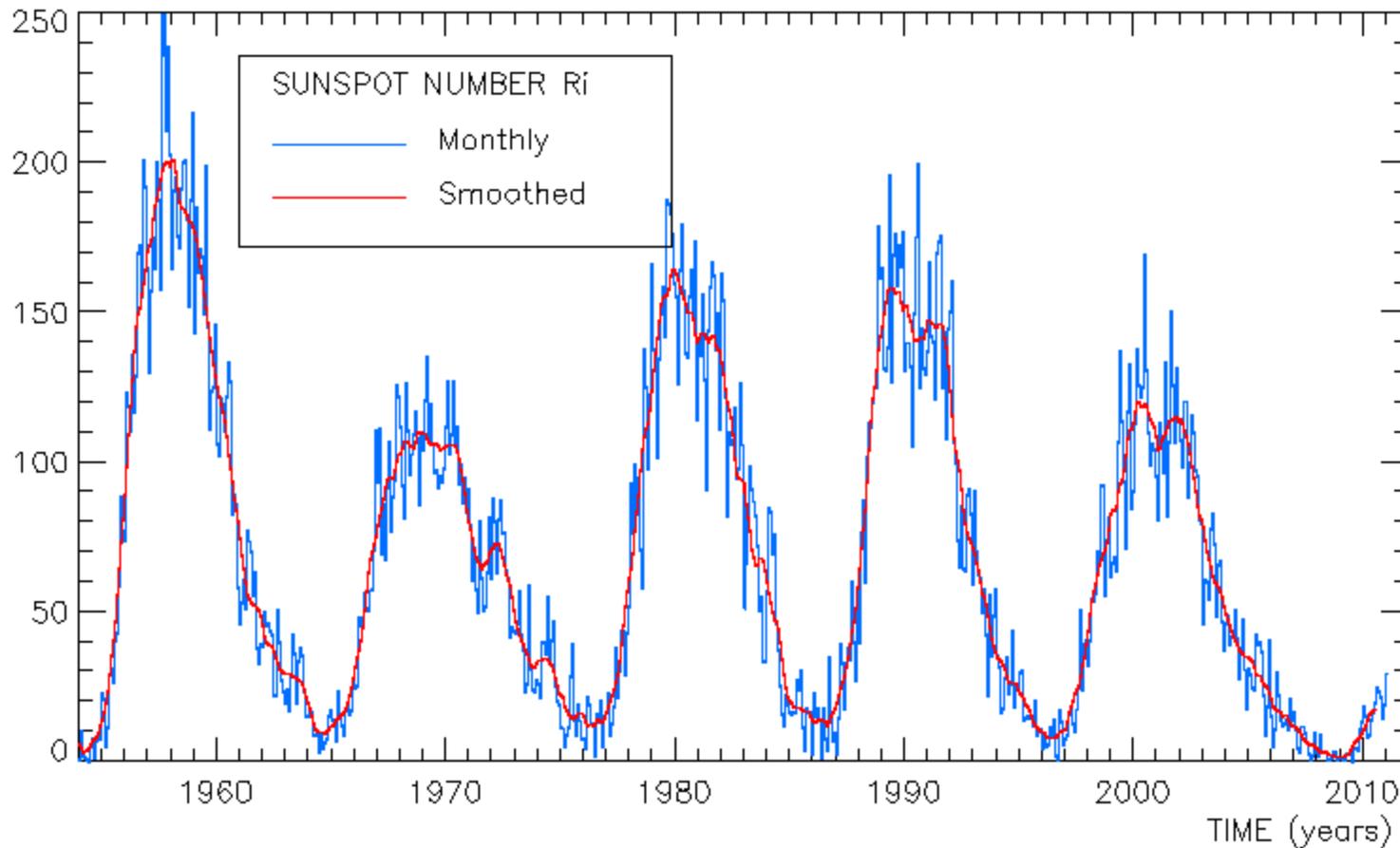


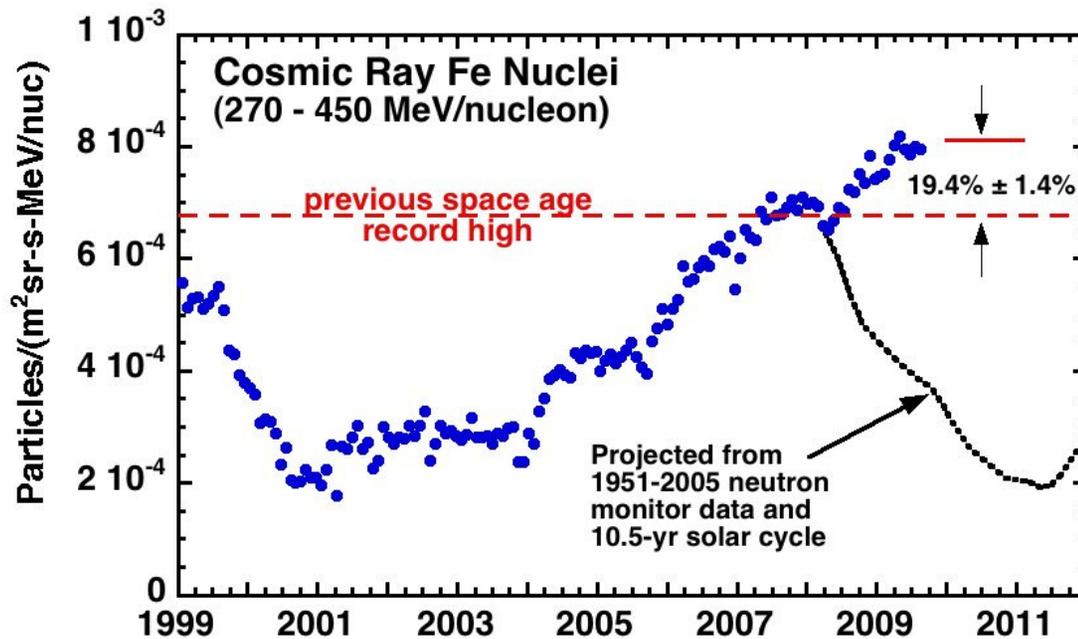
Five Sunspot Cycles



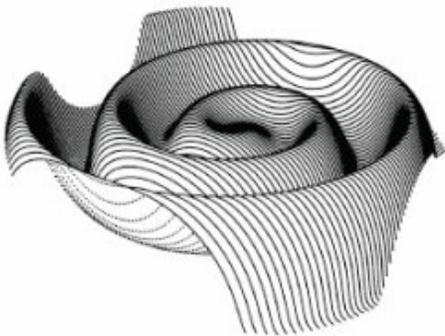
Courtesy of Solar Influences Data Analysis Center, Belgium

Cosmic Rays Hit A Space Age High

"In 2009, cosmic ray intensities have increased 