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Predictions for the influence of the nocturnal jet on the long range propagation of impulsive signals

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On clear nights, inland over flat ground, one generally finds a temperature inversion in the first hundred meters or so of the atmosphere. Near the ground, winds tend to be light, increasing with altitude. Above the temperature inversion one finds a stiff geostrophic wind known as the nocturnal jet. Theoretical predictions, based on ray theory and expansions in vertical modes, for the effect of the nocturnal jet on the long range propagation of impulsive signals are presented. For sufficiently short ranges, less than 3 km or so, the nocturnal jet has no effect. At these ranges only the temperature inversion and the light winds in the inversion play a role. At longer ranges the nocturnal jet significantly alters the arrival structure of the propagated signal. It is predicted that, due to coincident arrivals from the inversion and from the nocturnal jet, there is a segment of ranges about 1 km long, beginning at about 4 km, in which the amplitude of the first arrival becomes anomalously large and then splits into two distinct arrivals.