Supplement of Earth Syst. Dynam., 12, 1253–1273, 2021
https://doi.org/10.5194/esd-12-1253-2021-supplement

Supplement of

Is time a variable like the others in multivariate statistical downscaling and bias correction?

Yoann Robin and Mathieu Vrac

Correspondence to: Yoann Robin (yoann.robin@meteo.fr) and Mathieu Vrac (mathieu.vrac@lsce.ipsl.fr)

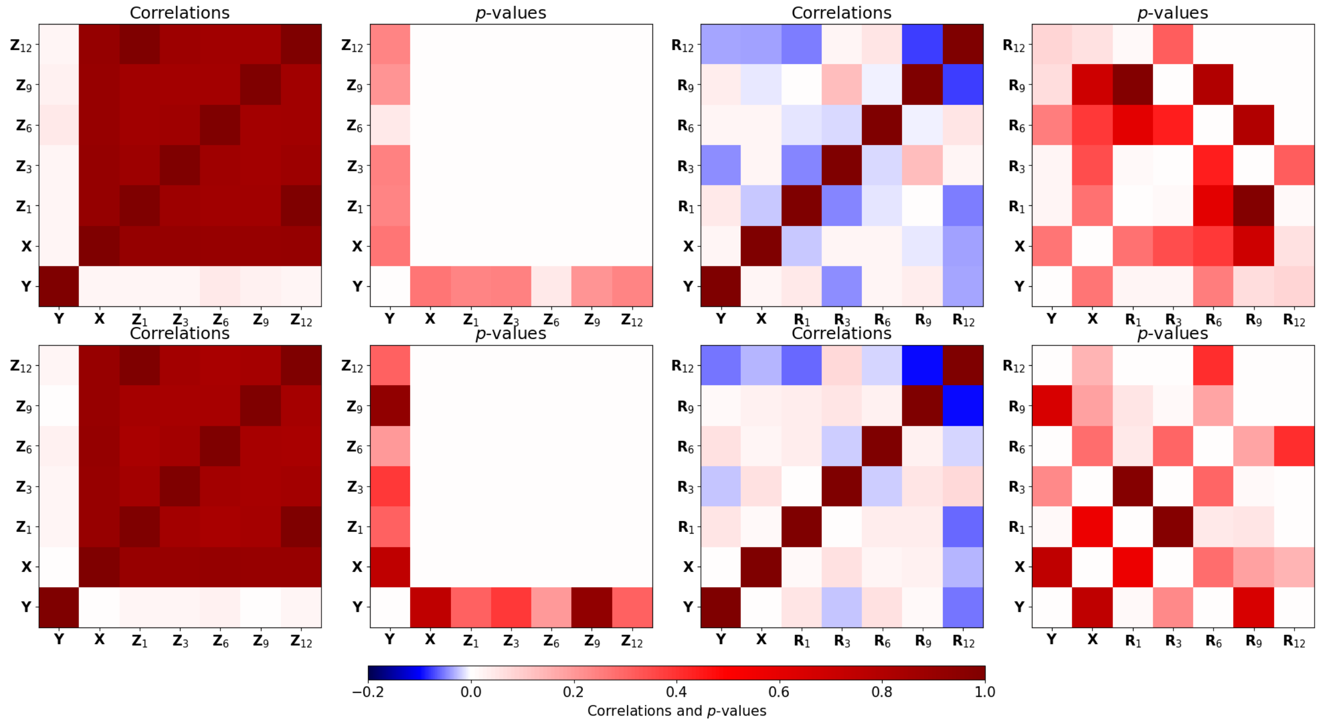

Figure S1. Correlations between corrections of the VAR with different choices of starting row for the reconstruction step. The two rows are for the two dimensions of the VAR. The first column is the correction with the method TSMBC with the underlying method OTC, and the second column contains the associated p-values. The third column is also TSMBC, but with the underlying method RBC, and the last column the associated p-values.

