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Memo to: The Climate Club -- C759 31 July 1988
From: Walt Roberts

Provocation No. 220
Sunspots are on the Rise

The sunspots are rapidly increasing in number and complexity. Their steep rate of climb signals what may turn out to be the biggest sunspot maximum ever recorded. No previously recorded cycle of sunspot activity has exhibited so fast a rise.

Just over a year ago I mentioned in "Provocation 162" (CC601, 20 Jun 1987) that the space coronagraph operated from our High Altitude Observatory (HAO) had detected the first outbreak of new sunspot cycle activity of Cycle 22. There I pointed out that the dark sunspots burst out in irregular patches over the sun as expanding convective gases cool the surface from its normal temperature of 6000 C. Sunspots wax and wane in a roughly periodic manner with an average cycle rate of about 11 years. Sunspots, flares and coronal hot spots are manifestations of solar activity important to satellite and ground communications, radio transmission, as well as trajectories of space vehicles, missiles, and space junk. Recently two of our close colleagues also found evidence of a solar activity effect in world weather patterns (Prov-187, CC692).

Gary Heckman, my close friend and colleague at the NOAA-Air Force Space Environment Services Center, here in Boulder, sounds a warning about the possible huge solar peak in "EOS," a journal of the American Geophysical Union.

This cycle is the 22nd since the early 1700s when daily telescopic sunspot measurements became routine. Cycle 19 is the strongest maximum recorded thus far. It came during the intensive, worldwide observational programs of the International Geophysical Year (IGY). Indeed, the IGY was planned for this period based on sunspot predictions made some years before. The HAO played a strong role in the solar observations of the IGY. As Director of HAO, I chaired the international committee for the detection and reporting of solar flares. At solar maximum, large bursts of X-rays strike the earth and space vehicles. Clouds of energetic protons wreak havoc with satellites and polar region radio communications. Geomagnetic storms disrupt power and telephone lines. Satellites in orbit experience increased drag, and space debris falls out at an increased rate. Stratospheric ozone increases, perhaps temporarily ameliorating the ozone deficiency from CFCs. (Prov-178 CC659 and Prov-168 CC620).

Heckman's prediction is based strictly on analyses of the past behavior of spot cycle maxima, which seem to be larger when the growth rate is faster. However other methods of prediction, including a more theoretical one by NASA Goddard/Yale University scientists, also predict that Cycle 22 will have a larger than average peak. One commonly used forecast method, called the "precursor method," does not project a record

size peak. The peak is expected by 1990 or 1991, so we shall not have to wait too long to see which forecast works best.

Many of our modern techniques of information management and transfer are resistant to adverse effects of the solar maximum. Fiber optics systems, for example, are far less sensitive than ones dependent of conduction of electricity or transmission of radio waves. But with the sheer volume and sophistication of today's information systems we remain highly vulnerable. It will be important to study intensely the measures needed to increase further our security from sun-induced disruptions, if indeed the maximum is a record breaker.

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