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Solar forcing and the evolution of climate on the Earth-like planets

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Solar forcing is the main driver for the climate and atmospheric evolution of the Earth-like plan ets. Climate evolution is a complex issue that strongly couples to the evolution of the atmosphere and ionosphere. On basis of new data from Mars Express (MEX) and Venus Express (VEX) we have reached a somewhat better understanding of the consequences of solar wind forcing for the upper atmosphere and ionosphere of Venus and Mars. We observe a strong dependence of the ionospheric mass escape on solar wind forcing for Mars. Some new results from MEX and VEX relevant for solar forcing will be presented. Besides solar wind forcing we have the solar X-ray, EUV and UV radiation interacting with the planetary ionosphere and upper atmosphere. The combined solar forcing may vary substantially with time, on short-terms ranging from hours (e.g. CMEs) to decades (solar cycle). The long-term variability/trend is even more pronounced and important for the evolution of a planetary atmosphere, considering that the forcing terms may have been up to a factor of 1000 times higher in the early period of the solar system (e.g. Wood et al., ApJ, 574, 412, 2002, Ribas et al., ApJ, 622, 680, 2005). However, knowing the impact of the short- term solar variability (up to a factor of 10), we may be able to scale backwards in time the climate evolution of the Earth-like planets from data obtained by existing and future satellites orbitting the planets.