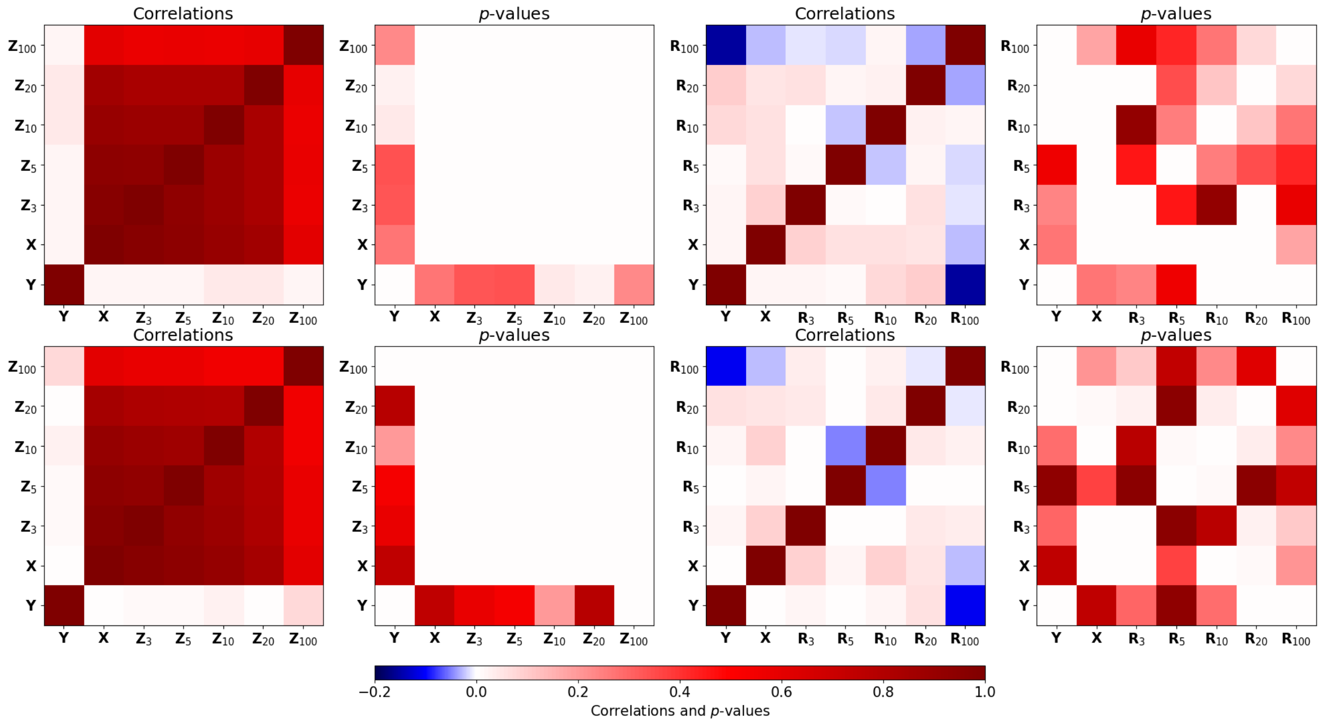

Figure S2. Same as Fig. S1 but for different choices of lag, instead of different choices of starting row.

