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# Helioseismology from South Pole: Past, Present and Future

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**Abstract.** The austral summer of 2002/03 marked the beginning of a new era for helioseismology from South Pole with the running of an experiment to seismically probe the solar atmosphere.

Helioseismology experiments conducted at South Pole over the period 1979 to 1995 provided several fundamental measurements of the properties of the solar interior including the internal sound speed and rotation profiles, and the sub-surface structure of a sunspot.

Today, thanks to these and other ground- and space-based helioseismology experiments, we have a good understanding of the overall properties of the solar interior. The Sun's atmosphere, however, is another story. This region of the Sun is not at all well understood (as evidenced by the lack of any reliable model). However, by observing the Sun at different heights in its atmosphere, and studying the behavior of the acoustic waves with frequencies above the acoustic cut-off frequency, it is possible to seismically map the properties of the atmosphere in an analogous way to that used for the interior (Jefferies 1998). Such maps will provide a strong constraint for any theoretical model of the atmosphere. The austral summer of 2002/03 saw the first multi-line observations at South Pole, with a double magneto-optical filter instrument being used to measure the velocity signals simultaneously in the photosphere and low chromosphere. These data have provided the first maps of sound-speed variations in the Sun's lower atmosphere. The next step is to tomographically map the 3-D structure of the Sun's atmosphere and to examine the coupling of this structure to both the local sub-surface structure and the magnetic field in the atmosphere. The goal being to better understand how and why the Sun varies and how the Sun drives space weather. The next generation of instrumentation has therefore been designed to provide both improved spatial resolution in the vertical direction (by observing more absorption lines in the atmosphere) and simultaneous measurement of the magnetic field at different heights in the atmosphere.

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## References

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