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Seasonal solar wind speeds for the last 100 years: Unique coronal hole structures during the peak and demise of the Grand Modern Maximum

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Solar coronal holes are sources of high-speed solar wind streams, which cause persistent geomagnetic activity especially at high latitudes. Here we estimate seasonal solar wind speeds at 1 AU for the last 100 years using high-latitude geomagnetic measurements and show that they give information on the long-term evolution of important structures of the solar large-scale magnetic field, such as persistent coronal holes.

We find that the centennial evolution of solar wind speed at 1 AU is different for equinoxes and solstices, reflecting differences in the evolution of polar coronal hole extensions and isolated low-latitude coronal holes. Equinoctial solar wind speeds had their centennial maximum in 1952, during the declining phase of solar cycle 18, verifying that polar coronal holes had exceptionally persistent extensions just before the peak of the Grand Modern Maximum of solar activity. On the other hand, solstice speeds had their centennial maximum during the declining phase of solar cycle 23 due to large low-latitude coronal holes.

A similar configuration of seasonal speeds as in cycle 23 was not found earlier, not even during the less active cycles of early 20th century. Therefore the exceptional occurrence of persistent, isolated low-latitude coronal holes in cycle 23 is not related to the absolute level of sunspot activity but, most likely, to the demise of the Grand Modern Maximum.