To examine the source of correction, let us examine the ENS and ecPoint’s ROC curve for VRE = 99th percentile for day 3 forecasts (**Figure 6b**). In “La Costa”, ENS and ecPoint’s ROC curves may belong to the same underlying curve as they are overlapping with the exception of a couple of points, so the underlying forecast information content in the ENS forecasts might be similar by ecPoint, which would mean that the added value provided by the post-processing lies in the tail (Ben Bouallègue and Richardson 2022). Consequently, ENS will provide a very similar ability to ecPoint in identifying areas at risk of flash flood, with the advantage of using ecPoint being seen when comparing ENS and ecPoint rainfall forecasts with rainfall observations, as ecPoint is more likely to provide better guidance on the actual extreme observed rainfall totals than ENS.

As an example, **Figure 5** overlaps day 3 ENS ROC curve for VER = 85th percentile (purple lines) with ecPoint’s ROC curve for VER = 99th percentile (orange lines) in order to examine whether there is any point in the unit square where the hit rates for ecPoint’s AURC for VREs >= 99th percentile are bigger than those for ENS’s ROC curve for VREs >= 85th percentile. In “La Costa” (**Figure 5a**), ecPoint’s ROC curve is marginally above ENS’s ROC curve for very small false alarm rates (<0.1). Above that threshold, hit rates from the ENS’s ROC curve are bigger. In “La Sierra” (**Figure 5b**), hit rates from ENS’s ROC curve are bigger for false alarm rates smaller than 0.5, while they get closer (but still below) for false alarm rates bigger than 0.5. The relative positions of the ENS and ecPoint’s ROC curves in **Figure 5** shows that if the only interest is to identify areas at flash flood risk, all type of users (i.e. users with different tolerance for false alarm rates) can obtain higher hit rates from using the ENS’s 85th percentile than using ecPoint’s 99th percentile. However, if users are also interested in validating the rainfall amounts that generated such flash flood events (which could help to increase users’ trust in the flash flood forecasts), it is likely that they will be obtained more realistic rainfall totals by using ecPoint’s 99th percentile, as demonstrated by Hewson & Pillosu (2021). This aspect is also seen when comparing ENS and ecPoint’s ROC curves for VREs = 85th percentile and 99th percentile. **Figure 6** shows an example of ROC curves for day 3 forecasts. For VREs = 85th percentile (**Figure 6a**), the ENS and ecPoint’s ROC curves are very similar in both regions (as seen also in **Figure 4a** and **c**). In addition, all points in ENS and ecPoint, contribute to the AURC. In ENS’s ROC curve, the points that correspond to high probabilities of exceeding the VRE are those mainly contributing to the AURC. In “La Sierra” (dashed lines in **Figure 6b**), the points in the blue line (i.e., ecPoint ROC curve) are distinct from the points in the red line (i.e., ENS ROC curve), and are closer to the top left corner of the unit square. This is a typical result expected from an increase in forecast predictive skill of extreme rainfall events (Ben Bouallègue and Richardson 2022). Furthermore, in the ENS’s ROC curve for the VRE = 99th percentile (**Figure 6b**, dashed red line) only the points at the bottom left of the unit square contribute to the AURC; the points that correspond to the small probabilities of exceeding the VRE (i.e., <10%, that correspond to last five points closer to the top right corner of the unit square) are lined up in a straight line, not providing any contribution to the AURC. Instead, the bigger contribution to AURC for ecPoint (**Figure 6b**, dashed blue line) is provided by the small probabilities of exceeding the VRE (i.e., <10%, that correspond to last 10 points closer to the top right corner of the unit square). This means that, although ENS’s AURC for the VRE = 85th percentile is bigger than ecPoint’s AURC for the VRE >= 99th percentile (as shown in **Figure 5**), the skill in identifying areas at flash flood risk comes from different sources i.e., small probabilities of exceeding high rainfall totals for ecPoint (dashed blue line in **Figure 6b**) and high probabilities of exceeding small rainfall totals for ENS (dashed red line in **Figure 6a**).

Chart, line chart, scatter chart

Description automatically generated

**Figure 6** – ENS ROC curves for VREs = 85th percentile in purple, and ENS ROC curves for VRE=99th percentile in orange. Panels (a) and (b) show ROC curves for “La Costa” and “La Sierra”, respectively. ROC curves are for the lead time step at the end of the 12-hourly accumulation period t+72 (i.e., day 3 forecasts), whose valid time corresponds to the accumulation period between 0600-1800 LT.

Chart, scatter chart

Description automatically generated

**Figure 7** – ROC curves for the lead time step at the end of the 12-hourly accumulation period t+72 (i.e., day 3 forecasts), whose valid time corresponds to the accumulation period between 0600-1800 LT. Panel (a) and (b) show, respectively, the ROC curve for the 85th and the 99th percentiles.Continues and dashed lines correspond, respectively, to “La Costa” and “La Sierra”. Read and blue lines correspond, respectively, to ENS and ecPoint.