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Plasma escape and parameter study on a CO2-rich terrestrial-type planet under extreme solar/stellar conditions

N. Terada (1, 2), Yu. N. Kulikov (3), M. Panchenko (4), M. L. Khodachenko (4), H. Lammer (4), I. Ribas (5), H.I.M. Lichtenegger (4), T. Tanaka (6, 2)

(1) National Institute of Information and Communications Technology, Tokyo, Japan, (2) CREST, Japan Science and Technology Agency, Saitama, Japan, (3) Polar Geophysical Institute (PGI), Russian Academy of Sciences, Murmansk, Russian Federation, (4) Space Research Institute, Austrian Academy of Sciences, Graz, Austria, (5) Institut d'Espacials de Catalunya/CSIC, Barcelona, Spain, (6) Department of Earth and Planetary Science, Kyushu University, Fukuoka, Japan

Recent detection of a super-Earth planet in the close vicinity of a low mass M-type dwarf star in the GI581 system by HARPS further highlights the importance of studies related to atmospheric erosion and its importance for habitability. The higher level of X-ray and EUV activity and the closer orbital distance of habitable zones (within 0.1 AU) of active M-type stars indicate that terrestrial planets within habitable zones of active dwarf stars are more influenced by stellar radiation and stellar plasma disturbances including Coronal Mass Ejections (CMEs) than those of Sun-like stars. In order to study the effect of high X-ray and EUV fluxes and CME-activity on the ion erosion rate from a CO2-rich terrestrial-type planet orbiting an active dwarf star and discuss how much of the ionized part of the upper atmosphere could have been lost to space over the planet's history, we apply a global 3-D magnetohydrodynamic (MHD) simulation model of the stellar wind interaction with the upper atmosphere of a CO2-rich terrestrial-type planet. For modelling thermosphere of a CO2-rich terrestrial-type planet for the high XUV conditions we apply a diffusive-gravitational equilibrium and thermal balance model which investigate the heating of the thermosphere by photodissociation and ionization processes, due to exothermic chemical reactions and cooling by CO2 IR emission in the 15 micro-m band. The main objectives of this paper are

to investigate the nature of planetary obstacle against impinging CMEs and to study the resulting oxygen ion erosion rate from a dry CO2-rich atmosphere for close-in unmagnetized or weakly magnetized terrestrial type exoplanets orbiting a dwarf star with high X-ray and EUV fluxes and high CME- activity.