

## *Comments on the beginning and strength of the new solar cycle (SC24)*

Written after the appearance of NOAA 0981 on 4 and 5 January 2008 and the nonsense that has been published about this on many Dutch and English websites

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\*\*\*First of all...

It is NOT so that a new solar cycle starts the moment a sunspot group with reversed magnetic polarity appears at high solar latitude. By definition, a new solar cycle starts the moment the (smoothed) number of sunspots (the "Wolfnumber") reaches its minimum. It is the general rule that groups at such high latitude usually appear about 10 to 20 months prior to the arrival of this minimum. One can compare the appearance of such a group with the pains of childbirth, and the start of the new solar cycle as the actual birth: They usually do not coincide!

To illustrate the above, a normal and an abnormal example are provided. The first group of the 20<sup>th</sup> cycle at really high latitude appeared in October 1963 (so during cycle 19) at +34° latitude. The Wolfnumber back then was about 26. The minimum was only reached in October 1964 (12 months later!), and had a value of 8. Only then, the 20<sup>th</sup> cycle officially started. For the 21<sup>st</sup> and 22<sup>nd</sup> cycle, the difference between the appearance of the first group at high latitude and the true minimum Wolfnumber was respectively 18 and 19 months.

An example of an abnormal cycle is the current 23<sup>rd</sup> cycle. The first group at relatively high latitudes appeared only in May 1996 at +25°. The minimum took place in... May 1996, with the Wolfnumber just under 8! Thus, the 23<sup>rd</sup> cycle immediately started with a peculiarity.

By the way: the minimum Wolfnumber in the series of official solar cycles has always varied between 0 and 13. It is simply a coincidence that the examples used here all had a minimum value of 8.

\*\*\*Secondly...

The prediction that the next solar cycle (so the 24<sup>th</sup>) will be very active, is the vision of only one half of the solar astronomers. The other half is predicting a moderate to low solar cycle. Both groups of astronomers do use methods in which one could put some reasonable thrust. Nonetheless, the split between both groups is so big that a NOAA/NASA-panel of international scientists could not come to a conclusion in the spring of last year. They published 2 predictions for SC24: one with a maximum Wolfnumber of 140 (+/-20) in 2011, and one with a Wolfnumber of 90 (+/-10) in 2012. See <http://www.swpc.noaa.gov/SolarCycle/SC24/>. During the last decades, scientists have learned a lot on solar cycles and solar activity, and the current situation simply shows how difficult it still is to predict a solar cycle!

However, even more important is that regardless whether the next maximum will be high or moderate, complex sunspot groups can form at any time and produce very powerful solar explosions. For example, the maximum Wolfnumber of the current solar cycle was 120 and as

such 25% lower than the two preceding cycles (+/- 160). Yet SC23 did produce quite a few very powerful explosions that have harmed satellites and disrupted communications, as for example the explosions of the Halloween groups. On September 1<sup>st</sup>, 1859, an explosion took place on the solar surface that was independently observed both by Carrington and Hodgson. Already a day later, this resulted in aurora visible as far south as Cuba and Japan: Truly exceptional! Interestingly, this explosion took place during the maximum of a solar cycle (SC10) that was even weaker than the 23<sup>rd</sup> cycle and that did not even reach 100!!

\*\*\*Finally...

Some rectifications on SC23. The maximum of the 23<sup>rd</sup> cycle took place in April 2000 and reached +/-120. The period of the cycle maximum lasted roughly from about mid-1999 till mid-2002. The appearance of the super-active Halloween groups in October 2003 completely surprised the solar scientists: It was already over 3 years after solar cycle maximum, and the average Wolfnumber had decreased already to barely 60 (so only half of the maximum!). Most remarkably however was that the Sun put up a few encores, but even further down the solar cycle and thus with even lower Wolfnumbers. Most prominently were the sunspot groups of January and September 2005, as well as in December 2006 (!) producing the same powerful explosions and geomagnetic trouble as active groups usually do during solar maximum.

A solar cycle does not begin on a day, but in a month. It is the month where the smoothed (simply said: the 13-month average) Wolfnumber is minimal. This means that for a certain month the smoothed Wolfnumber is known only 6 months later. So, it can only be stated in the summer of 2008 whether or not SC24 really started in January 2008. For the period of minimum activity, one can take as a rule of thumb the period for which the smoothed Wolfnumber is lower than 20. For the ongoing cycle transition, the Wolfnumber dipped under this level only in January 2006. The period of minimum activity is not over yet!