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Solar Wind-Ionosphere Interaction and the evolution of the Earth-like Planets

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The Earth-like planets: Mercury, Venus, Earth and Mars have certain commonalities, like their proximity to the Sun (0.3-1.5 AU) and their average densities. The former makes the Earth-like planets particularly vulnerable to what happens on our star. They are exposed to an unruly expanding solar corona and intense solar radiation. Specific differences, like the intrinsic magnetization, make them evolve in different ways. Under the assumption that the Earth-like planets accreted from matter of similar chemical origin, the differences we observe today must have resulted from their respective evolution. Of particular interest here is the evolution of volatiles on the planets. For instance, why is the Earth the only planet out of the four with a significant hydrosphere? Is it a matter of gain, or a matter of retain? The focus in this talk is on the loss of volatiles resulting from the expanding solar corona - the solar wind. The solar wind affects primarily the ionized part of a planetary atmosphere, but direct sputtering may also be a relevant scavenging process. The main point, though, is how energy and momentum is being transferred by the solar wind. The available energy and momentum is certainly capable of fast erosion if the target area is sufficiently large. The long visible tail of a comet illustrates fast erosion from a small body with large target area. For the Earth-like planets with their differences in gravity, distance to the Sun and intrinsic shielding magnetization the problem of solar wind erosion is more complex, as will be discussed in this review.