Scenario comparison between version 1 and version-2: for 36 solar and 115 wind assets

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ABSTRACT

We compare the performance of the new simulations generated by the Scoville server, released on 2022/04/27 compared to the Sept'2021 Texas AM runs. We do the comparison in terms of the following measures: (i) KS score (ii) ES scores, (iii) PIT histograms, (iv) coverage probabilities, (v) Brier scores, .

1 comparison of simulation between version-1 and version-2 (for 36 solar and 115 wind assets)

We calculate the energy score and percentiles through the script $run-script.ipynb$ using the scenario folder, which were generated by Glen's data directly from the Scoville server. We use the version 2 data, released on 2022/04/27. These are currently done on a zonal level. In the notebook (TX20220427DAWind-SubsetAssets.ipynb and TX20220427DASolar-SubsetAsset.ipynb) the analysis is being shown for 115 wind assets and 36 solar and compared with the previous version-1. We thus have seven zones ('Coast','Far West', 'North', 'North Central', 'South','South Central', 'West') for solar assets and five zones ('Far West', 'North', 'North Central', 'South', 'West') for wind assets.

How closely the percentile for different zones match to the uniform distribution is checked using the K-S score. The K-S score values for the version-1 and version-2 for both wind and solar scenarios are shown in Fig. 1

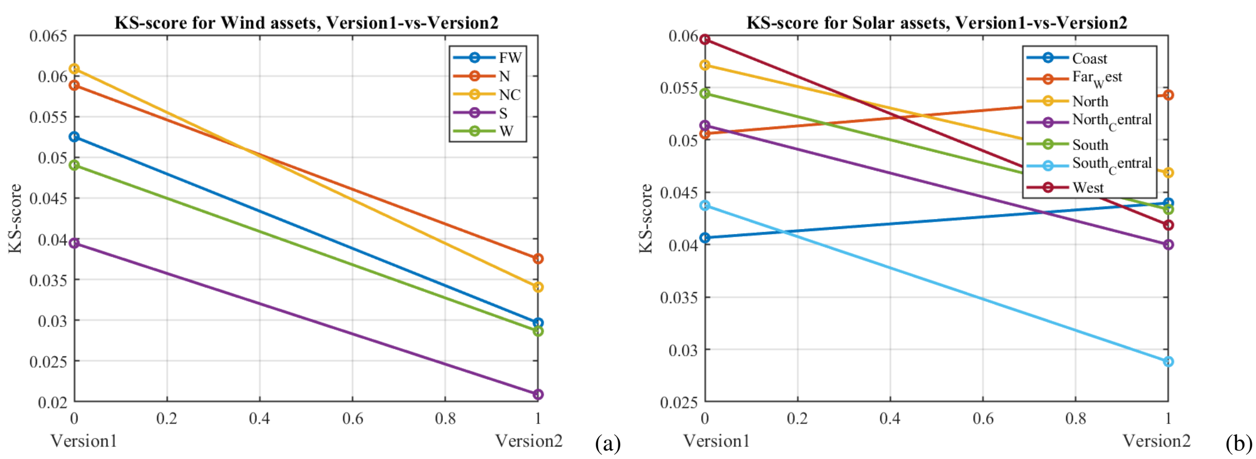

Figure 1. KS score fore both version 1 and version 2 are shown for both (a) wind , (b) solar assets.

1. For wind, KS score for all five zones and the aggregated all assets are low in case of the version 2. The less the KS score means, the distribution is more close to the uniform distribution and better the results are. So, for version-2 , the wind scenarios works better than version 1.

2. For solar, Coast and Far west, the KS score increases and for other five zones, the KS scores decreases in version2. KS score for the aggregated assets decreases for version2.

