The TropD software package: Standardized methods for calculating Tropical Width Diagnostics – Supplementary Material

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Supplementary Material

To assess the sensitivity of the various methods to the smoothing parameter `n`, the sensitivity of the `STJ:core` and `STJ:adjusted` methods, and of the `TPB:max_gradient` and `TPB:max_potemp` methods to `n` is shown in Figs. S1–S4 (the top rows of Figs. S1–S4 are identical to Figs. 9–10 in the main text). The annual-mean metrics are calculated using data taken from the ERAI dataset and from historical simulations of 34 models participating in the fifth phase of the Coupled Model Intercomparison Project (CMIP5, Table 1 in the main text). Shown are the mean value, inter-annual variability (defined as the standard deviation of inter-annual variations) and decadal trend (°/decade) in each hemisphere for the period 1979–2004. While the statistical significance of the decadal trends of the various metrics is often low (e.g., Fig. 8 in the main text), the aim of this analysis is to compare consistently-defined characteristics of the metrics, as opposed to rigorously analyzing the properties of each metric. Therefore, for simplicity, the confidence bounds of the decadal trends are not included in the analysis.

Figure S5 shows an analysis of the five available methods of the PSI metric derived from annual-mean values of zonal mean meridional wind (cf. Fig. 12 in the main text). Similar candle plots for the TPB and OLR metrics are shown in Figs. S6 and S7, for the STJ and EDJ metrics in Fig. S8, and for the PE, UAS and PSL metrics in Fig. S9. As for the PSI metric, the default methods for each metric are shown in bolded text. The inter-annual variability and decadal trends are calculated as in Figs. S1–S4. The top rows of Figs. S5–S9 and Figs. 12–16 in the main text are identical.