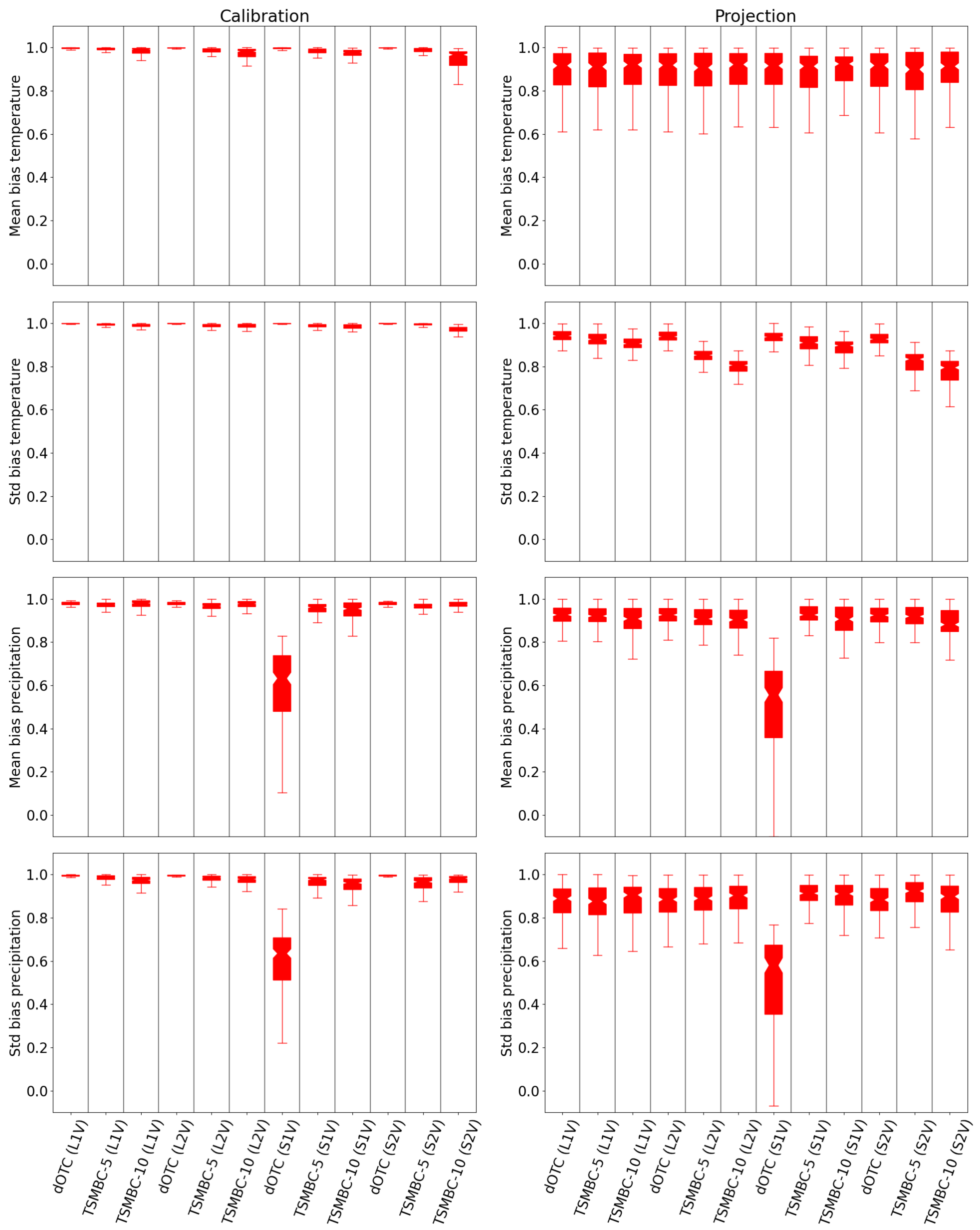

Figure S3. Same as Fig. 4 of the article but for winter, i.e.: Boxplots bias reduction in mean and standard deviation ($BR_{\mathbb{E}}$ and BR_{σ}) in calibration (first column) and projection (second column) periods for temperature and precipitation in winter. The closer the boxplot is to 1, the closer the results are to the reference and therefore the better they are.