19% beyond anything we've seen in the past 50 years. This is a direct result of solar minimum and a weakened solar magnetic field." Richard Mewaldt of Caltech.

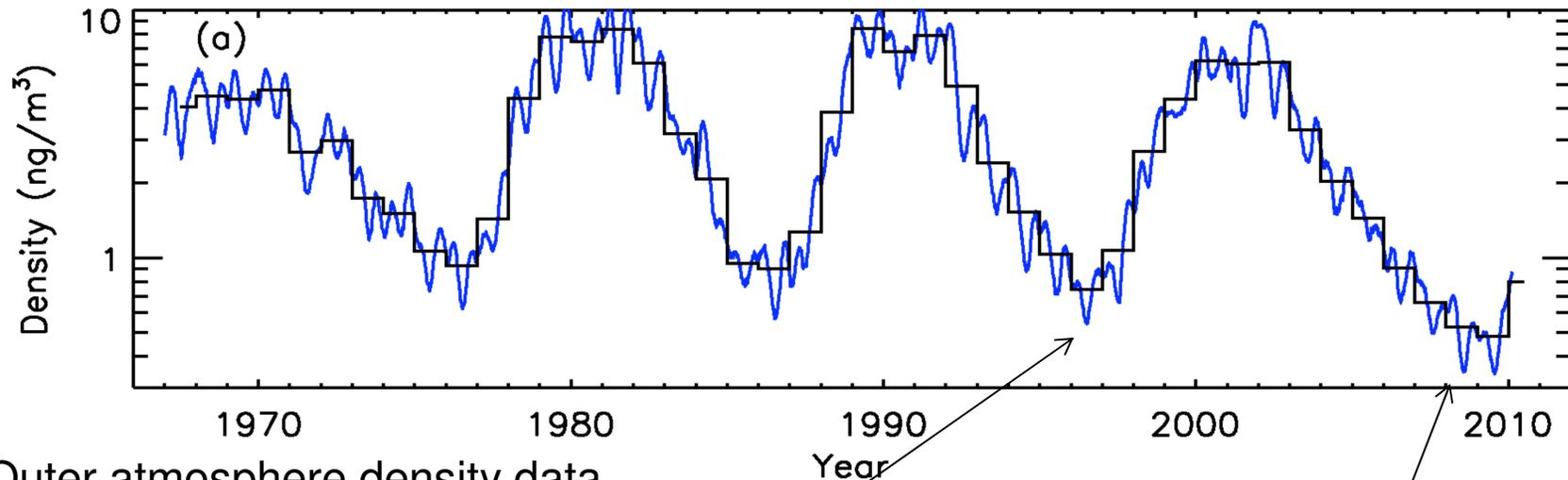


Data from NASA's ACE spacecraft reveal the surge in biologically-significant iron nuclei:



