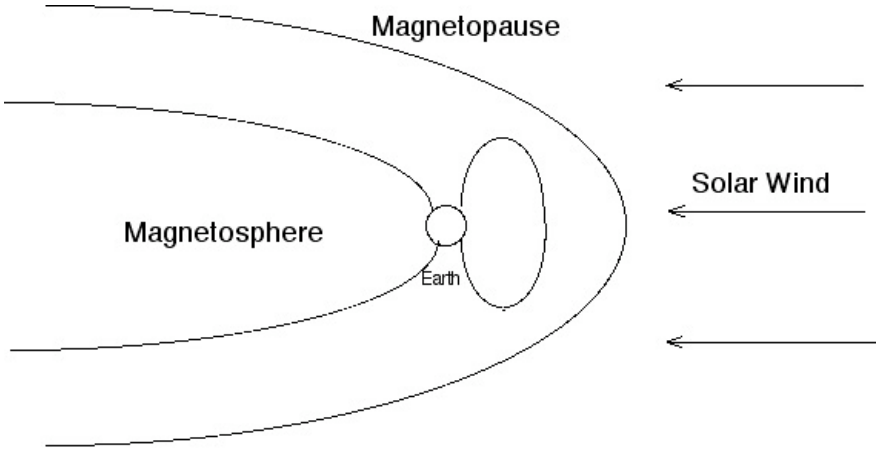
The Magnetosphere and Weather in Space

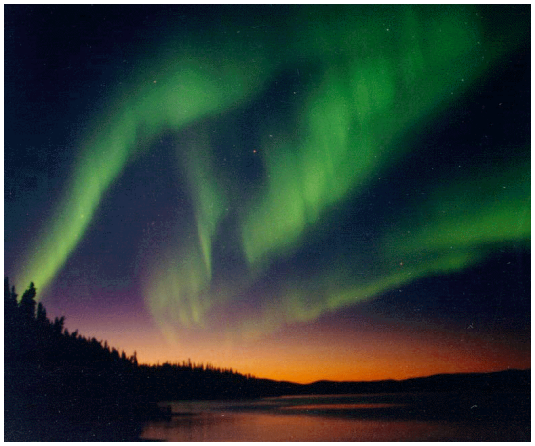
Above the ionosphere is the magnetosphere. The magnetosphere (and part of the ionosphere) is in a part of the atmosphere that can also be called the exosphere. This region is so high above the Earth that a molecule can escape from the atmosphere into interplanetary space without ever running into another molecule! However, the Earth's magnetic field can make an ion or electron's "escape attempt" difficult. In the magnetosphere, the Earth's magnetic field is the main force acting on the low-density plasma that exists above the main atmosphere. Some of the ions and electrons in the magnetosphere have escaped from the atmospheric layers below, and others are from the **solar wind** (a stream of ions and electrons coming from the Sun). Both sets of particles get trapped in the Earth's magnetic field. There are large amounts of these trapped plasma particles in the magnetosphere.

The shape of the magnetosphere is also a bit strange. It isn't "sphere" at all, but has a long tail, like a comet! On the dayside of the Earth, it stretches 5 times the diameter (width) of our planet. (That's 1/6 of the way to the moon!) On the night side, the tail stretches out to more than 100 Earth diameters, or past the moon. The magnetopause is the place in space where the Earth's magnetic field interacts directly with Sun's own powerful magnetic field and the solar wind. The force of solar wind pushes the Earth's magnetic field in on the dayside and stretches it out on the night side, creating the tail. The magnetosphere isn't just a strange place in near-Earth space. This region protects the Earth, and all life on our planet, from the high-energy ions in the solar wind.



Stretching far into space, the magnetosphere is pushed into a comet-like shape by the powerful solar wind. *Illustration by Dr. Marc Hairston.*

Much like the winds in the troposphere that can bring storms to our homes and schools, the solar wind can carry the particles and energy from the Sun's magnetic storms to our planet. These magnetic storms can strongly affect our magnetosphere. If the storm is strong enough, the magnetosphere can't trap or deflect all of the high-energy particles. High-energy ions can stream toward the ionosphere near the Earth's magnetic poles. When these ions strike the particles in the ionosphere they causes them to glow, producing beautiful colors in the night sky called aurora. High-energy ions can also break satellites, interfere with communications, and cause problems with satellite navigation. Very strong storms can even affect our electrical systems on the ground!



Aurora's (also called Northern or Southern Lights) are a spectacular example of weather in space affecting the atmosphere of the Earth.

Image from the NASA Exhibit: **Earth – In the Path of a Storm** http://www-istp.gsfc.nasa.gov/exhibit/earth.html

Learn more about Storms from the Sun at

http://pwg.gsfc.nasa.gov/istp/outreach/cmeposter/

Learn more about Earth's magnetosphere at

http://science.nasa.gov/ssl/pad/sppb/edu/magnetosphere/mag2.html

Explore how the Solar and Heliospheric Observatory (SOHO) helps scientists monitor Sun-related space weather at http://sohowww.nascom.nasa.gov/