Geophysical Research Abstracts, Vol. 9, 06496, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06496

The strong high-energy and particle emissions of the young Sun: impact on the Martian atmosphere and water inventory

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Investigations using solar analogs of different ages have revealed that the Sun may have been much more active in the past, when it rotated some ten times faster than today. Such enhanced magnetic activity manifests itself in the form of strong high-energy and particle emissions. The results from the so-called "Sun in Time" program indicate that the emissions of the young Sun (i.e., 4-4.5 Ga ago) in X rays, far ultraviolet and ultraviolet were stronger than today by factors of 100-1000, 20-60, and 10-20, respectively. In addition, it has been inferred that the particle emissions would have also been much stronger in the past, possibly by factors up to 100-1000. Such environment of intense radiation and particle emissions could have had a strong influence on Solar System planets and, in particular, on the paleo-atmosphere and water inventory of Mars. In this talk I will review the evidence suggesting an active young Sun and briefly address some of the implications on the early Martian atmosphere.