [2]LMD, IPSL (Universite Paris 6, BP99, 75252 Paris Cedex 05 France;, [3]NASA Ames Research Center, USA, [4]Laboratoire de Planétologie de Grenoble, Grenoble, France, [5]IAS, Orsay, France.

Introduction: Analyses of imaging data from Mariner, Viking and MGS have shown that surface properties (albedo, temperature) of the northern cap present significant differences within the summer season and between Mars years [1,2,3]. These observations include differential brightening and/or darkening between polar areas from the end of the spring to mid-summer. These differences are attributed to changes in grain size or dust content of surface ice. To better understand the summer behavior of the permanent northern polar cap, we perfomed a high resolution modeling (~1°x1°) of northern cap in the Martian Climate/water cycle as simulated by the Laboratoire de Météorologie Dynamique (LMD) global climate model. We compare the predicted properties of the surface ice (ice thickness, temperature) with the Mars Express Omega summer observations of the northern cap [4].

Climate Model : The climate model is based on the LMD General Circulation model (Forget et al. JGR, 1999). It includes a complete water cycle parametrisation that take into account sublimation, condensation, cloud formation and transport of water vapor and water ice (Montmessin et al., JGR, 2004) and that have been validated through comparisons with the MGS TES dataset. Current predictions of the baseline LMD GCM supports a “quasi-solid state ” return of water ice on the pole at the end of the spring, driven by the CO2 cap recession, which tends to close the north polar cap's annual water cycle, before an intense summer sublimation.

Zoom function: Because the current resolution (5.6° x 5.6°) of the GCM is not sufficient to have an accurate prediction of the northern cap evolution, in comparison with MEX/OMEGA observations (ranging from 3 to 5 km), GCM simulations will be performed with a zoom effect on the northern cap area with a (1° x1°, ~ 20 km x 20km) resolution, closer to the OMEGA resolution. A finer grid resolution of 0.5°x 0.5° will be also investigated. The current water cycle is simulated with a constant albedo corresponding to the beginning of the summer [5] which can not be used to follow the large albedo variations of the summer cap. GCM simulations will be also tested for several albedo and thermal inertia svariations model. In particular, albedo variations could be constrained by OMEGA data.

Meteorological predictions of the LMD GCM wil be presented at the conference to interpret the unprecedently resolved OMEGA observations. The specific evolution of regions of interest (cap center, Chasma Boreal...) and the possibility of late summer global cap brightening will be discussed.

References:

[1] Bass et al.,2000, *Icarus*, 144.[2] Kieffer and Titus, 2001, *Icarus*, 154. [3] Langevin, Y. et al, *this issue.* [4] Paige et al., 1994, *JGR*, 99.