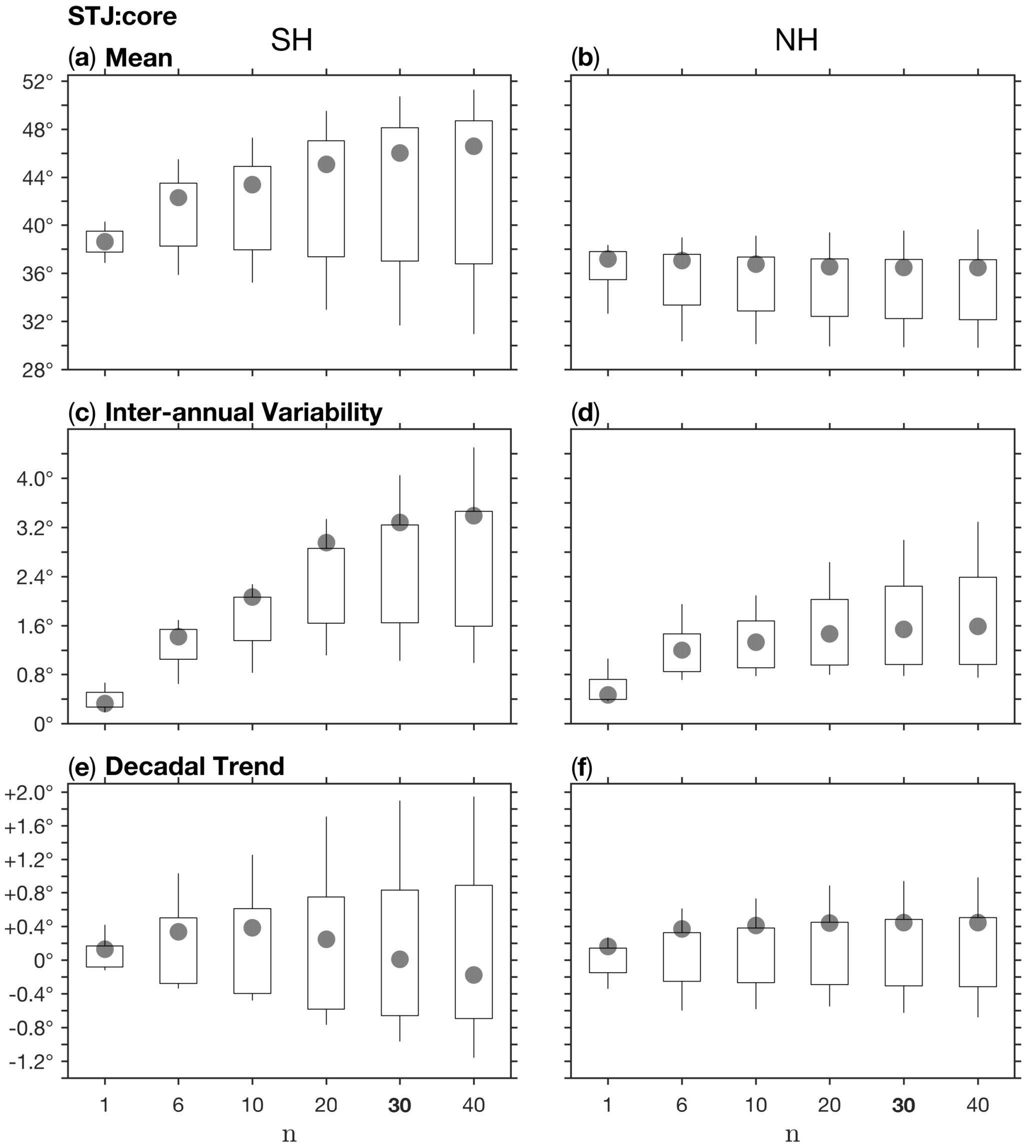

Figure S1. The dependence of the mean latitude (first row), inter-annual variability (second row), and trend (°/decade, third row) on the smoothing parameter `n` for the `STJ:core` method, derived from annual means of the zonal-mean zonal wind in the SH (left column) and NH (right column), for the period 1979–2004. The default value of `n` (30) is bolded. For simplicity, positive values are used for both the NH and SH. Candle boxes show mean $\pm$ 1 standard deviation of CMIP5 inter-model spread. Candle wicks show maximal and minimal CMIP5 model values. ERAI values are shown in gray dots.