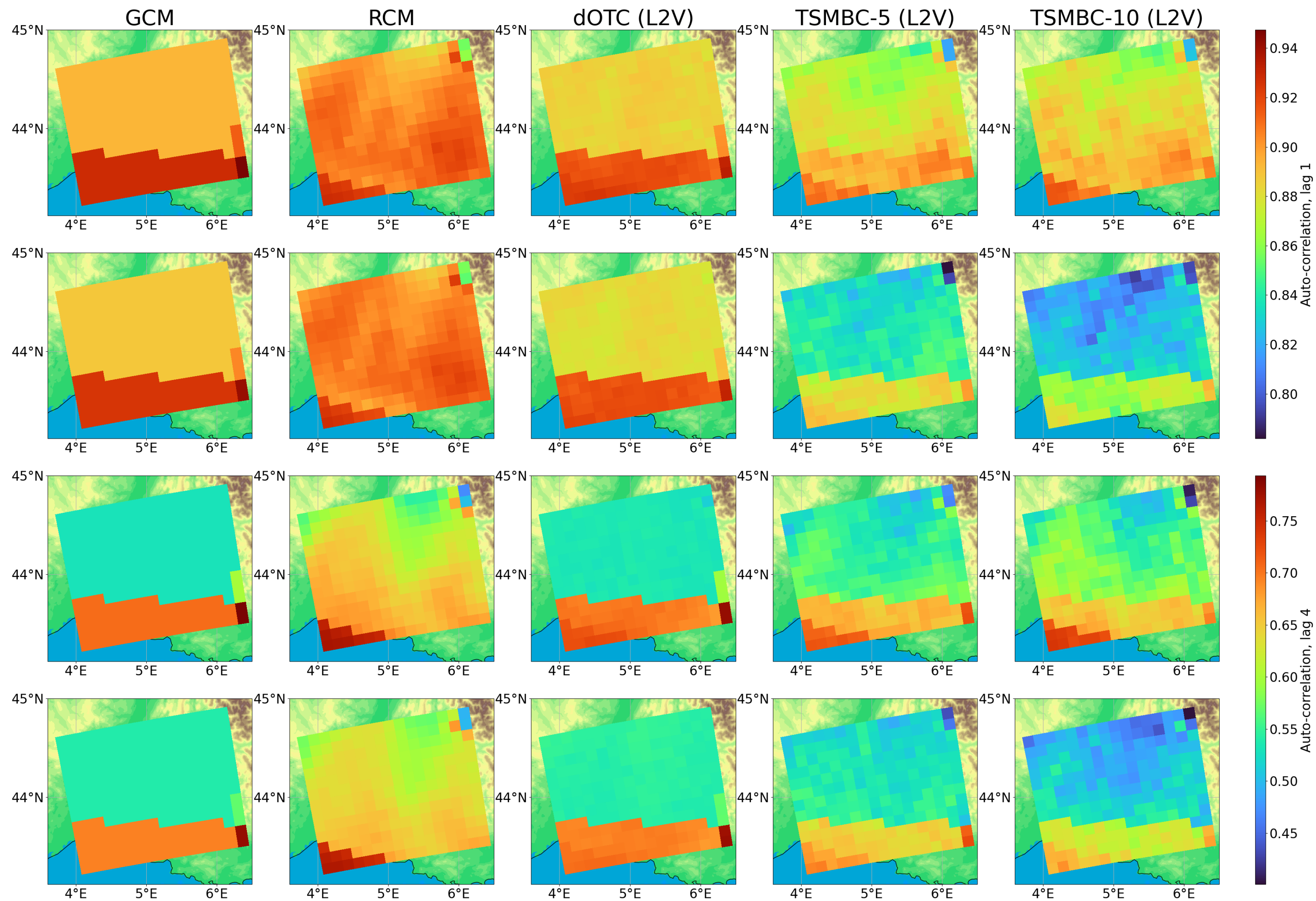

Figure S4. Same as Fig. 6 of the article but for temperature, i.e.: Map of lag-1 (two first rows) and-lag 4 (two last rows) auto-correlations of temperature in summer. The first and third rows are for the calibration period, the second and fourth rows are for the projection period. The first (resp. second, third, fourth and last) column gives the maps of auto-correlations of the RCM to correct (resp. the GCM, the correction dOTC, the correction TSMBC-5 and the correction TSMBC-10 with method L2V). A key point of this figure is to compare the evolution between calibration and projection periods for the RCM, GCM and the corrections.

