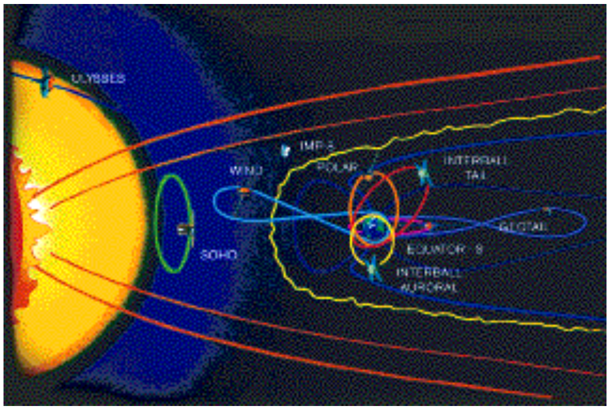
Seeing the Invisible

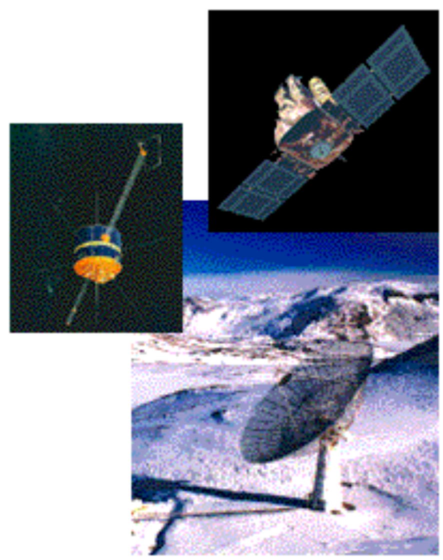


Movie: CME to Earth (700K QT)

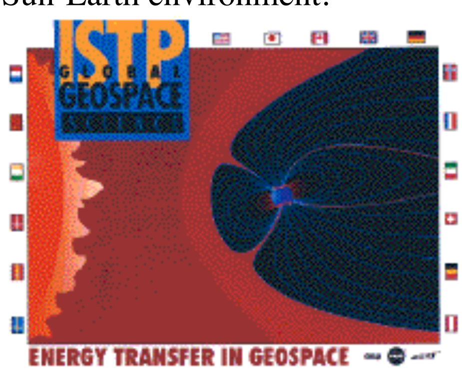
Auroras are a visible sign of the magnetic mayhem in our atmosphere, but beyond that, the human eye can't detect much of what we call space weather. That's because most of the material flowing from Sun to Earth is too small, too diffuse, or too dim-when measured against the background of space or the brightness of the Sun-to register in the visible portion of the spectrum.

For instance, since the corona is only visible to the naked eye during an eclipse, scientists must use an occulting disk-which blocks out the light from the solar surface to create an artificial eclipse-to detect what the Sun is spitting into space. Some of the most important recent advances in understanding and tracking coronal mass ejections have come from cameras that photograph the corona and detect the plasma of a CME as it heads toward Earth. In order to see the invisible, space physicists rely on telescopes that detect visible light, ultraviolet light, gamma rays, and X rays. They use receivers and transmitters that detect the radio shock waves created when a CME crashes into the solar wind (the equivalent of a sonic boom in space). They employ particle detectors to count ions and electrons, magnetometers to record changes in magnetic fields, and cameras to observe the auroral patterns over the whole Earth.

All of these instruments and many others are the tools of the hundreds of scientists participating in the International Solar-Terrestrial Physics (ISTP) program, a global effort to observe and understand our star and its effects on our environment. An armada of more than 25 satellites carry those instruments into space, and together with ground-based observatories, they allow scientists to study the Sun, the Earth, and the space between them. Individually, the spacecraft contributing to ISTP act as microscopes, studying the fine detail of the Sun, the solar wind, and the boundaries and internal workings of Earth's magnetic shell. When linked together with each other and the resources on the ground, they act as a wide-field telescope that sees the entire Sun-Earth environment.



Movie: Sondrestrom (2.5M MPEG)



The spacecraft of ISTP-principally, Wind, Polar, Geotail, and the Solar and Heliospheric Observatory-allow physicists to observe all the key regions of Earth's space. They study the interior of the Sun, its surface and corona, the solar wind, and Earth's magnetosphere, including the auroral regions and Van Allen radiation belts. Orbiting as far as one million miles and as close as a few hundred miles from Earth, the spacecraft of

Movie: Total Solar Eclipse (900K MPEG)

ISTP make coordinated, simultaneous observations of the Sun and activity in the magnetosphere. Working together with ground observatories, these spacecraft can now-for the first time ever-track CMEs and other space weather events from cradle to grave. Someday, they might even be able to predict the arrival and effects of CMEs.

NEXT PANEL: Blackouts, Burnouts, and Bummers

Brought to you by the International Solar-Terrestrial Physics Program and NASA.