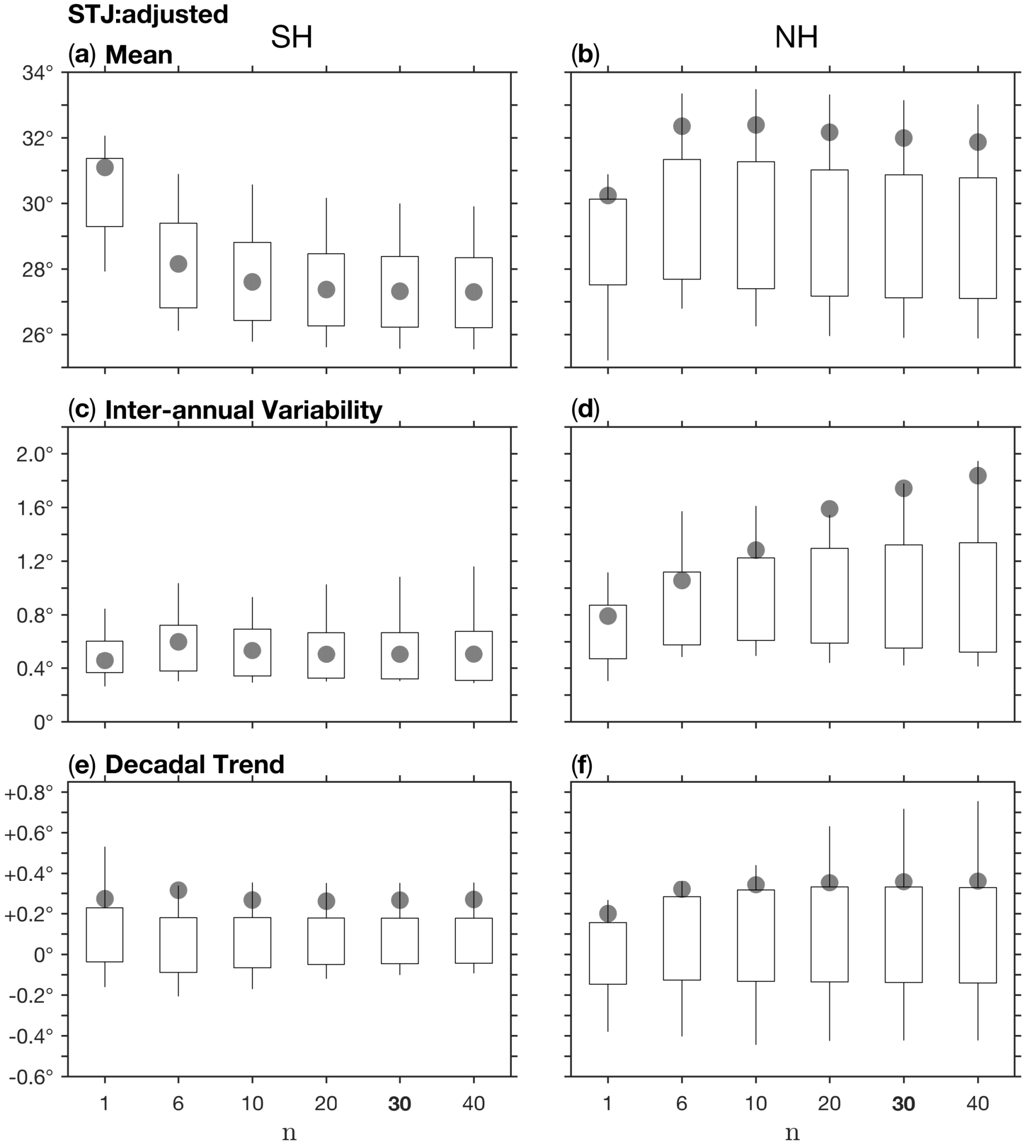

Figure S2. As in Fig. S1 for the dependence of `STJ:adjusted` on the smoothing parameter `n`.

