SKYWARN TIMES

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SKYWARN NET: Fridays @ 9 pm EST, FREQ: 147.315 MHz, PL-100 Hz
NCS: DAVID TORREY, NCS OF THE FRIDAY NIGHT SKYWARN NET 483-4885
PACKET RADIO CHANNEL: 145.090 MHz.
PACKET APRS WX: 144.390 MHz
MARQUETTE NWS: wx8mqt-1 (Use 145.090 Mhz Packet radio - AX.25)
PACKET LINK: c wx8mqt-1 v kwnw (AX.25 Packet)
SPOTTER'S LINK TO NWS: 1-800-828-8002 (Spotter's only):

NOAA WX HOME PAGE IN MARQUETTE: http://www.crh.noaa.gov/mqt/
AMATEUR RADIO STATION IN NEGAUNEE: WX8MQT
METEOROLOGIST-IN-CHARGE: Robin J. Turner: KC8TII (906) 475-5782 EXT. 642
WARNING COORDINATION METEOROLOGIST: Matt Zika , KD8EFY (906) 475-5782 EXT. 726

CONTACT INFORMATION:
Marquette, MI Weather Forecast Office
112 AIRPARK Drive, South
Negaunee, MI 49866
E-Mail: w0mqt.webmaster@noaa.gov

CHECKINS TO THE SKYWARN NET FOR THE MONTH OF FEBRUARY-2010
(Highlighted names/calls are "Honor Roll" Checked in 4 times during February)

WB8CBA	Edwin	Calumet	1
W8FMR	Terry	Laurium	2
W8FWG	**George**	**Laurium**	**4**
KD8GBH	David	Dollar Bay	3
KC8HBE	Michael	Bay City (Via Echolink)	1
K8HRO	**Randy**	**Aura**	**4**
KD8JAM	**William**	**Allouez**	**4**
W8KQB	**Tom**	**Elo**	**4**
WX8MQT	William	Negaunee	2
KC8OCK	Al	Ontonagon	1
N8PUM	Brandon	Ishpeming	1
KB8XI	Roland	Hancock	1
KC8YDU	Mark	Hancock	1
KC8YSZ	**Gary**	**Bumbletown**	**4**
TOTAL:			**33**

NOAA / Space Weather Prediction Center

SWPC Frequently Asked Questions

General Space Weather | Effects on Earth | Noaa Space Weather Scales | ACE Real-Time Solar Wind

General Questions about Space Weather

1. What is the role of the Space Weather Prediction Center?To deliver space weather products and services that meet the evolving needs of the nation. The Space Weather Prediction Center gathers, in real time, the available data that describes the state of the Sun, Heliosphere, Magnetosphere, and Ionosphere to form a picture of the environment from the Sun to the Earth. With this information, forecasts, watches, warnings and alerts are prepared by the Space Weather Prediction Center and issued to anyone affected by space weather.

2. How do you monitor events on the sun?SWPC scientists and technicians utilize a variety of ground- and space-based sensors and imaging systems to view activity at various depths in the solar atmosphere. A worldwide network of USAF-sponsored optical observatories also provides space weather forecasters with detailed plain-language discussions and coded reports of activity in and around sunspot groups, as well as other areas of interest on the Sun.

3. What types of industries might be impacted by space weather and how?GPS sales are projected to be $9 billion per year in 2000. GPS receivers are increasingly interwoven into the fabric of commerce and recreation.New investment in low and mid Earth orbiting spacecraft is expected to be $30 billion by 2001. Each constellation's loss of revenue is estimated at $1 k per minute of outage per satellite; this does not consider the users' losses.Delay in assembly of International Space Station could have a domino effect on Shuttle flight manifests, at $500 M per flight. One credible electric power outage could result in a direct loss to US Gross Domestic Product of $3 - $6 billion (reference: Barnes, P.R. and J.W. Van Dyke, "On the Vulnerability of Electric Power to Geomagnetic Storms," Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1990. (published as a Technical Report of the Oak Ridge National Laboratory).A recent estimate is that the use of good forecasts by the power industry could save the US $365 M per year, averaged over the solar cycle (reference: "An Estimate of the Value of Geomagnetic Storm Forecasts," by Rodney F. Weiher and Thomas J. Teisberg. (Published in an economics journal.)

4. What is a solar flare?A solar flare is an intense burst of radiation coming from the release of magnetic energy associated with sunspots. We typically see a solar flare by the photons (or light) it releases, at most every wavelength of the spectrum. The primary ways we monitor flares are in x-rays and optical light. Flares are also sites where particles (electrons, protons, and heavier particles) are accelerated.

