11.14 A MONOTONIC ALGORITHM FOR ESTIMATION OF THE SPECIFIC DIFFERENTIAL PHASE

NAN.YU[1], NICOLAS.GAUSSIAT[1]

[1] Radar Meteorology Centre, Météo-France, France
nan.yu@meteo.fr

The specific differential phase (KDP) is defined as the slope of range profile of the phase difference (ϕ_{dp}) between horizontally and vertically polarised pulses. It is an appealing measurement immune to attenuation, radar calibration and partial beam blocking for the quantitative precipitation estimation (QPE). However, the derivation of KDP needs a smoothing filter to remove fluctuations, including the variability affected by the reflectivity gradient within a radar pulse volume (non-uniform beam filling effect) and the interference of differential backscattering phase (δ effect). In operational application of radars, contamination of non-meteorological echo may further increase the fluctuation in the ϕ_{dp} observation. The heterogeneous variance induced by different error source hinders the conventional filter technique, in which the errors are generally assumed to be homogeneous.

In this study, a new filter that constrains a monotonic increasing of ϕ_{dp} is presented. Two monotonic functions of ϕ_{dp} are constructed: the function follows ϕ_{dp} positive gradients from the first gate of the radar to the last one and the second function follows ϕ_{dp} negative gradients from the last gate to first one. The gap between the two functions at each radar gate reflects the local uncertainty of ϕ_{dp} measurement. An iterative process removes the most extreme gradients one by one to minimize the gap between the two functions until a criterion (e.g. less than 5°) is reached. Then a Kalman filter conditioned by the self-consistent relationship between KDP and reflectivity factor (ZH) is used to determine the derivative of the ϕ_{dp} observations with a stable variance depending on the criterion. A case study illustrates the benefice of this new filter to estimate KDP in the presence of ground clutter contamination and δ effect.