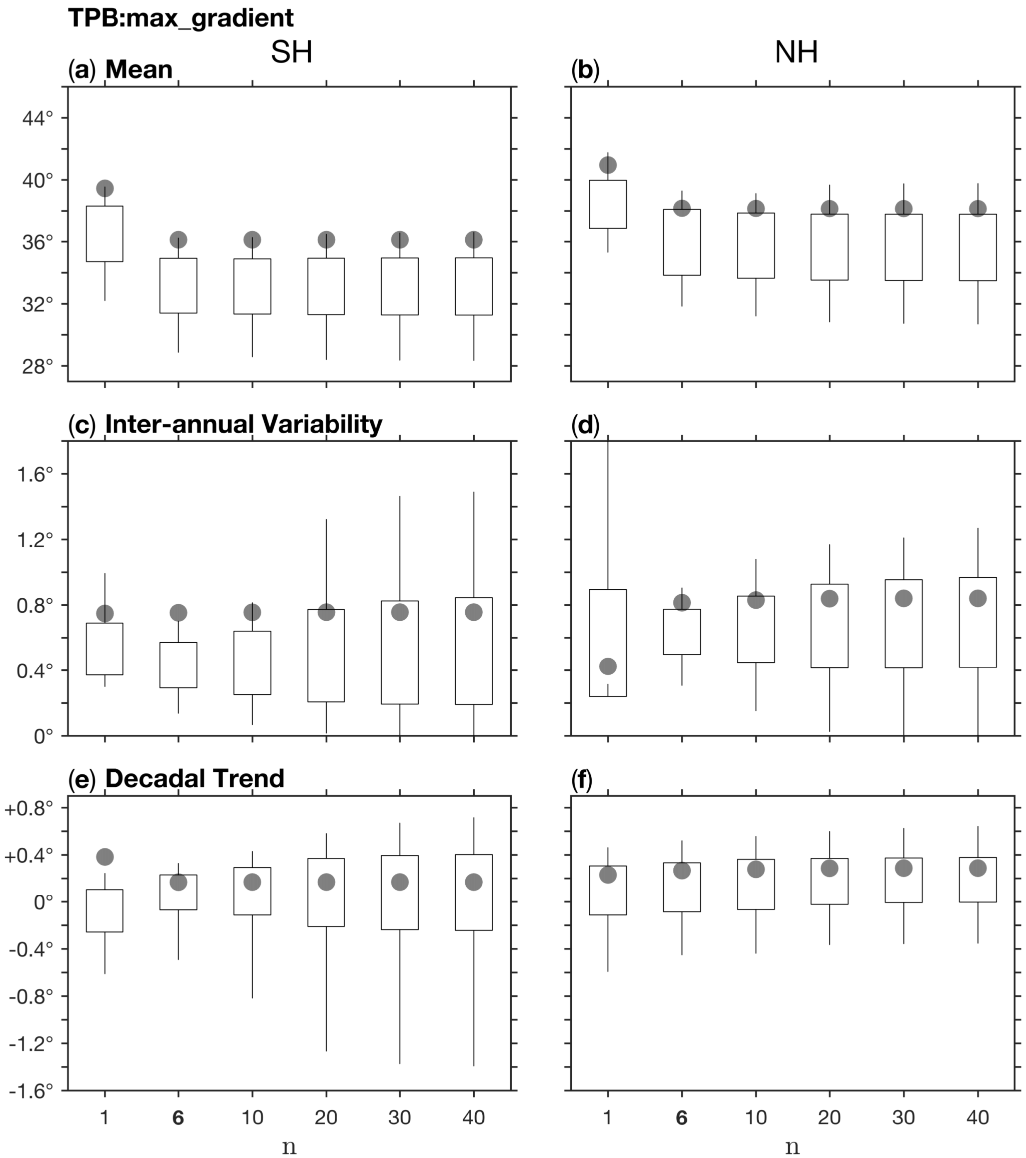

Figure S3. As in Fig. S1 for the dependence of `TPB:max_gradient` on the smoothing parameter `n`.

