8.8 BISTATIC SCATTERING FROM BRAGG TURBULENCE AT X-BAND: A POTENTIAL MECHANISM FOR CLEAR AIR SENSING USING CASA-TYPE RADAR NETWORKS

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Dense networks of low-power, short-range (a few 10's of km) X-band radars are an emerging technology with the potential for superior spatial resolution and lower-altitude observations compared to long-range C and S band weather radars. Absent precipitation, and potentially insect echoes, there is concern about the ability of these networks to perform weather surveillance in clear-air conditions. It is well known that clear-air echoes from Bragg-scale turbulence can be used for atmospheric sensing at long micro wavelengths (eg, S band, L band, and lower frequencies) but this is not a reliable scattering mechanism at X-band, where the Bragg-resonant wavelength is below the inertial sub-range. In this presentation, we consider the problem of Bragg scattering from atmospheric turbulence in an X-band bistatic geometry. In such a geometry, where the radar transmitter and receiver are separated from each other by tens of km, the Bragg resonant wavelength can be substantially larger than the wavelength of an X-band radar. Theoretical calculations show that, when the atmospheric structure parameter is high enough, the volume reflectivity can be large enough to allow low-power X-band radars to perform clear-air weather surveillance. The theory is not new here. However, when it is applied in the context of a network of low-power phased array radars which allow practical weather surveillance in a bistatic mode it could result in a new capability to sense low-level winds in clear air at X-band. That would be a game changer.