The separation of noise and signal components in Doppler RADAR returns

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Knowing the correct noise value in a Doppler radar return is essential for (a) computing moments with good data quality, (b) optionally censoring (i.e. setting it missing) data which contains noise only and (c) contributing to a data quality metric. The receiver noise, however well calibrated a radar may be, will drift over time. Furthermore, both clutter and weather emit energy as black bodies, and these emissions add to the thermal noise. This is especially problematic at shorter wavelengths, such as Ka-band and W-band. Radar moments in noise-only regions have well-known statistical properties. For vertically pointing radars it is possible to compute these statistics from a single gate over time. For a scanning radar we need to consider the statistics from a number of adjacent gates, substituting variance in space for variance in time. In this paper we present a method to identify noise regions in data from a scanning radar, utilizing the known spatial statistical behavior of returned power and radial velocity in noise. We show that the method is applicable to radars over a range of frequencies, from S-band to Ka-band. We demonstrate that the method can robustly identify noise regions, allowing us to compute the noise on a beam-by-beam basis. The radar moments for individual beams can therefore be effectively adjusted to account for noise.