Using inpaint to replace clutter with plausible radar data

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The radar processing system in MET Norway (ProRad) has different procedures for detecting and identifying different kind of clutter in the reflectivity data. In many cases the clutter is seen with no precipitation surrounded or mixed with the clutter, making it easy to remove the local clutter by static clutter maps without affecting the meteorological echos elsewhere. However, when frontal precipitation is passing over a mountainous region, the data gets infected by the clutter and these strong echos can be misinterpreted as regions of intense precipitation in the accumulation products. Removing the clutter by methods like static maps or Doppler filter may produce holes in the data set. Hence, vital radar data such as convective cells in the data set may be lost. We have developed a method that runs operational at MET Norway, which fills the holes that has been flagged by the ground clutter process, with surrounding meteorological echos.

A variational approach is used to regularize the solution, and we choose the total variation as the regularity term which was introduced by Rudin, Osher and Fatemi, this term smooths the flat areas while preserving the edges in the radar domain. By building up a functional together with a fidelity term that keeps the solution close to the domain without clutter controlled by a dominating fidelity parameter.

The examples present a frontal precipitation passing through a montainous region in the southern part of Norway as seen by the high reflectivity points from topography which are stationary through the data set. The clutter is identified and removed by static maps and finally inpainted with the proposed method. Accumulations over 24 hours is also presented to show the effect with and without inpainting.