



Environmental Conditions on Mars at the end of the Noachian

Lê Binh San Pham and Özgür Karatekin

Royal Observatory of Belgium, Brussels, Belgium (lebinhsan.pham@oma.be)

Geological and morphological evidences show that liquid water or saline solution could have flowed on the Early Mars' surface, at the end of the Noachian (3.8 – 3.9 Gyr ago). However, while it is mostly thought that liquid water existed in the past, the environmental conditions such as the surface pressures and temperatures of this period and their variation are not known.

We estimate the surface pressure values with the use of an atmospheric mass evolution model, which includes the effects of impacts erosion and volatiles delivery and non-thermal solar loss. Because of the uncertainties regarding the impact volatile delivery model and the efficiency of carbonate weathering since the end of the Noachian, estimated surface pressure on Mars at the end of the Noachian are between 0.25 bar and 2 bars.

Latitudinal temperature profiles and surface pressure values are calculated for different orbital parameters. For this purpose, we use a one-dimensional energy balance model which includes meridional heat transport and greenhouse warming. Our model suggests that stable saline solutions can exist on early Mars only for surface pressures higher than 1.9 bar and with a strong greenhouse warming. For lower surface pressures and a weak greenhouse warming, saline solutions can flow sporadically at high latitudes during high obliquity periods.