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Ulysses returns to the south polar cap: Magnetic field observations

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The initial Ulysses observations above the Sun's south polar cap occurred in 1993-1994 during the approach to solar minimum. As a consequence of the 6.3 -year orbital period of Ulysses, the recent observations that began in November 2006 are also being obtained near solar minimum. However, at least two major changes have taken place that might lead to significant differences in the two sets of observations. First, the polarities of the magnetic fields reversed as anticipated during the intervening solar maximum so that the polar cap field in now outward instead of inward. Second, the strength of the polar cap fields is about one-half what it was during the earlier observations. We can now compare the recent observations of the polar cap fields with the most important scientific results from the earlier studies. Is the open magnetic flux, measured by the product of the radial component, B_R, and the square of the radial distance, still independent of latitude? If so, what is the total open flux averaged over the Sun? How does it compare with the total open flux at the previous solar minimum? Is there evidence of a significant difference between the latitude of the observed field lines and the latitude at which they originate on the Sun? What does such non-radial expansion of the field imply about the latitude gradient in solar wind speed? Are large amplitude Alfvén waves and magnetic field decreases (mirror mode waves?) continually present and how do their properties compare with those found earlier? Answers to these questions will be discussed using the Ulysses magnetic field observations obtained in late 2006 and early 2007.