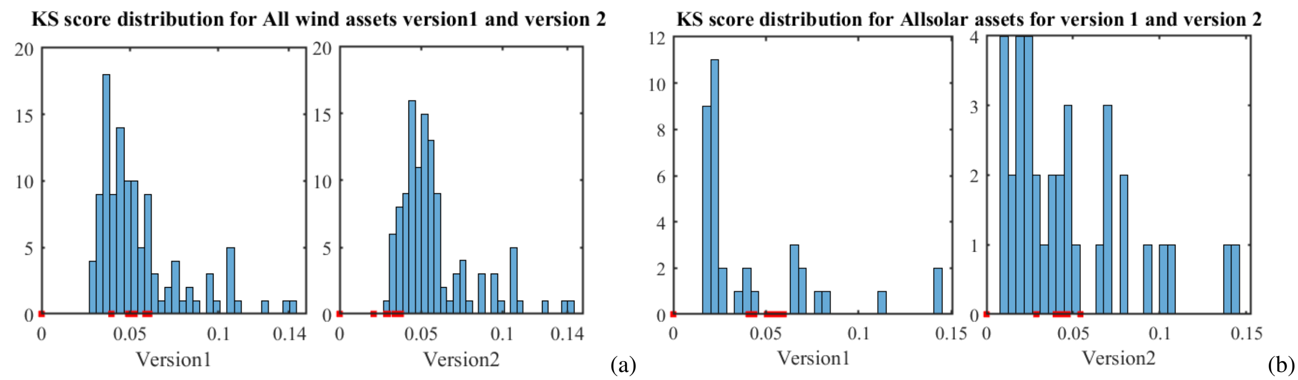

Figure 2. KS score for the assets are shown in distribution and the KS scores for the five zones are shown with red color. (a) wind, (b) solar.

The distribution KS score for percentiles of all the assets are shown and KS scores for percentiles of all the five zones (seven zones in case of solar data) are shown with five red points in Fig. 2(a) and Fig. 2(b) for wind and solar respectively. In case of wind assets, Fig. 2(a) the distribution does not change much from version 1 to version 2, the shape remains almost same. The KS score for the five zone (shown in red points) moves towards the left tail of the distribution.

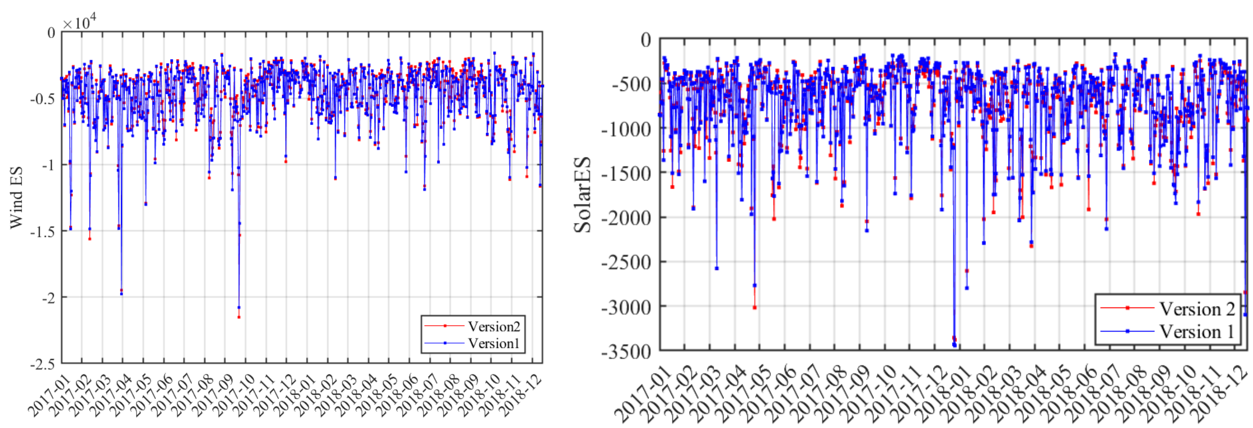

Figure 3. Version1: $ES^{Wind}_{Mean} = -4724$, $ES^{Solar}_{Mean} = -716.1267$.
Version2: $ES^{Wind}_{Mean} = -4596$, $ES^{Solar}_{Mean} = -719.3949$

For wind and solar data (Fig. 3(a) and Fig. 3(b) respectively), the energy score for the version-1 (blue color) and version-2 (red color) data are shown.

1. The extreme days are same for both version-1 and version-2. The mean of energy score is less in version-2 compared to version-1 which implies for wind data, version 2 works better whereas in solar data mean value is of the same order. For solar data, the range of the energy score are of the order 1000. So, the change in mean of energy score in the two versions are negligible compared to the range of the energy score, it has increased by 0.3% in version2. For wind assets, the range of energy score is of the order 10000. The mean of energy score has decreased by 1.2%.

