# Properties of ionospheric Doppler oscillations driven by downgoing ULF waves

**F. W. Menk and C. L. Waters**

**School of Mathematical and Physical Sciences, University of Newcastle, Callaghan, NSW 2308 Australia; Email: fred.menk@newcastle.edu.au**

ULF waves are observed on the ground by virtue of their propagation through the ionosphere. The wave fields may drive perturbations of the ionospheric plasma during this process. For example, ULF Doppler oscillations are frequently observed in sea scatter returns from the TIGER radar. In order to establish the properties of such Doppler oscillations we deployed and operated a large low latitude array of magnetometers and HF Doppler sounders and examined the ionosphere-ground power and phase properties over the 5-150 mHz frequency range, using cross-phase techniques to identify the local field line resonance (FLR) frequency. We found that downward propagating ULF waves always produce an ionospheric Doppler shift signature. For waves away from the local FLR there is an almost constant ionosphere-ground phase difference, while at the resonance frequency there is a sudden sharp peak in amplitude and decrease in the cross-phase. These features can be used to detect resonance harmonics at low latitudes more clearly than with ground magnetometer data alone. We outline a boundary value model of ULF plasma wave propagation that provides a physical explanation of these observations.