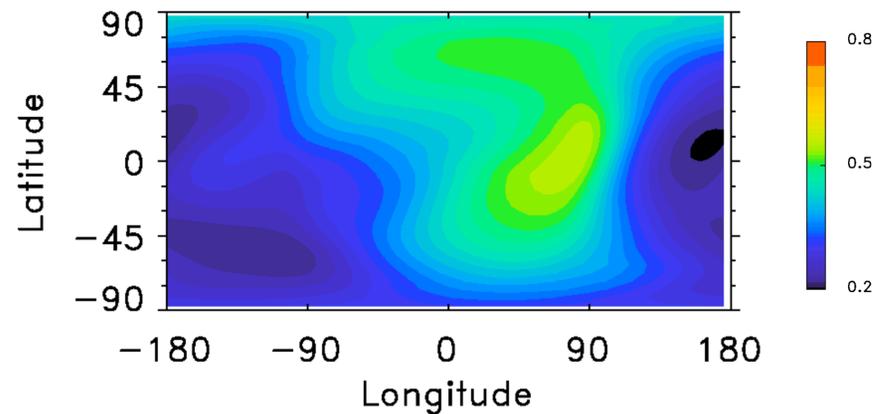
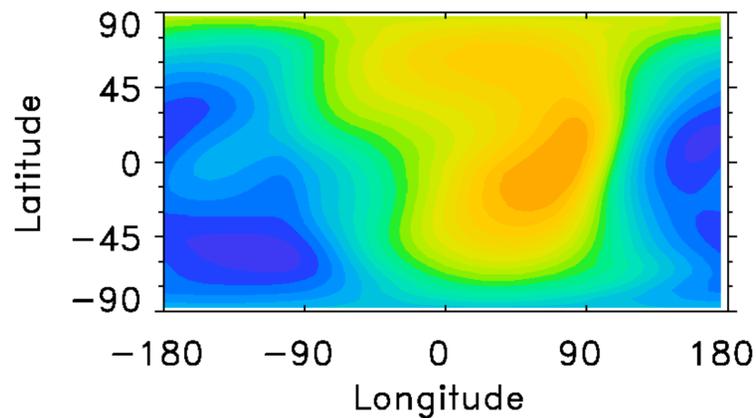
Shape of the Sun's extended envelope during solar maximum. During solar minimum the shape flattens and thus provides less protection from cosmic rays. In a deep solar minimum the protection is further reduced

Outer Atmosphere Density Decreases



Outer atmosphere density data
from John Emmert, Naval
Research Laboratory
1996

2008

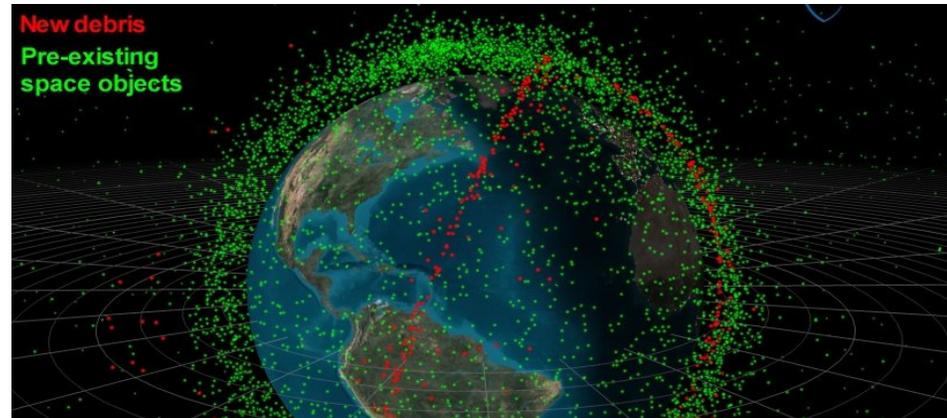


Model density data from Stan Solomon at the
National Center For Atmospheric Research

Space Junk Accumulates

In February 2009, the Kosmos 2251 and Iridium 33 satellites collided over northern Siberia, spewing thousands of fragments into low-Earth orbit. The usual decay of these fragments has been slowed and almost stopped by the effects of extreme solar minimum.

