Proposed changes to radar composite products

Background

Radar composite products, depicting precipitation rates estimates, are currently generated at 1, 2 and 5 km resolutions, to address a wide range of customer requriements. These are derived from Cartesian single-site products which are also created at 1, 2 and 5 km resolution. Prior to 2005, the conversion between polar and Cartesian co-ordinates was performed as part of the processing performed at the radar sites. The data transmitted from site consisted of 1 km data to 50 km range, 2km data to 100 km range and 5 km data to 250 km range from the radar site. The range limitations were imposed partly due to the available bandwidth for transmitting data and partly due to the radars' sampling characteristics. Increases in the capacity of communications links between the radar sites and the Met Office at Exeter have allowed full resolution polar data to be transmitted from the radar site. Radarnet IV, the centralised radar data processing system, receives polar data at 1° x 750(or 600)m resolution. All the quality control and correction is carried out on this polar data, with the conversion to Cartesian being carried out as the final processing step. There is therefore now the possibility of generating radar composites direct from the processed polar data, thus avoiding the imposition of artificial range limits for particular resolution products.

Proposed changes

A new method of converting between polar and Cartesian data has been developed as part of the Radarnet Algorithm Development Project. This method bases the resulting Cartesian pixel value by weighting polar cells, using a Gaussian function, according to their distance from the centre of the Cartesian pixel. A maximum distance is specified to limit the polar cells that are used to form the final Cartesian pixel value. This distance increases with range so as to ensure that minimal unnecessary smoothing is performed whilst ensuring that at least one polar cell is identified as contributing to the Cartesian product at maximum range. The choice of which radars' data to use at any one location is still made on the basis of the height of the lowest useable radar scan, which is the current operational method.

Impact

The impact of this change is most apparent in the higher resolution products, i.e. at 2 and 1 km resolution, where more detailed structure of precipitation areas should be visible. Impact at 5km is minimal. A trial comparing products derived using the existing and proposed methods has been carried out and the results analysed. Comparison with ground-truth rain gauges has been used to assess the relative performances. These indicate that the new method leads to an overall reduction in the RMS and RMSF (gauge-radar). The false alarm rate is similar for both approaches. The impact, however, is best demonstrated by sample images of significant rainfall events. The images in figures a) - f) show an area of the UK radar composite at the three different resolutions. The corresponding operational product is shown for comparison.

Benefits

Although the spatial resolutions of the composite products are not changing (the high-resolution composite will still be generated on a 1 km grid), the change in the method of derivation will mean that the amount of detail visible within the products will be significantly increased. In addition there will be better preservation of peak preciptitation intensities due to the reduced spatial averaging performed. The improvement should be particulalry noticable beyond 50 km range from the nearest radar.

Implementation

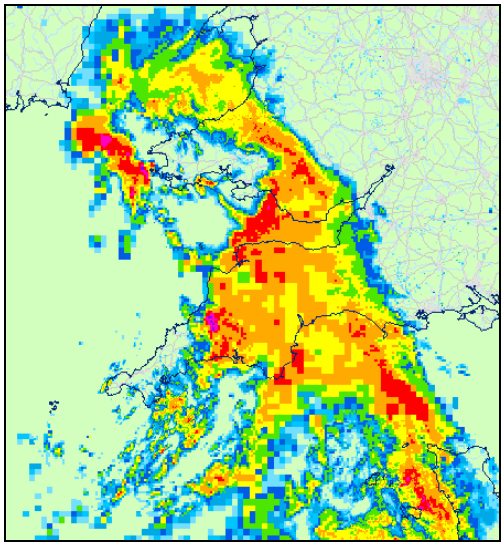
It is proposed to implement this new method operationally on Radarnet. This will be performed incrementally, with the 1km composite being the first to change (expected late October 2007), followed by the 2km and 5km composites, once all customers for these products are satisifed that the impact of the changes will be a positive one. Therefore, all customers for these products are encouraged to consider the impact of these changes for their particular