2. For the extreme days, a cut off has been chosen (in case of wind -10000 is chosen as cut off) to define the extreme days. For those days, there is sharp drop in the energy score. Version-2 has higher drop (by

magnitude) than the version-1 (for 9 days, version-2 works better and for 10 days version-1 works better). For solar asset (-2000 is chosen as cut off), we get version-1 has higher drop (by magnitude) than version-2 (for 4 days version-1 works better and for 8 days version-2 works better)

3. Wind energy score for version 2 works better than version 1 (115 wind assets) for 64.25% of the days in two years.
   Solar energy score for version 2 is better than version 1 (36 solar assets) for 44.65% days out of two years.

2 Comparison between subset assets (36+115) and all the assets (226+264) for the version 2 data (2022/04/27)

This section talks about the change in simulation as we go from 36 solar asset to 226 solar asset and 115 wind asset to 264 wind assets. We check this using the Version-2 data.

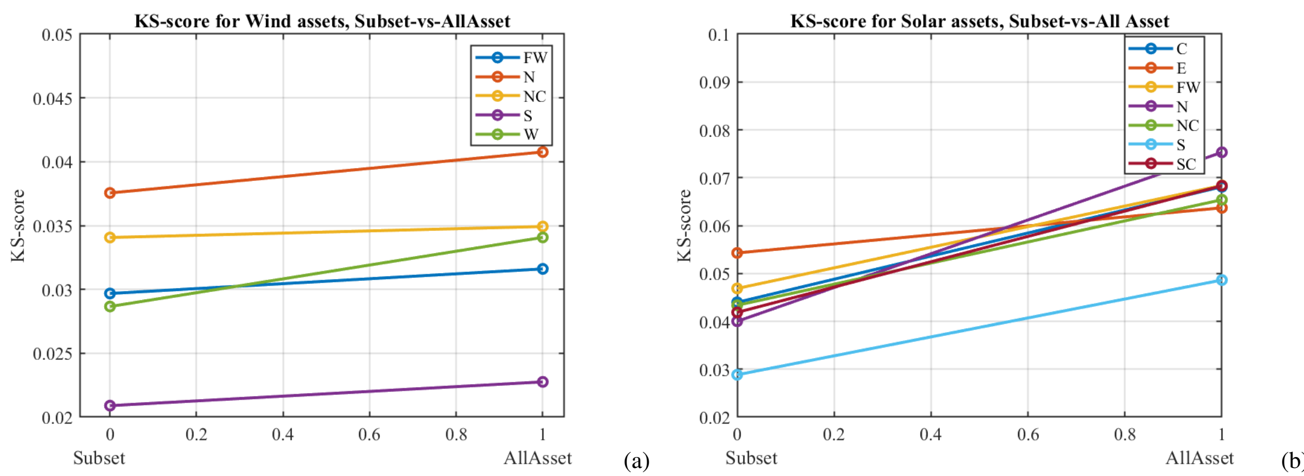

Figure 4. KS score fore both version 1 and version 2 are shown for both (a) wind , (b) solar assets.