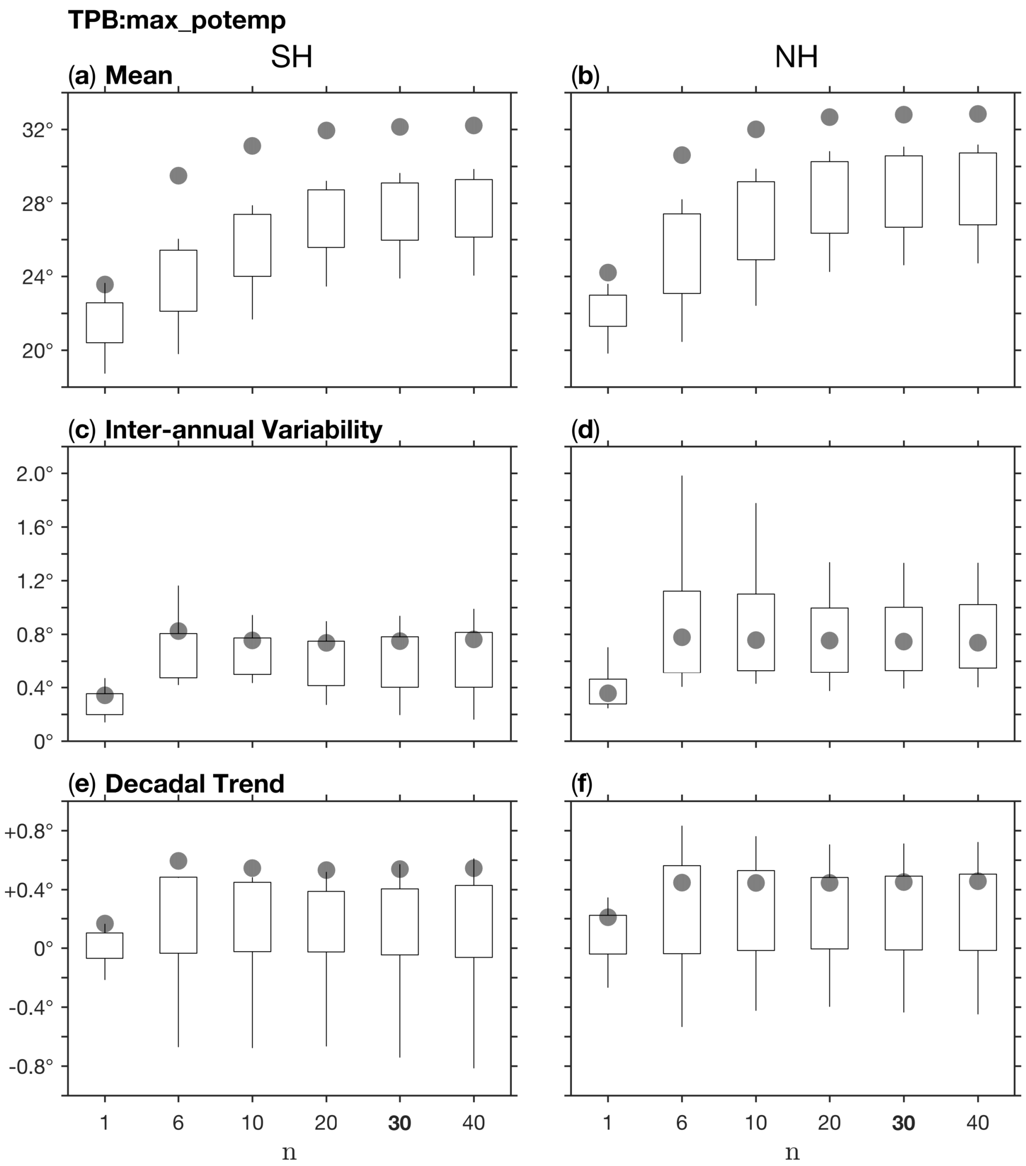

Figure S4. As in Fig. S1 for the dependence of `TPB:max_potemp` on the smoothing parameter `n`.

