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Digital HF Radar for Antarctic Space Science Research

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Abstract content
 (Max 300 words)

High Frequency (HF) radio waves are frequently used to probe and study the plasma properties and convection patterns in the ionosphere. A network consisting of a number of phased-array HF radars are currently being used to monitor global plasma convection in the E and F regions of the ionosphere in the polar and mid latitude regions. These radars are part of a global network called SuperDARN. South Africa currently has one of these radars located at SANAE in Antarctic. This radar operates largely on analogue principles.

A new digital radar is currently being constructed, in collaboration with the researchers at La Trobe University, Australia, as a replacement for the current system. The radar antenna system consists of a main array and an interferometer array. The main array has sixteen antenna elements, while the interferometer array contains four antennas elements. The radar is capable of transmitting in narrow beams in specific directions. Each antenna is driven by a FPGA based transceiver unit. Each transceiver unit is responsible for generating a transmit waveform with the correct phase to achieve beam forming in a specific direction and for digitising the received signals. All transceivers are synchronised using a timing unit.

In this paper the basic principles of the HF radar as a device for monitoring the ionosphere is reviewed. This is followed by a description of the digital system, highlighting operational differences and advantages compared to the current analogue system.

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