GROUND-LEVEL AND LOW-ALTITUDE OBSERVATIONS OF AURORAL KILOMETRIC RADIATION

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Although theory suggests that Auroral Kilometric Radiation (AKR) is beamed outward from sources in the auroral acceleration region and cannot penetrate the ionosphere, there have been a number of observations over the years of AKR-like radio signals detected from sounding rockets, low-earth-orbit satellites, and ground-level. In many of cases, it is hard to confirm the source of the emissions aside from noting their superficial resemblance to AKR. However, recently the connection of these low-altitude phenomena with AKR has been supported by simultaneous observations at ground-level and with the GEOTAIL satellite (LaBelle and Anderson, *Geophys. Res. Lett., 38*, L04104, 2011, doi:10.1029/2010GL046411), and by recent DEMETER satellite observations suggesting that these emissions are a relatively common phenomenon at low altitudes during periods of sustained magnetic activity (Parrot and Berthelier, *J. Geophys. Res., 117*, A10314, 2012, doi:10.1029/2012JA017937). Subsequently, several dozen examples of AKR-like signals have been observed using receivers in the Automatic Geophysical Observatories (AGOs) on the Antarctic Plateau, characterized by various levels of correlation with AKR detected by GEOTAIL, and ongoing ground-level measurements using crossed-loop antennas combined with a digital receiver at South Pole Station, Antarctica, detected AKR-like emissions at 0215-0230 UT on August 2, 2013, also coincident with GEOTAIL AKR observations. These data allow polarization and presence or absence of AKR-like frequency fine-structure to be determined for the first time from ground-level observations of this phenomenon. If these low-altitude AKR-like signals are associated with AKR, they probably do not represent penetration of X- or O-mode signals but rather mode-converted signals, possibly in the whistler mode, as proposed for example by Oya et al. (*J. Geomagn. Geoelectr., 37*, 237262, 1985, doi:10.5636/jgg.37.237). Recent observations and theory suggesting that the cyclotron maser instability in and near the AKR source region can often energize Z-mode waves, besides the standard X-mode maser, presents another possible pathway for mode conversion and propagation to low altitudes. The recent observations, demonstrating stronger evidence for a connection between low-altitude signals and AKR generated at sources near 5000 km altitude, provide motivation for and constraints on further development of theory of propagation and mode conversion associated with cyclotron maser instability in the strongly inhomogeneous environment of the AKR sources.