

Research Summary – Rankin Inlet PolarDARN Radar - 2011

The Rankin Inlet radar, which operates jointly with its partner radar at Inuvik, is a world-class facility for ionospheric monitoring. The addition of the CFI-funded digital beam forming (DDS) to both radars in the past two years has made these radars state of the art. This additional capability allows scientists to perform more useful and more complicated scanning patterns than the other two dozen SuperDARN radars in the network. The DDS matrix is alone in its class. No other SuperDARN group can offer full digital frequency, phase and amplitude control in the system's phasing matrix.

The PolarDARN radars are positioned in the polar cap region, which is highly dynamical and is directly controlled by space weather conditions in near-Earth space. The polar caps are the regions that contain those magnetic field lines that are connected directly between the Earth and the interplanetary medium. No field lines but those in the vicinity of the magnetic north and south poles are so directly driven by the conditions in near-Earth space. It is by studying the direct interaction between the interplanetary medium and the Earth's upper atmosphere that we can begin to understand the influences that phenomena like solar storms have to communications, satellites, astronauts, large power grids at ground level, and the influence of space weather upon weather at the Earth's surface. Understanding the effects of space weather has benefits to travel in the North by improving radio communications and GPS accuracy. Communication satellites, which are essential in rural and northern communities can be damaged during a solar storm.

We have enhanced our collaborations with the American team at SRI International, who run a powerful "incoherent scatter radar" (ISR) facility at Resolute Bay. The Canadian team, which is led by Dr. Eric Donovan at the University of Calgary and which includes Dr. Kathryn McWilliams and Dr. Jean-Pierre St. Maurice at the University of Saskatchewan, has received \$25M in CFI funding to build a partner ISR radar at Resolute Bay. This ISR will be fully operational at Resolute Bay before the end of 2012. The research done with the data from the ISR radar is greatly enhanced by the overlapping data from the PolarDARN radars and the reliability of the PolarDARN system. Towards more fruitful collaborations, Dr. McWilliams informs the SRI team of the PolarDARN operations schedule (what beams we are scanning, when we are running specific scan modes, etc., which applies to the international SuperDARN radar consortium). Unlike the PolarDARN/SuperDARN radars, ISR radars do not operate at all times, but the ISR team will do their best to schedule the American ISR to overlap with the PolarDARN schedule. This gives all involved the best combined scientific potential. . We shall continue this collaboration, and we currently have trainees analyzing the data.

The \$25M in CFI funding towards the Canadian ISR at Resolute Bay also includes funding for a third PolarDARN radar (also fully digital) to be installed at Clyde River, Nunavut. This radar is currently under construction, and will be operational by September 2012. The Inuvik, Rankin, and Clyde River PolarDARN radars will be located and orientated so that they will provide the opportunity for exceptional research collaboration with the ISR radar. They will also enhance the ability to do HF radio wave propagation experiments in the polar cap region. For the times when HF radio wave transmission is the only viable communication option for aircraft in the polar regions, understanding the propagation of these waves will be very important.

It has been a very busy and productive year for the Rankin Inlet radar team, and the future promises to hold even greater research and collaboration opportunities.