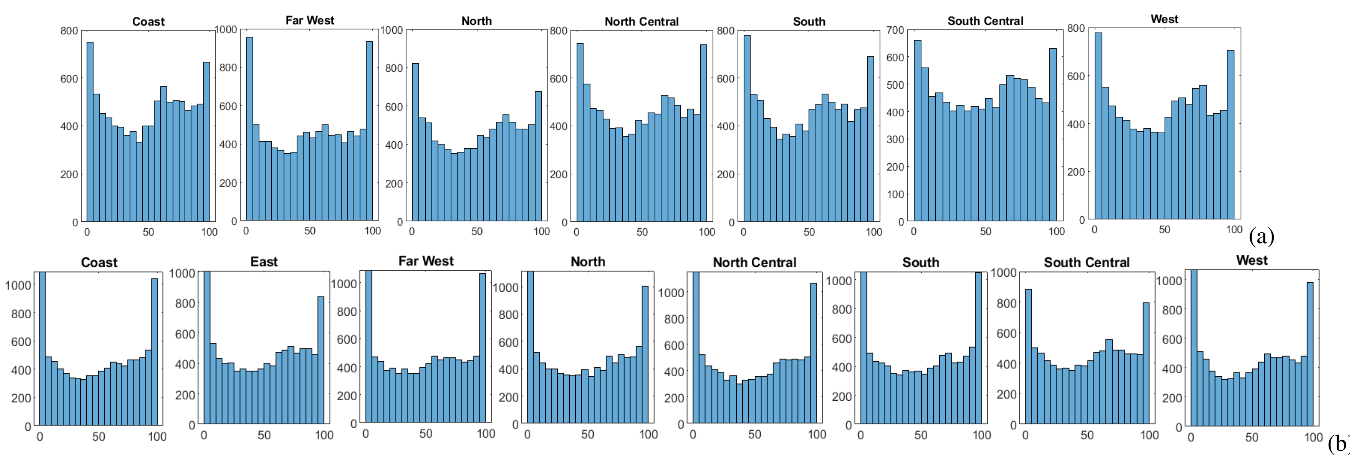

Figure 5. PIT histograms for Solar assets, (a) seven zones for 36 solar assets, (b) eight zones for 226 solar assets

1. Low KS score implies the PIT histograms are more uniform. In case of wind data, moving from 115 assets to 264 assets does not effect much on the KS score. KS score does not increase much with the data size. The change in KS-score is not more than 0.01. In case of solar data as we move from 36 assets to 226 assets, the KS score increases significantly with data size, it increases more than 0.01 for all the zones. see Fig. 4

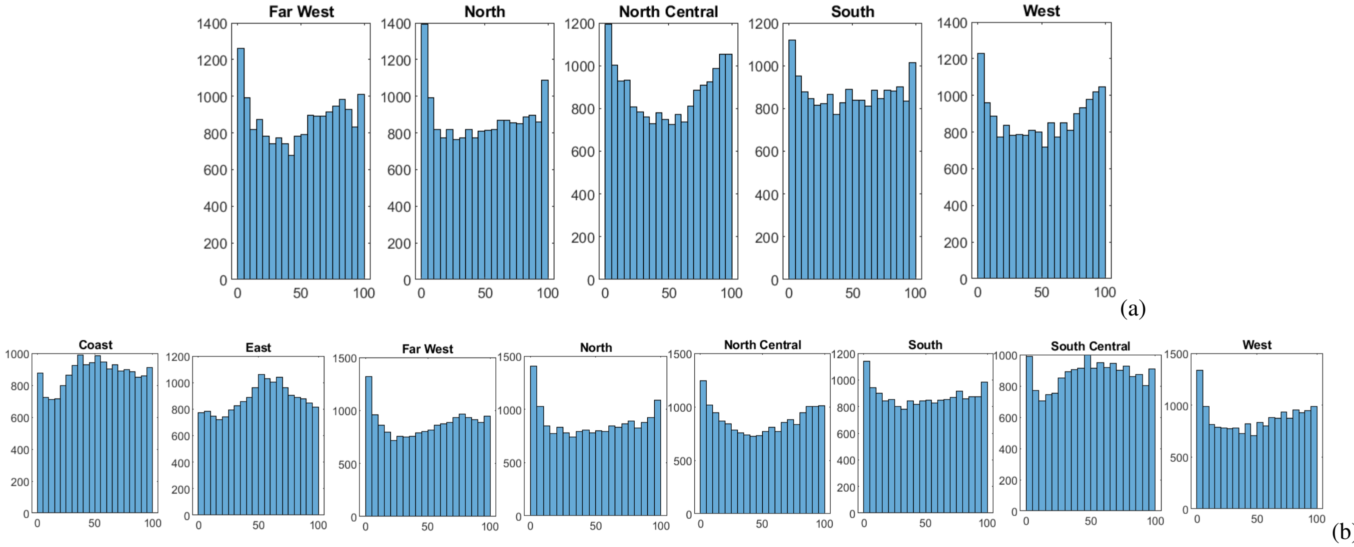

Figure 6. PIT histograms for Wind assets, (a) five zones for 115 wind assets, (b) eight zones for 264 wind assets

2. PIT histograms for 36 solar assets and 226 assets are sown in Fig. 5 (a) and (b). For 226 solar assets the PIT histograms become less uniform and more U-shaped. The extra assets those are added after the 36 assets are causing the PIT histograms more U-shaped.