5. Does ALL solar activity impact Earth? Why or why not?We can divide solar activity into four main components. Solar flares, coronal mass ejections, high speed solar wind, and solar energetic particles.Solar flares impact Earth only when they occur on the side of the Sun facing Earth. Because flares are made of photons, these travel out directly from the flare site, so if we can see the flare, we can be impacted by it. Coronal mass ejections, also called CMEs, are large clouds of plasma and magnetic field that erupt from the Sun. These clouds can erupt in any direction, and then continue on in that direction, plowing right through the solar wind. Only when the cloud is aimed at Earth will the CME hit Earth and therefore cause impacts.High speed solar wind streams coming from the Sun come from special areas on the Sun known as coronal holes. These holes can form anywhere on the Sun and usually only when they are closer to the equator than to the solar poles do the winds they produce impact Earth. Solar energetic particles are high energy charged particles, thought to primarily be released by coronal mass ejections. Where the cloud of a CME plows through the solar wind, the solar energetic particles are travelling much faster and because they are charged, must follow the magnetic field lines that pervade the space between the Sun and the Earth. Therefore, only the charged particles that follow magnetic field lines that intersect the Earth will have an impact on Earth.

6. How strong is solar wind (compared to wind on Earth)?The solar wind is very weak compared to the wind on Earth, though it is much, much faster. When we measure solar wind speeds, we typically get speeds of 1-2 million miles per hour. They end up being weaker because there is very little of it. The solar wind density is usually about 100 particles per cubic inch. Thus, a typical pressure from the solar wind is measure in something called nanopascals whereas at the Earth's surface, the atmospheric pressure is 100 kilopascals, and surface winds are about 100 pascals. Since solar wind is measured in nanopascals (10^-9 pascals) it is approximately 1000 million times weaker than winds here on Earth.

7. Have scientists seen changes in the intensity of space weather?On a short time scale, the intensity of space weather is always changing. Conditions can be mild one minute and stormy the next. On longer time scales, space weather varies with the solar cycle. The solar cycle is an average 11 year cycle where the number of sunspots goes from very few per month, to many, and back to very few. At solar minimum, we might see no sunspots where at solar maximum, we can have 200 sunspots in a month. Solar flares, coronal mass ejections and solar energetic particles all increase in frequency as we get closer to solar maximum. High speed wind streams are more frequent at solar minimum, thus ensuring that space weather is something to watch for no matter where we are in the solar cycle.

8. What are sunspots and how do they relate to space weather?The magnetic field in sunspots stores energy that is released in solar flares. As a result, flares usually occur in a cycle that mimics the eleven-year sunspot cycle. Other forms of space weather such as geomagnetic storms and proton radiation showers follow a similar cycle. Sunspots usually occur in groups-usually as simple pairs-but at times in complicated arrangements with many spots and complex shapes. These unusual regions most often produce solar flares. Space weather forecasters use the complexity and shapes of sunspots to make flare forecasts-the more complex the groups of spots, the more likely a flare will occur.

9. What is the solar max and solar min?At solar minimum, the sun may go many days with no spots visible. At maximum, there may be several hundred spots on any day.

10. What are the northern lights and are they related to space weather?When the sun is active, it often produces mass ejections that interact with Earth's magnetic field. Electric currents begin to flow in the upper atmosphere, and these currents produce the aurora borealis, which occurs almost simultaneously around both the north and south poles.

11. How do you forecast space weather?A good space weather forecast begins with a thorough analysis. SWPC forecasters analyze near-real-time ground- and space-based observations to assess the current state of the solar-geophysical environment (from the Sun to the Earth and points in between). Space weather forecasters also analyze the 27-day recurrent pattern of solar activity. Based on a thorough analysis of current conditions, comparing these conditions to past situations, and using numerical models similar to weather models, forecasters are able to predict space weather on times scales of hours to weeks.

12. Why is forecasting space weather important?Some of the specific effects of space weather on Earth systems include interference with short wave radio propagation, problems with electric power grids, the decay of satellite orbits, and radiation hazard for satellites and for astronauts during some phases of space missions.

13. When do the effects of space weather show up?Flares (sudden brightenings) affect the ionosphere immediately, with adverse effects upon communications and radio navigation (GPS and LORAN). Accompanying radio bursts from the Sun are expected to exceed cell phone system noise tolerances 2 - 3 times per solar cycle.Solar energetic particles arrive in 20 minutes to several hours, threatening the electronics of spacecraft and unprotected astronauts, as they rise to 10,000 times the quiet background flux.Ejected bulk plasma and its pervading magnetic field arrive in 30 - 72 hours (depending upon initial speed and deceleration) setting off a geomagnetic storm, causing currents to flow in the magnetosphere and particles to be energized. The currents cause atmospheric heating and increased drag for satellite operators; they also induce voltages and currents in long conductors at ground level, adversely affecting pipelines and electric power grids. The energetic particles cause the northern lights, as well as surface and deep dielectric charging of spacecraft; subsequent electrostatic discharge of the excess charge build-up can damage spacecraft electronics. The ionosphere departs from its normal state, due to the currents and the energetic particles, thereby adversely affecting communications and radionavigation.Rayleigh-Taylor instability often occurs in tropical latitudes, causing rising bubbles to ascend out of the top of the ionosphere and substantially distorting the normal layering. This causes radio beams propagating through the rising columns to suffer up to 30 dB of scintillation; GPS receivers lose lock and communication signals break up as a result.