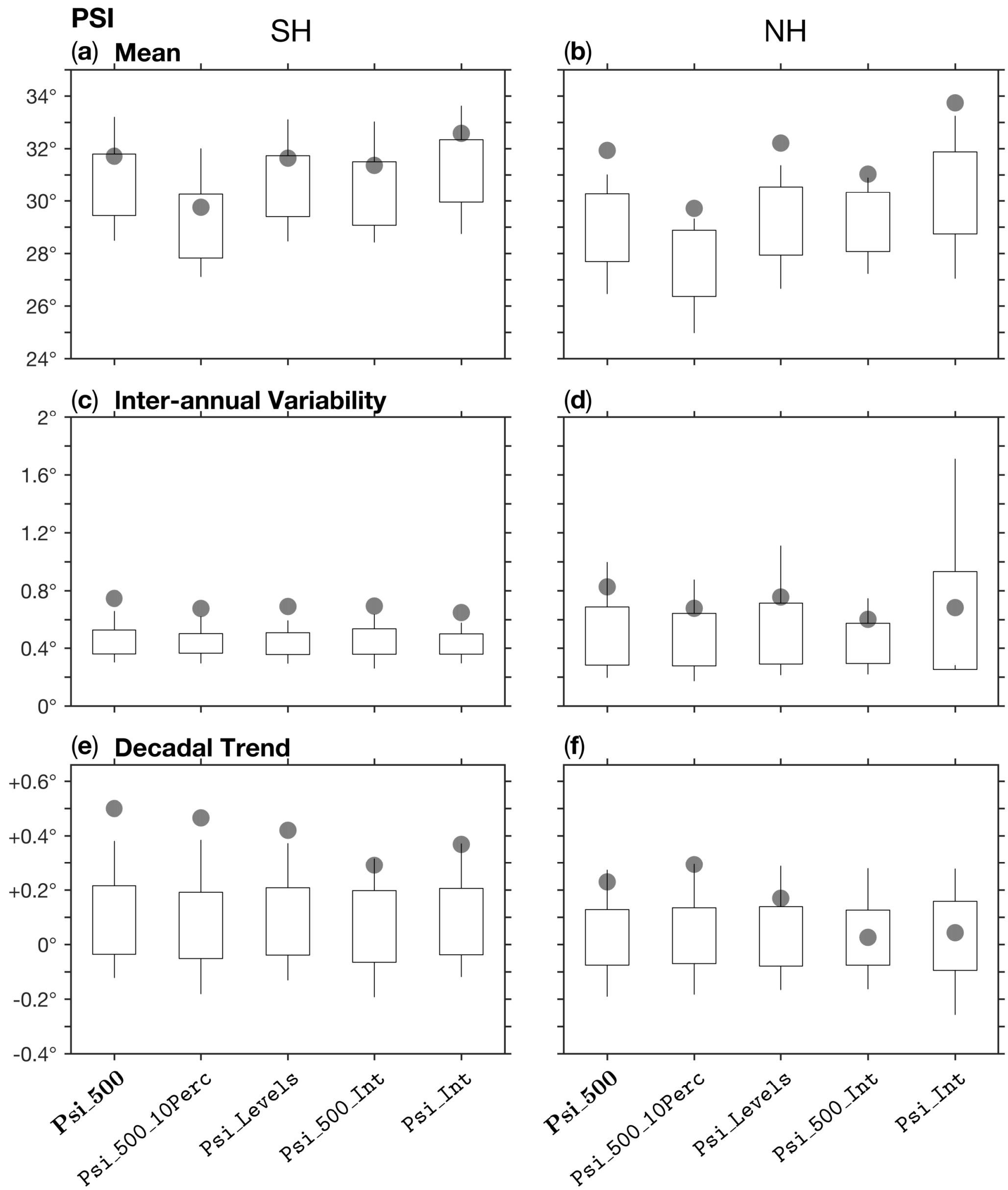

Figure S5. The mean latitude (first row), inter-annual variability (second row), and trend (°/decade, third row) of the 5 available PSI metric methods, derived from annual means of the zonal-mean meridional wind in the SH (left column) and NH (right column), for the period 1979–2004. The default method (`Psi_500`) is bolded. For simplicity, positive values are used for both the NH and SH. Candle boxes show mean $\pm$ 1 standard deviation of CMIP5 inter-model spread. Candle wicks show maximal and minimal CMIP5 model values. ERAI values are shown in gray dots. The input parameter `Lat_Uncertainty` is set to zero (default) in all of the methods.

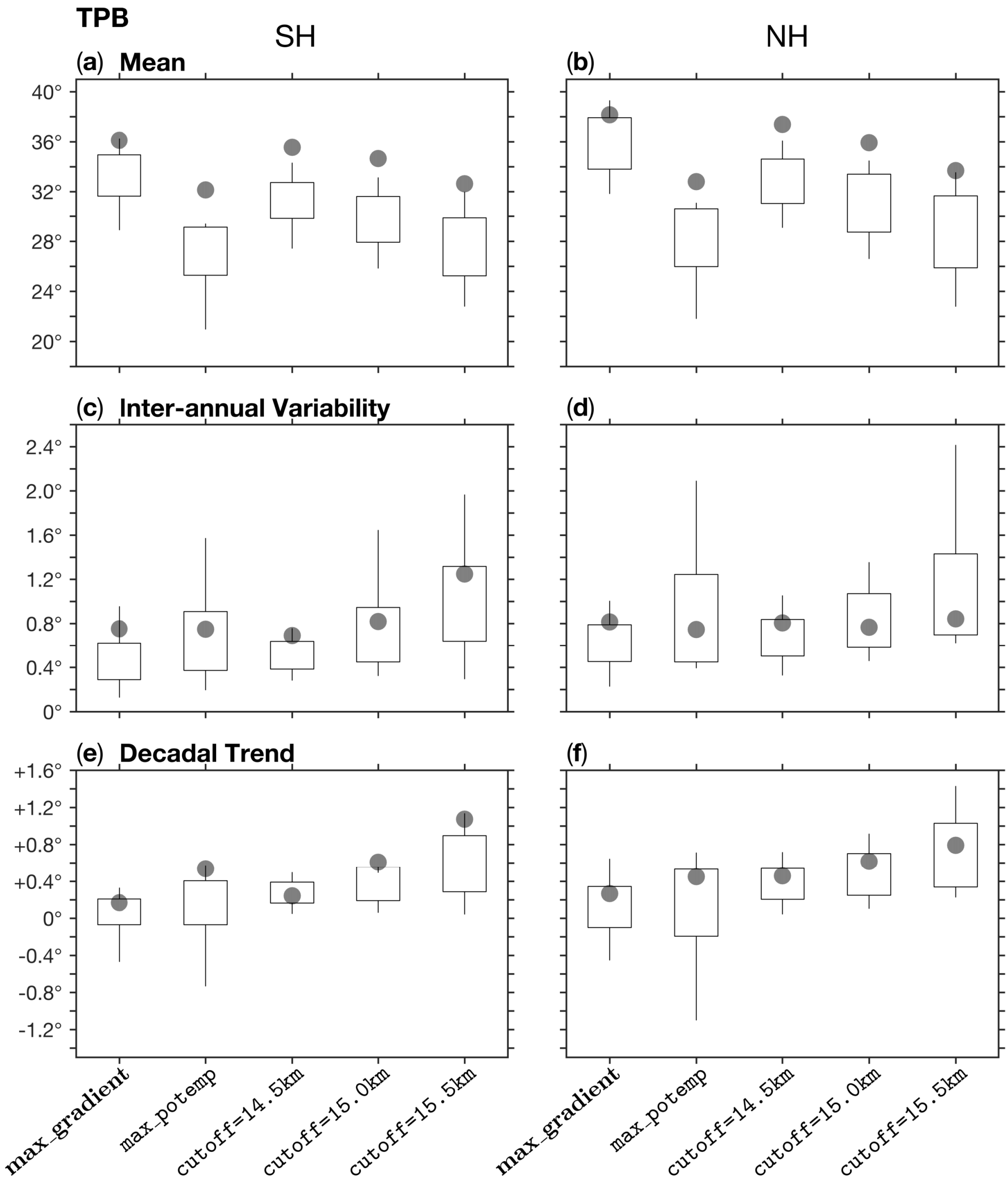

Figure S6. As in Fig. S5 for the TPB metric. For the `cutoff` method, geopotential height cutoff values of 14500m, 15000m (default), and 15500m are shown. (For `Cutoff`=15,500 and for `max_potemp`, three of the models produced unrealistic results and were removed from the analysis).