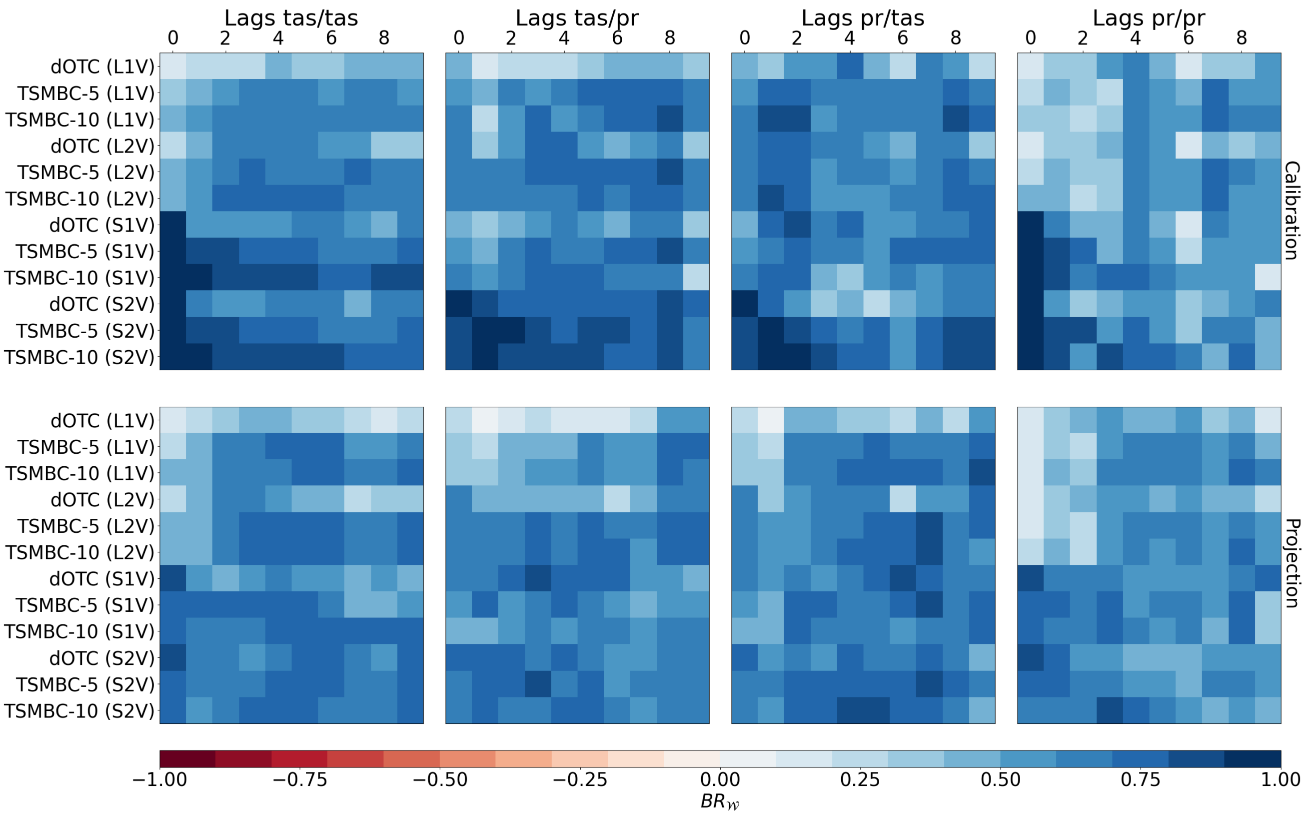

Figure S5. Same as Fig. 8 but for winter, i.e.: Bias reduction of dependence ($BR_{\mathcal{W}}$) values, based on the Wasserstein distances computed on bivariate (correlation, distance) distributions between reference and the different BC datasets or model simulations in winter. The (correlation, distance) 2d-distributions come from the calculated correlograms (see Fig. 8 and text for details). The first line of matrices corresponds to the calibration period, and the second line to the projection period. The BC results and model simulations correspond to rows. The correlations are calculated between tas and tas (first matrix), tas and pr (second matrix), pr and tas (third matrix) and pr and pr (fourth matrix). For each matrix, the columns correspond to different lags and thus correlations indicate auto-correlations. Hence, the two central matrices (tas/pr and pr/tas) contain cross-correlations and cross-auto-correlations. In order to compare the shape of (correlation,distance) set, a normalization is performed separately for each cell (i.e., each couple method-lag) of each matrix. This normalization allows us characterizing the pattern of the distributions, and to get rid of the marginal properties. Hence, the comparison between different couples method-lag is possible but only to characterize the shape of the (distance, correlation) distributions. The closer the $BR_{\mathcal{W}}$ value is to 1, the closer the results are to the reference and therefore the better they are.

