



Analysis of Fraction Skill Score properties for a displaced rainy grid point in a rectangular domain

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Fraction Skill Score (FSS) is a recently developed and popular metric used for precipitation verification. A compact analytical expression for FSS is derived for a case with a single displaced rainy grid point in a rectangular domain. The existence of analytical solution is used to determine some properties of FSS which might also be applicable in other cases since the rain areas of any shape will asymptote towards this solution if the displacement is sufficiently large. The use of the simple square shape of the neighborhood causes the FSS value to be dependent on the direction of the displacements (not only on the displacement size). The effect is limited in scope but can increase or decrease the FSS value by 0.1. Moving a nearby border closer to the rainy points can either increase or decrease the FSS value depending on the location of the border. The FSS value near a border can be at most 33% larger than the FSS value in the infinite domain assuming the same neighborhood and displacement. Changing the orientation of the displacement can either increase or decrease the FSS value – the effect of the nearby border is intertwined with the effect of the square shape of the neighborhood. The effect of the nearby corner is similar to the effect of the nearby border but is stronger – assuming the same diagonal displacement in both cases. The useful forecast criteria (FSS_{useful}) is defined as a value of FSS for a precipitation feature with displacement half the neighborhood size. FSS_{useful} for a displaced rainy grid point depends on the orientation of the displacement being the largest for displacements that are parallel to the borders and the smallest for a diagonal displacement where the value can be as low as 0.42.