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Sonification and Citizen Science: New Tools for Magnetospheric ULF Wave Research?

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Sonification, the process of converting an oscillatory time-series into audible sound, is a technique little used in space physics but offers effective navigation, mining, and analysis of large datasets. Such a technique not only enables researchers to gain broader insights into the data but also lends itself well to citizen science.

A pilot demonstrating this saw sonified GOES (which often maps near to the auroral oval during disturbed times) magnetometer data being released to London schools as part of exploratory projects. This technique differs from typical citizen science projects which tend to be more prescriptive. We present a case study identified by school students via this approach of novel long-lasting narrowband decreasing-frequency standing Alfvén waves over multiple days. It was found that this event occurred during the recovery phase of a geomagnetic storm where, through simultaneous plasma density measurements by the THEMIS spacecraft, the decreasing frequencies were due to the refilling of the plasmasphere following the storm. Further exploration of the audio revealed similar events following other major storms.

Finally, we present preliminary multi-instrument sonification of conjugate high-latitude ground magnetometers for interhemispheric comparisons of ULF wave phenomena. Two events are presented during similar solar wind driving conditions but under different ionospheric conductivity configurations (one was near solstice and the other near equinox).

We therefore highlight the potential of sonification and citizen science in tackling the “zoo” of ULF wave phenomena in the auroral oval, polar cap and nearby regions of Earth’s magnetosphere-ionosphere system.