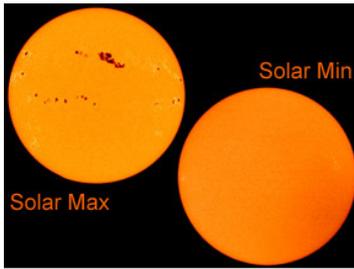
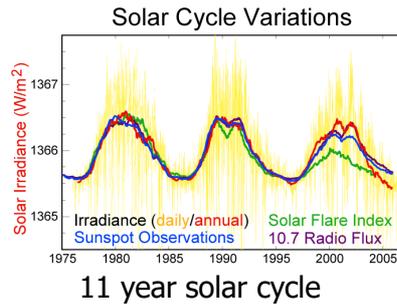


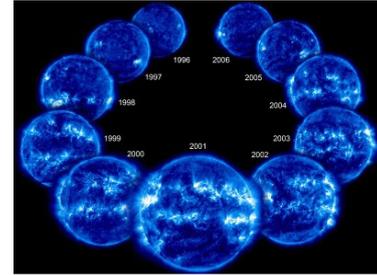
Sun – Part 22 - Solar cycle 1



Sunspot cycle



11 year solar cycle



Solar cycle in ultraviolet

This is also known as the sunspot cycle or the solar magnetic activity cycle. The best known of the Sun's cycles, the name applies to the nearly periodic 11-year observable change in the Sun's activity. Changes include altered levels of solar radiation and ejection of solar material, including solar flares, coronal mass ejections (CME), and changes in the Sun's appearance, including changes in sunspot numbers and position. Changes also occur on Earth eg numbers and strength of aurorae.

Solar maximum and solar minimum, the two extremes of the cycle, refer to the periods of maximum and minimum sunspot count. One cycle spans from one solar minimum to the next one. During solar minimum, solar activity like sunspots and solar flares often does not occur for days at a time. The dates of the solar minimum and maximum are identified by a smoothed average over 12 months of sunspot activity, so identifying the date can usually only happen six months after the event has taken place. At solar maximum, the Sun's magnetic field lines are the most distorted, this phenomenon being associated with the highest levels of solar activity, both in terms of numbers and amplitude of events like solar flares and CMEs.

In each successive cycle, the north and south magnetic polarities of the Sun are reversed, so there is, effectively, a 22-year cycle. However, nearly all manifestations of the solar cycle are insensitive to polarity, so the 11-year cycle remains the focus of interest. The 11-year periodicity is thought to arise from the nature of the solar dynamo.

Observational history From 1826 onwards, the German amateur astronomer Samuel Schwabe started keeping daily records of sunspot numbers in his efforts to find a planet closer to the Sun than Mercury. In 1843, he announced that these numbers varied with a period of about 10 years. In 1857, Rudolph Wolf, a Swiss astronomer, studied these and other observations going back as far as those of Galileo. He confirmed Schwabe's findings and, although refining the cycle length to an average of 11 years, formally acknowledged Schwabe as the discoverer of the sunspot cycle.

In 1899, the American astronomer George Ellery Hale invented the spectroheliograph which he used to study the Sun's surface features and prominences and advanced understanding of sunspots. He identified that they are cooler than the surrounding photosphere (1905) and was also the first to link the solar magnetic field and sunspots (1908). His observations enabled him to describe the physical basis of the solar cycle. In 1919, he showed that the magnetic polarity of sunspot pairs is constant throughout a cycle, is opposite across the equator throughout a cycle, and reverses itself from one cycle to the next. This led to his 1925 proposal that the full solar cycle lasts 22 years, covering two periods of increased and decreased sunspot numbers, accompanied by polar reversals of the solar magnetic field dipole, before the system returns to its original state.

Solar cycle history Sunspot numbers over past 11,400 years have been reconstructed using carbon-14 dendrochronology in addition to more recent visual observation records. Since observations began, the length of solar cycles have ranged from 9-14 years and significant intensity amplitude variations have also occurred. Cycles with larger maximum amplitudes tend to take less time to reach maximum than cycles with smaller amplitudes (the Waldmeier effect). Maximum amplitudes have also been found to be negatively correlated to the lengths of earlier cycles, aiding prediction.

The level of solar activity beginning in the 1940s has been exceptional. The last period of similar magnitude was around 9,000 years ago during warm Boreal period. Overall, the Sun was at a similarly high levels of magnetic activity for only around 10% of the past 11,400 years. Also, almost all early high-activity periods were shorter than the present one.

Solar cycles are numbered, cycle 1 beginning in August 1755. The current cycle number is 24. It began in January 2008, with minimal activity until early 2010. Since then, it has featured a double peak solar maximum, 99 in 2011 and 101 in early 2014. Despite these peaks, it is currently on track to have lowest recorded sunspot activity since accurate records began in 1750.

Cycle 23 lasted 11.6 years, from May 1996 to Jan 2008. The maximum smoothed sunspot number (averaged over a 12 month period) was 120.8 and the minimum 1.7. 805 days had no sunspot activity.

Sources: Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.en.wikipedia.org, www.cse.ssl.berkeley.edu