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Directional Wind Measurements of the Southern Ocean Using the TIGER and Unwin SuperDARN radars

R. I. Greenwood¹, M. L. Parkinson¹, H. Ye², and P. L. Dyson¹

¹*Department of Physics, La Trobe University, Melbourne, Victoria 3086, Australia*

²*Department of Electronic Engineering, La Trobe University, Melbourne, Victoria 3086, Australia*

e-mail of corresponding author: ri2greenwood@students.latrobe.edu.au

The TIGER Tasmania and New Zealand radars are HF over-the-horizon radars and represent Australia's contribution to the Super Dual Auroral Radar Network. By using a specialised pulse sequence and radar operating system, the radars are able to collect high time resolution in-phase and quadrature samples largely free of range ambiguities out to ranges <3000 km. Radio waves refracted by the ionosphere can backscatter from ocean surface waves of length equal to half the transmitted wave length. Wind driven waves propagate in all directions but with peak energy in the prevailing wind direction; only the components of wave energy propagating directly towards and away from the radar will be observed in Doppler spectra. These two peaks are known as Bragg peaks and they are routinely revealed at many ranges in our plots of backscatter power versus group range and Doppler frequency. The prevailing wind direction can be determined by constraining a model of the directional sea spectrum to the ratio of the amplitude of the two Bragg peaks. Alternatively by knowing the wind direction the shape of the directional sea spectrum can be inferred. We have demonstrated the ability to determine the wind direction free of ambiguities over a 250,000 km² region corresponding to the overlapping footprints of the two TIGER radars.