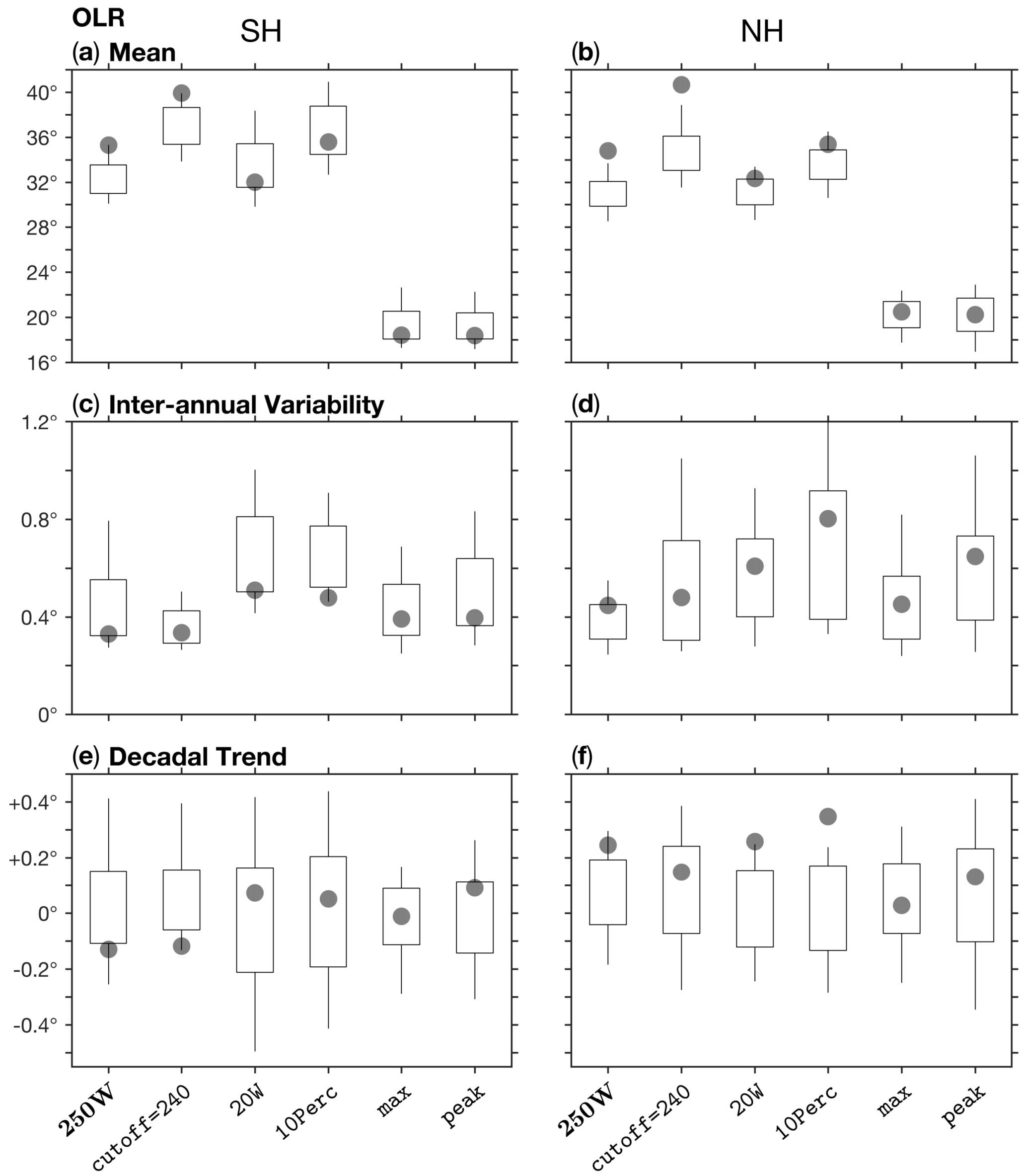

Figure S7. As in Fig. S5 for the OLR metric. The `cutoff` method is shown for the cutoff parameter `Cutoff=240` Wm^{-2}.