14. How long have scientists known about space weather?Space weather is noticed mostly by its effects on Earth. After a great solar flare in 1859, telegraph operators discovered that currents from the intense aurora borealis was flowing through their systems, causing their telegraph keys to melt and stick in position. During World War II, the new invention of radar failed whenever the space weather activity was high. Comet tails that curved and pointed way from the sun showed that a solar wind, a part of space weather, was always blowing out through the solar system. When police cars in San Francisco tried to talk to their dispatchers, dispatchers in Minneapolis answered (reference: The Northern Light, A. Brekke, A. Egeland, Springer-Verlag, New York. 1983). Plans for revisiting the Hubbell Telescope in orbit and boosting it high enough that it will not fall to Earth are driven by space weather. When space weather is high, the orbit decays more rapidly and booster missions must be flown more often.

15. How does the "South Atlantic Anomaly" affect satellites?The South Atlantic Anomaly is a dip in the Earth's magnetic field which allows cosmic rays, and charged particles to reach lower into the atmosphere. The anomaly is always there, but it does change in intensity. The SAA is populated with high energy particles that can penetrate the skin of the spacecraft and cause upsets in spacecraft electronics.-DS

16. What types of industries might be impacted by space weather and how?GPS sales are projected to be $9 billion per year in 2000. GPS receivers are increasingly interwoven into the fabric of commerce and recreation.New investment in low and mid Earth orbiting spacecraft is expected to be $30 billion by 2001. Each constellation's loss of revenue is estimated at $1 k per minute of outage per satellite; this does not consider the users' losses.Delay in assembly of International Space Station could have a domino effect on Shuttle flight manifests, at $500 M per flight.One credible electric power outage could result in a direct loss to US Gross Domestic Product of $3 - $6 billion (reference: Barnes, P.R. and J.W. Van Dyke, "On the Vulnerability of Electric Power to Geomagnetic Storms," Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1990. (published as a Technical Report of the Aoak Ridge National Laboratory)).A recent estimate is that the use of good forecasts by the power industry could save the US $365 M per year, averaged over the solar cycle (reference: "An Estimate of the Value of Geomagnetic Storm Forecasts," by Rodney F. Weiher and Thomas J. Teisberg. (Published in an economics journal.)

17. How could I demonstrate the effect of space weather on power systems?For demonstration of induced currents in the electrical power grid, you could find a basic induction experiment, i.e. show that a voltage, and therefore a current, is induced in a conductor when exposed to a changing magnetic flux. The basic physics configuration one sees in textbooks is a simple loop-shaped wire through which one moves a bar magnet to induce a flow of current.--CB

18. How sensitive does a meter have to be to sense voltage in an induced current?There is a formula to calculate the current induced in the wire but it depends on the strength of the bar magnet, the rate of change of the magnetic flux threaded through the current loop, and the resistance of the circuit. The faster you can pass the bar magnet through the loop, the stronger the current. If you have a multimeter, you might test the multimeter with a simpler circuit by hooking it up a battery and a light and seeing if you can measure current flow through the multimeter.To get a rough idea of the voltage and current produced by magnetic induction, suppose your bar magnet has a 1 Tesla magnetic field strength, and that the area of the current loop is 100 cm^2 (0.01 m^2). When the bar magnet is in the loop the magnetic flux is the product of the field strength and the area. Let's suppose that the flux goes from zero to 1 Tesla x 100 cm^2 in 1 second. If we use the meter-kilometer-second system of units, then the voltage would be aboutE = 1 T x 0.01 m^2/1 s = 0.01 VoltsFor a circuit with 2 Ohms of resistance this would give a current of 0.005 Amps, (5 mA). I have used Ohm's Law that current equals voltage divided by resistance.As you can see, the larger the circuit and the stronger the magnetic field, the larger the current. Also the faster the field changes the larger the current. As a caution, note that I assumed a uniform magnetic field throughout the current loop. In reality the field falls off as one moves away from the magnet. The closer the magnet size is to the size of the loop, the closer the uniform field approximation works. If you can get some current readings, this experiment would be one way to estimate the field strength of a typical bar magnet.--CB

19. What satellites observe the sun that have data we can look at?* The Solar and Heliospheric Observatory (SOHO)
* Advanced Composition Explorer (ACE) and SWPC's ACE Real-Time Solar Wind
* GOES 8 and 10
* GOES 12 -- Solar X-ray Imager
* NOAA POES - Energetic Particles
* NOAA POES - Extrapolated Auroral Activity
* Transition Region and Coronal Explorer (TRACE)
* STEREO

20. Where can I get more information?You can find more information on the Internet at the following sites:
Space Weather Prediction Center
SWPC Education Web Page
Space Weather Sites
Space Physics Educational Sites
Solar Terrestrial Activity Report
Space Weather Report
SpaceWeather.com

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