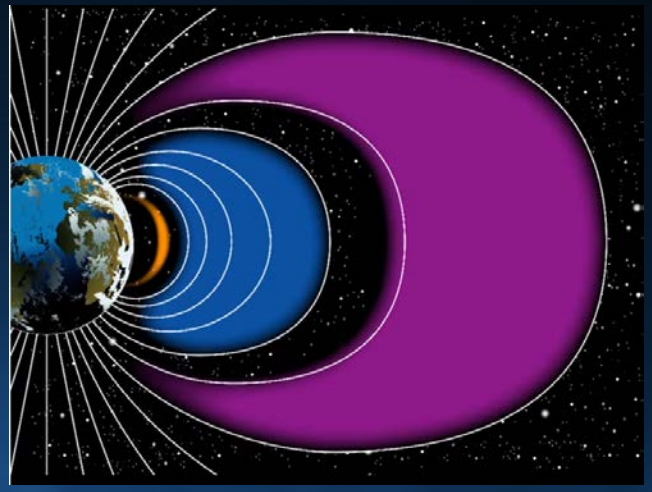
Space Weather Events Linked to Human Activity



This is a still capture of an SDO video showing the artificial radiation belts created as a result of the tests. Credit: NASA GSFC/Genna Duberstein

A collaboration of researchers from the U.S. and the U.K. has found that Cold War era nuclear tests conducted in the 1950s caused space weather effects similar to some initiated by storms on the surface of the sun. Their analysis was recently published in *Space Sciences Reviews.*

From 1958 to 1962, the U.S. and U.S.S.R. ran high-altitude tests with exotic code names like Starfish, Argus and Teak. The tests have long since ended, and the goals at the time were military. Today, however, the analysis of these tests and their effects can provide crucial information on how human activity can affect space.

These tests, which were nuclear detonations, created effects that were seen around the world. A first blast wave expanded into a fireball of plasma upon detonation. The resulting geomagnetic disturbance distorted Earth's magnetic field lines, inducing electric fields on Earth's surface. As a result of this anthropogenic activity, aurora appeared at the equator instead of the poles, utility grids in Hawaii became strained, and, in some cases, satellites were affected. Some of the tests even created artificial radiation belts, akin to the natural Van Allen radiation belts surrounding Earth. The charged particles in these artificial belts remained trapped in Earth's magnetosphere in significant numbers for weeks, and in one case, years.

Such atmospheric nuclear testing has long since stopped, and the present space environment remains mostly affected by natural phenomena. However, considering such historical events allows scientists and engineers to better understand the effects of space weather on our infrastructure and technical systems, which can help support efforts to protect satellites and astronauts from the natural radiation inherent in space.

NASA Heliophysics missions, like MMS, Van Allen Probes and THEMIS, study Earth's magnetosphere and the causes of space weather. Other NASA missions, like STEREO, constantly survey the sun, studying activity that could trigger space weather. NASA's ICON and GOLD missions will soon launch to better understand the interaction between Earth-based and space-based processes. These missions help inform scientists about the complex system we live in, and how to protect the satellites we utilize for communication and navigation on a daily basis.