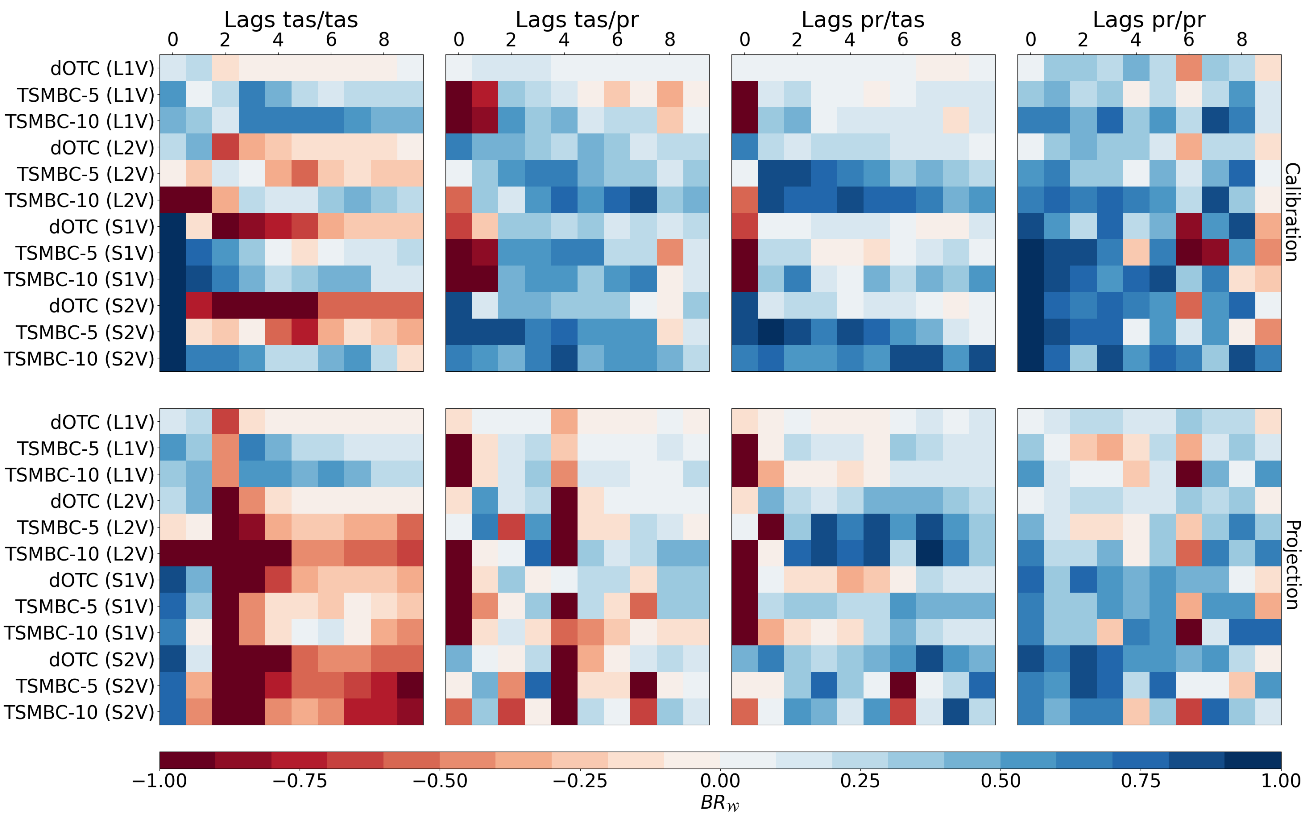

Figure S6. Same as Fig. S5, but with a normalization by column (i.e., by given lag), before computing the $BR_{\mathcal{W}}$ values. Hence, the $BR_{\mathcal{W}}$ values of a given method for two different lags cannot be compared with this