3. Fig. 6 PIT histograms for 115 wind assets and 264 assets are sown in Fig. 6 (a) and (b). For 264 Wind assets the uniformity of the PIT histograms remains more or less the same, it does not change significantly.

5. Having congested or empty space in the coverage plot is not desired. In case of wind, as we go from the 115 assets to 264 assets, the coverage plot becomes evenly distributed and in case of solar when we move from 36 solar assets to 226 solar assets, the coverage plot does not become more uniformly distributed.

A Brier Score can take on any value between 0 and 1, with 0 being the best score achievable and 1 being the worst score achievable. The lower the Brier Score, the more accurate the prediction(s). The Brier score increases in Version-2 (2022/04/27). The distribution of Brier scores for the event-zero wind generation are shown for (a) 115 wind assets with the version-1 data, (b) 264 wind assets-version-2 data are shown in Fig. 7.

1. As we move from version-1 solar data (36 solar assets) to version-2 solar data (with 36 solar assets), the Brier score decreases, see Fig. 7 2nd row (a) and (b). That is true in case of wind assets as well, see Fig. 7 1st row (a) and (b). The less the Brier score value is the better the prediction is. So, For version-2 both the solar and wind assets works better.

2. In version-2, as we move from the subset to the all assets, even though the system size increases, the shape of the distribution and its range does not change much which is good sign, see Fig. 7 2nd row (b) and (c). The distribution still remains in the left tail. This observation is true for both wind and solar assets.

2.1 Coverage

1. As we move from 115 wind assets to 264 wind assets in version 2, the number of bars changes from 3495 to 5585, see it in Fig. 8 1st row.

2. As we move from 36 solar assets to 226 solar assets in version-2, the number of bars changes from 4950 to 5106, see it in Fig. 8 2nd row.

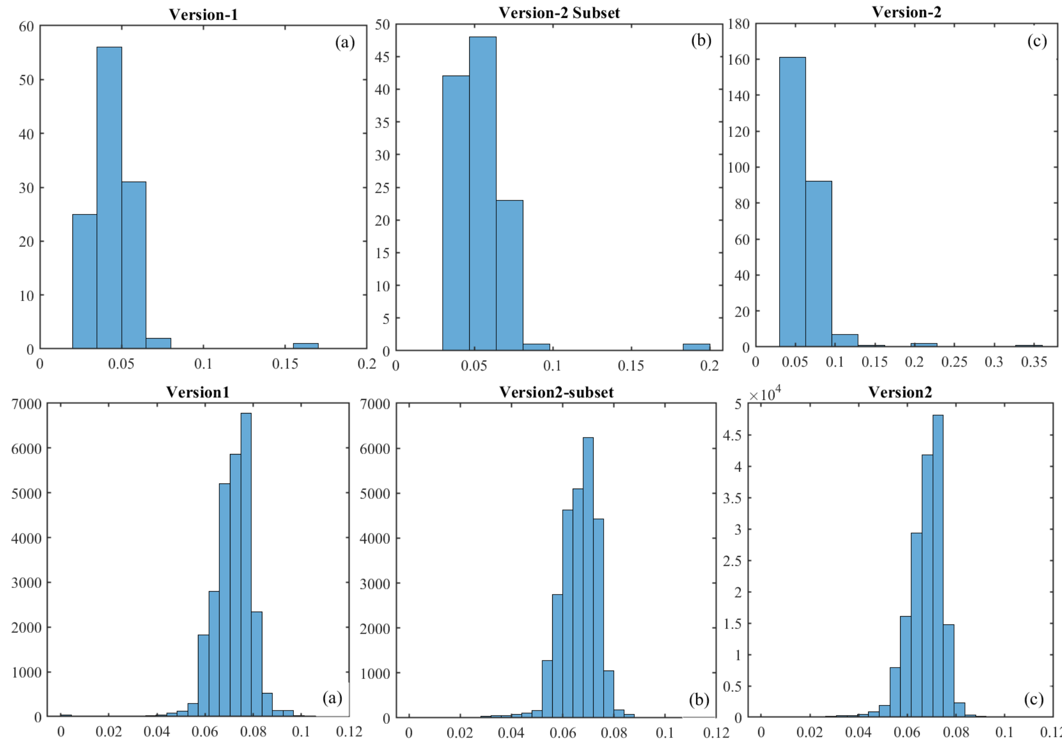

Figure 7. 1st row: Distribution of the Brier score for the zero wind generation for (a) Version-1 data, for 115 wind assets, (b) Version-2 data, for 115 wind assets, (c) Version-2 for eight zones for 264 wind assets. 2nd row: Distribution of the Brier score for the Max solar generation for (a) Version-1 data, for 36 solar assets, (b) version-2 data, for 36 solar assets, (c) version-2 for eight zones for 226 solar assets.