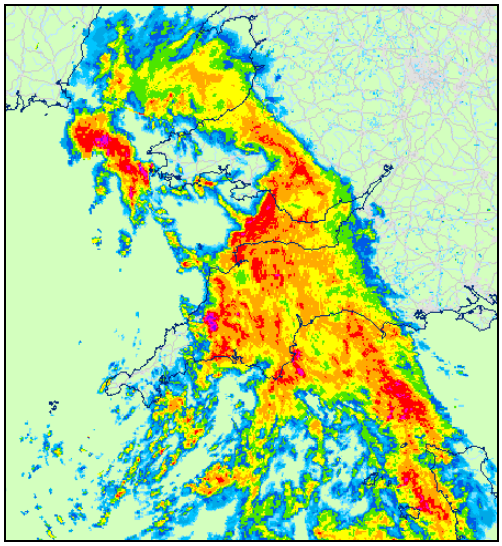
application of the products. If further clarification and testing is required then these requirements should be communicated to Dawn Harrison as soon as possible.

Figure 1: Sample images taken from the 09:25 20/08/2007 UK radar composites

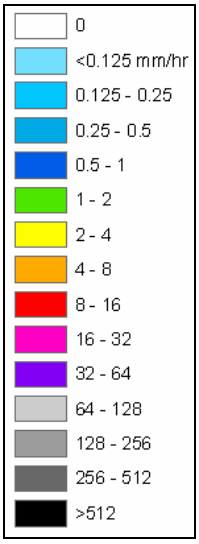
a) 1 km Operational

b) 1 km Trial



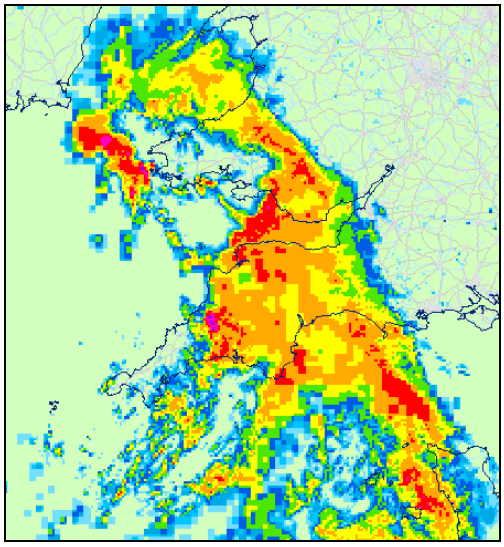


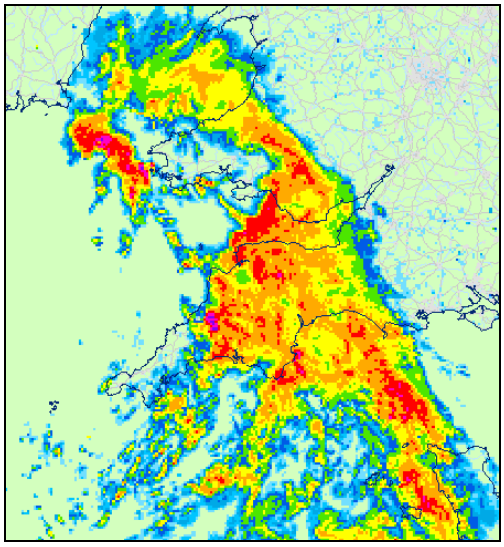
Rain rate

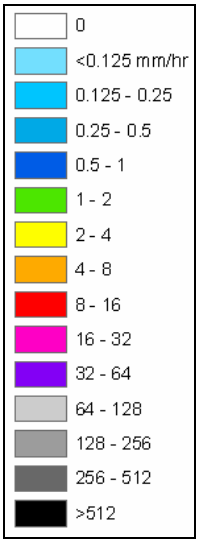


c) 2 km Operational

d) 2 km Trial







e) 5 km Operational

f) 5 km Trial