normalization. The closer the $BR_{\mathcal{W}}$ value is to 1, the closer the results are to the reference and therefore the better they are.

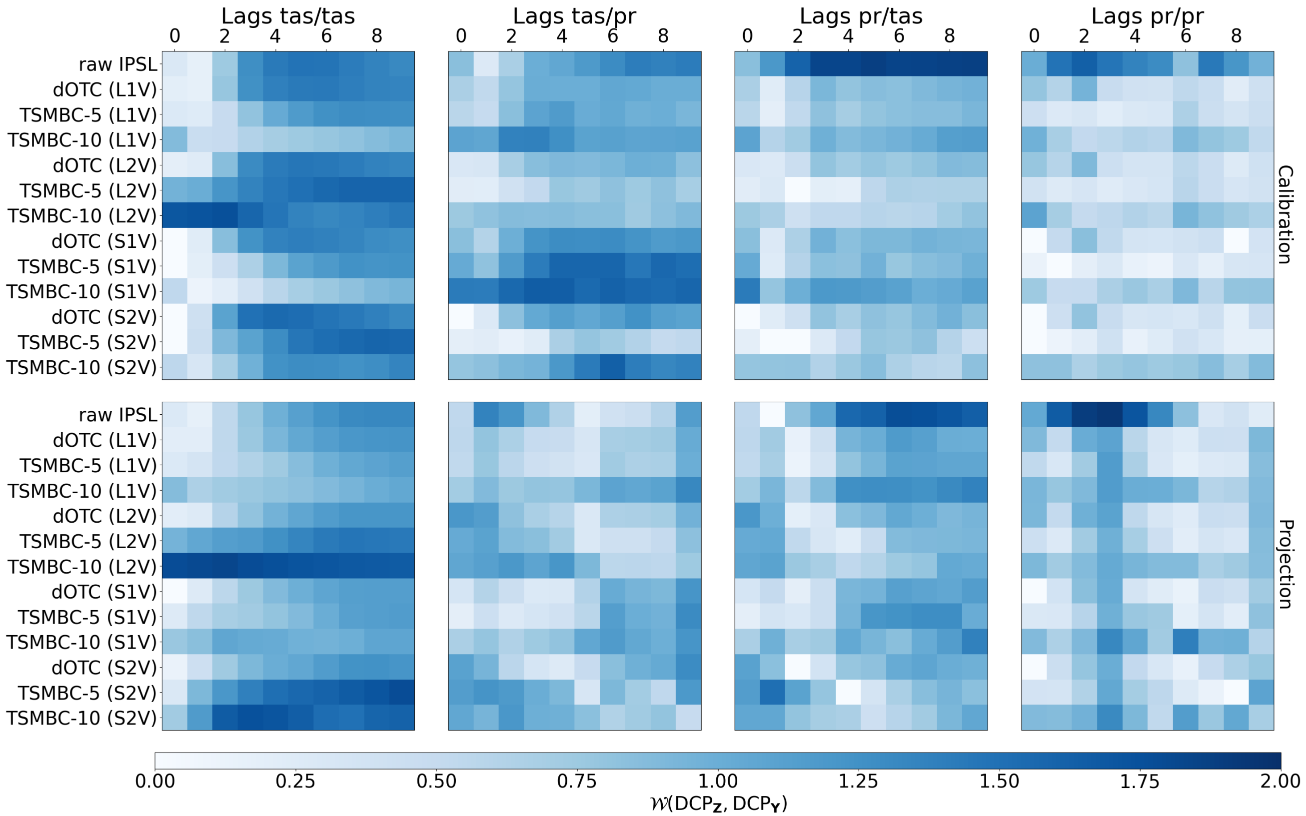

Figure S7. Wasserstein distances computed for the Fig 9, i.e. with a normalization by column in Summer.