3 Conclusion

Compared to the version-1, version-2 for wind assets work better whereas the solar assets have not improved much.

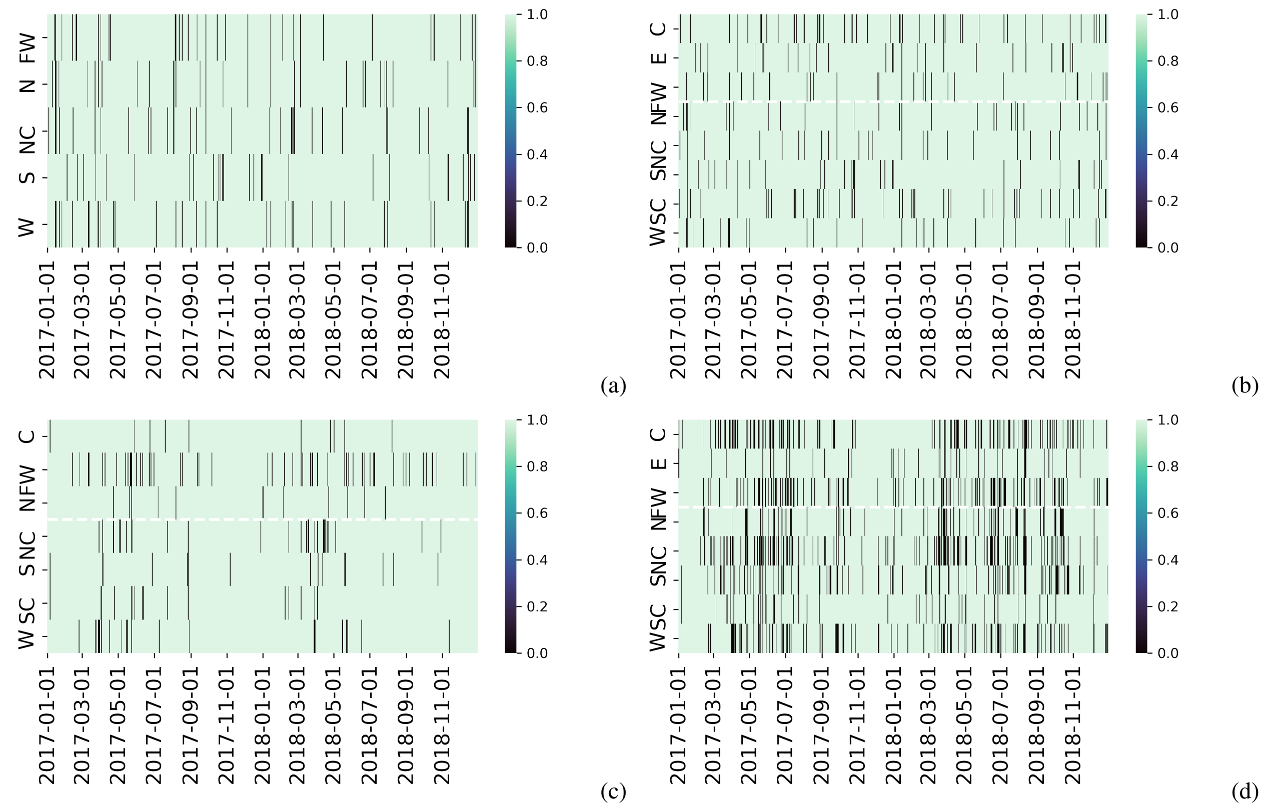

Figure 8. 1st row: Coverage for wind data (a) 115 assets, (b) 264 assets. 2nd row: Coverage for solar data (c) 36 assets, (d) 226 assets.