Ionospheric outflow: influence of the earth magnetic environment

One of the most remarkable features of the solar system is the variety of planetary atmospheres. Venus, Earth, and Mars are approximately at the same distance from the Sun. This means they formed out of the same material and had approximately the same initial temperatures. However, they have evolved differently. The atmosphere is now dense and hot on Venus, cold and tenuous on Mars and in-between on Earth. This is partly because the atmospheric erosion differs from one planet to another.

Among the mechanisms that control atmospheric erosion, the interaction between the solar wind -a flow of charged particles continuously emitted by the Sun- and the planetary ionospheres -the ionized portion of the upper atmosphere- is believed to play a significant role.

Contrary to Mars and Venus, the Earth has a strong magnetic field. It acts like a shield creating a bubble, the magnetosphere, which separates its ionosphere from the solar wind. However, this shielding is only partial. The magnetosphere is actually a complex and dynamic environment coupling the solar wind and the ionosphere via plasma and energy exchange.

After a brief introduction on atmospheric evolution, I'll go through the main mechanism that controls ionospheric outflow on unmagnetized (Venus and Mars) and magnetized planets (Earth). We'll see how the presence of a magnetosphere influences ionospheric particles escape on Earth and to what extent the Earth magnetic shield is protective.