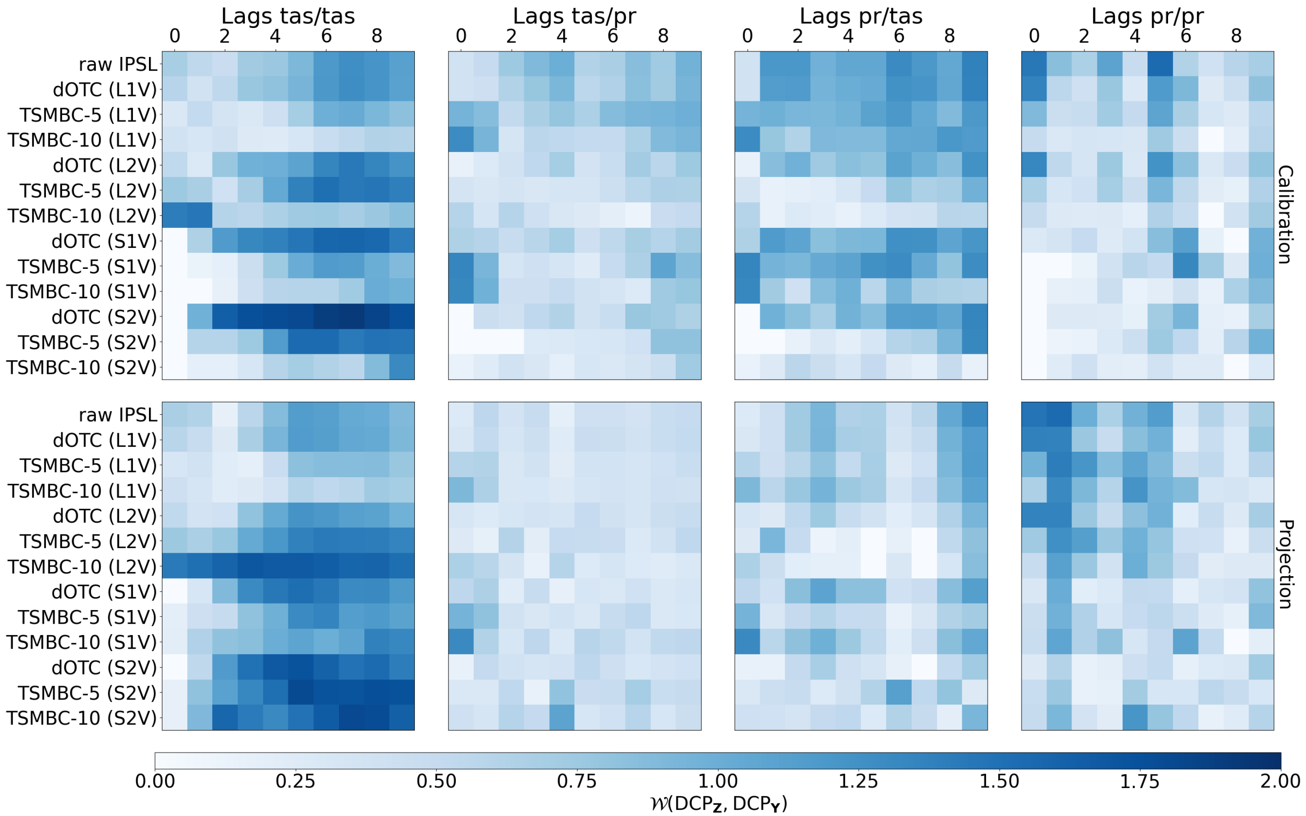

Figure S8. Same as Fig. S7, but in Winter.