

## **Solar Minimum Alert**

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Increased cosmic radiation during solar minimum results in an increased risk of breast cancer for the female grandchildren of females who as fetuses experienced the exposure.

ICECAP (<http://www.icecap.us>) has brought us the disturbing news that according to sensors on NASA's ACE (Advanced Composition Explorer) spacecraft, the quantity of galactic cosmic rays hitting the Earth's surface during the current solar minimum has reached historic highs. "In 2009, cosmic ray intensities have increased 19% beyond anything we've seen in the past 50 years," says Richard Mewaldt of Caltech. The cause of the surge is solar minimum, a deep lull in solar activity that began around 2007 and continues today. See [http://www.nasa.gov/topics/solarsystem/features/ray\\_surge.html](http://www.nasa.gov/topics/solarsystem/features/ray_surge.html)

High levels of solar activity result in a reduced incidence of high energy cosmic radiation hitting the Earth. When the Sun is less active, a greater amount of high energy cosmic radiation hits the Earth. High levels of solar activity generate more turbulence in the heliosphere scattering galactic cosmic rays before they reach the inner planets. When the Sun is less active, the Heliospheric magnetic fields are smoother with less scattering of galactic cosmic rays.

Interestingly, the higher the level of solar activity the more Earth's geomagnetic field is disturbed. This strengthens its connection with the Heliospheric magnetic field, which would allow more galactic cosmic rays in, except that the more active Sun has already depleted the incidence of them in the solar system.

Right now solar activity is as weak as it has been in modern times, setting the stage for what Richard Mewaldt of Caltech calls "a perfect storm of cosmic rays." "We're experiencing the deepest solar minimum in nearly a century," says Dean Pesnell of the Goddard Space Flight Center, "so it is no surprise that cosmic rays are at record levels for the Space Age."

The news is disturbing because it means that there is an increased risk of breast cancer in the female grandchildren of unborn female fetuses who are being exposed to the cosmic radiation during the current solar minimum i.e. 2007 to 2010. This statistically significant relationship has been established by the most meticulous and authoritative epidemiological studies of Dr David Juckett, a leading epidemiologist who researches cancer.

Juckett (2007) reported evidence of a grandmother effect in the development of cancer in adults whose mother, whilst an evolving fetus at a particular stage of development, was exposed to increased incidences of galactic cosmic rays sweeping the planet during times of low solar activity. He found a statistically significant correlation between the birth cohort oscillation and variations in background cosmic radiation one generation prior to the birth cohorts.

Juckett and Rosenberg (1997) demonstrated that exposure to cosmic radiation results in an increased risk of breast cancer for the female grandchildren of females, who as fetuses experienced the exposure. This study examined only US female breast cancer and total female cancer deaths between 1940 and 1990. The authors' analysis showed that the priming event which gave rise to this increased risk was probably increased amounts of cosmic radiation during an episode of reduced solar activity. The authors proposed that the priming event, by preceding other steps of carcinogenesis, works in concert with risk factor exposure during life.

Juckett (2007) explored the global nature of that effect by examining cancer time variations for population cohorts in five countries on three continents. He used age-period-cohort analysis to separate cohort-related effects from period-related effects. This technique generated time signatures for comparisons among both male and female populations in the United States (US), United Kingdom (UK), Australia (AU), Canada (CA), and New Zealand (NZ). Available cancer mortality data spanned most of the twentieth century for US, UK, and AU, with shorter periods for CA and NZ.

Juckett (2007) found that the longest cohort series spanned 1825 to 1965 and exhibited two peaks of higher mortality likelihood approximately 75 years apart in all countries and in both sexes. He reasoned that the constancy of this oscillation on three continents and both hemispheres suggests the presence of a global environmental effect.

Juckett (2007) noted that during an early phase of fetal development, the migrating germ cell is highly sensitive to radiation and that there is a real probability that each germ cell could receive more than one ionizing radiation event during this sensitive migration period. He considered that the hypothetical link between cosmic radiation and epigenetic changes may only be the tip of the iceberg regarding background radiation effects. This particular radiation is detectable because of its time signature.

Juckett (2007) cautioned that while the results of this analysis suggest a global cohort effect that may be linked to environmental cosmic radiation, knowledge of this effect does not lend itself to simple strategies that can prevent the damage from occurring in Earth populations.

#### References:

Juckett, D., and Rosenberg, Barnett, 1997. "Time series analysis supporting the hypothesis that enhanced cosmic radiation during germ cell formation can increase breast cancer mortality in germ cell cohorts". *International Journal of Biometeorology* Vol 40, No. 4 pps 206-222 DOI 10.1007/s004840050043.

Juckett, D. A., (2007). A 140-year global time signature in cancer mortality birth cohorts correlates to galactic cosmic ray variation. *International Journal of Astrobiology*, 6: 307-319 CUP; doi:10.1017/S1473550407003928. Published online by CUP 29 Oct 2007.