The collapse of Earth's upper atmosphere reduces aerodynamic drag on satellites and space junk.

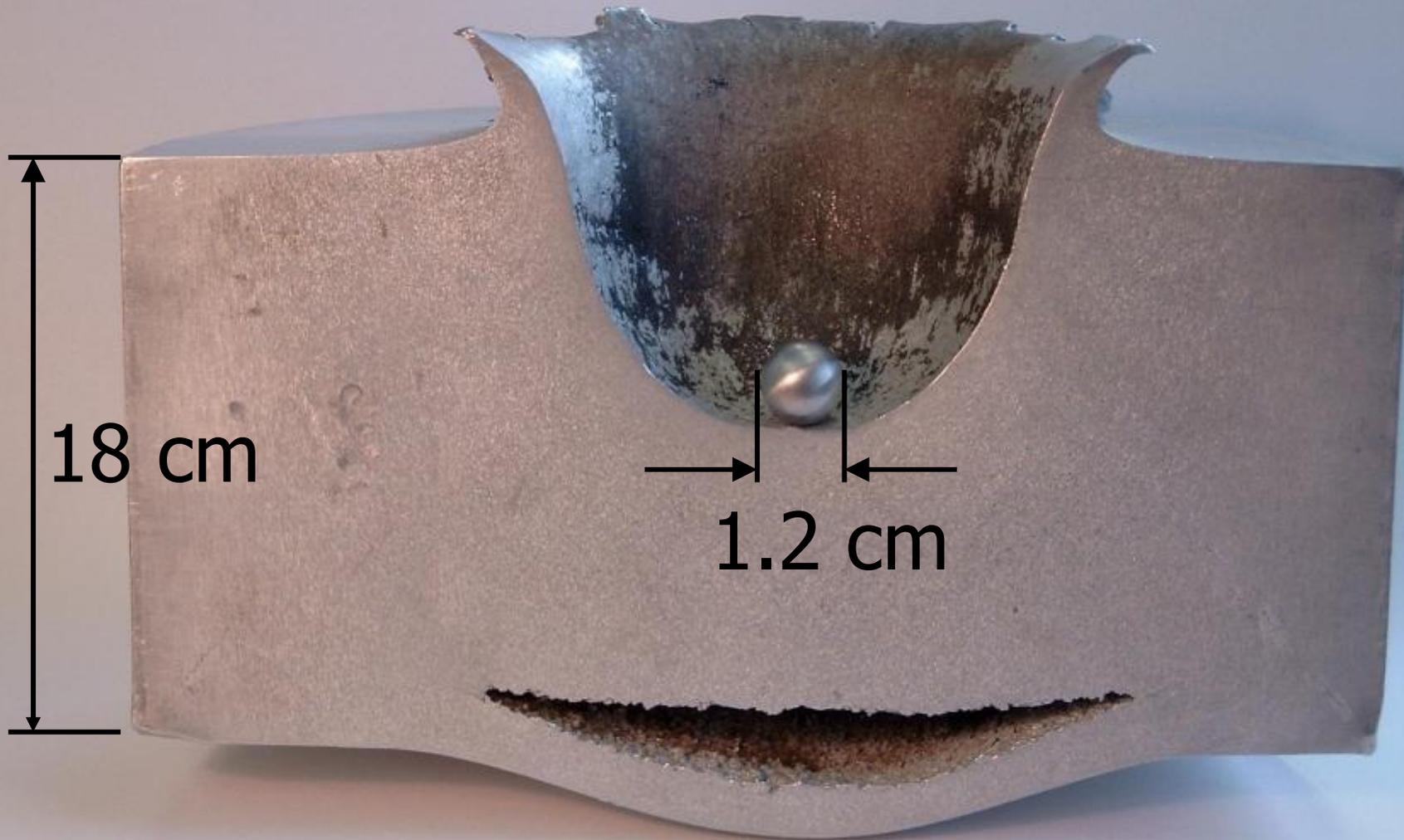


If Solar Cycle 24 is of average strength, 50% to 75% of Kosmos/Iridium debris will decay within the next 11 years.

On the other hand, if Solar Cycle 24 is very weak, as much as 80% of the debris will remain in orbit.

This is according to simulations done by the Orbital Debris Group at JSC.

Space debris hazards



Impact at 6.8 km/s: 56,500 J

Image
courtesy of
ESA