

ACE News #165 – December 2, 2013

Weakest Solar Wind of the Space Age and the Current “Mini” Solar Maximum

The last solar minimum, which extended into 2009, was especially deep and prolonged. Since then, sunspot activity has gone through a very small peak while the heliospheric current sheet achieved large tilt angles similar to prior solar maxima. The solar wind fluid properties and interplanetary magnetic field (IMF) have declined through the prolonged solar minimum and continued to be low through the current “mini” solar maximum. Compared to values typically observed from the mid-1970s through the mid-1990s, the proton parameters are lower on average from 2009 through the day 79 of 2013 by: solar wind speed and beta (~11%); temperature (~40%); thermal pressure (~55%); mass flux (~34%); momentum flux or dynamic pressure (~41%); energy flux (~48%); IMF magnitude (~31%), and radial component of the IMF (~38%). These results have important implications for the solar wind’s interaction with planetary magnetospheres and the heliosphere’s interaction with the local interstellar medium, with the proton dynamic pressure remaining near the lowest values observed in the space age: ~1.4 nPa, compared to ~2.4 nPa typically observed from the mid-1970s through the mid-1990s. The combination of lower magnetic flux emergence from the Sun (carried out in the solar wind as the IMF) and associated low power in the solar wind points to the causal relationship between them. Our results indicate that the low solar wind output is driven by an internal trend in the Sun that is longer than the ~11-year solar cycle, and suggest that this current weak solar maximum is driven by the same trend. See McComas et al. [<http://iopscience.iop.org/0004-637X/779/1/2/article>] for more information.

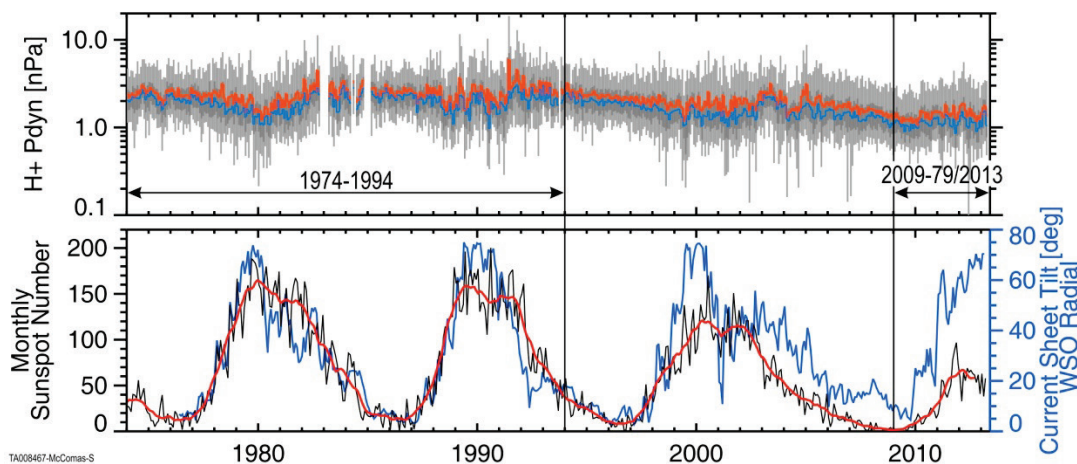


Figure: Top – Solar wind dynamic pressure in the ecliptic plane at ~1 AU, taken from IMP-8, Wind, and ACE and inter-calibrated through OMNI-2. Means (red), medians (blue), 25%-75% ranges (dark grey), and 5%-95% ranges (light grey) are shown averaged over complete solar rotations from 1974 through the first quarter of 2013. Bottom – monthly (black) and smoothed (red) sunspot numbers and the current sheet tilt (blue) derived from the WSO radial model [Hoeksema, SSRv, 72, 137, 1995].

Contributed by Dave McComas, Nigel Angold, Heather Elliott, George Livadiotis, Nathan Schwadron, Ruth Skoug, and Chuck Smith on behalf of the ACE/SWEPAM and MAG teams. Address comments and questions to dmccomas@swri.edu. For an archive of earlier ACE News items, see http://www.srl.caltech.edu/ACE/ACENews_Archives.html