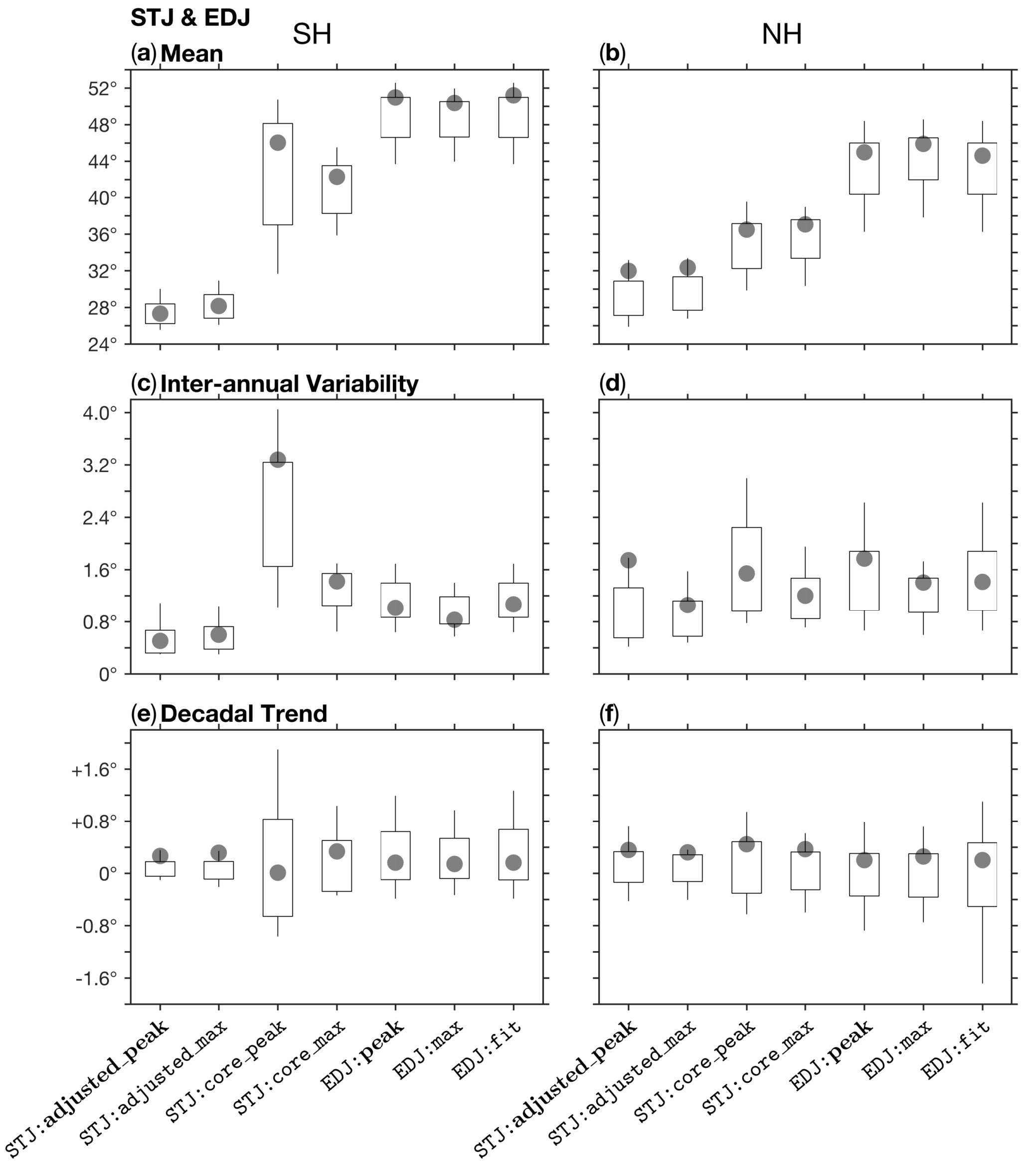

Figure S8. As in Fig. S5 for the STJ and EDJ metrics.

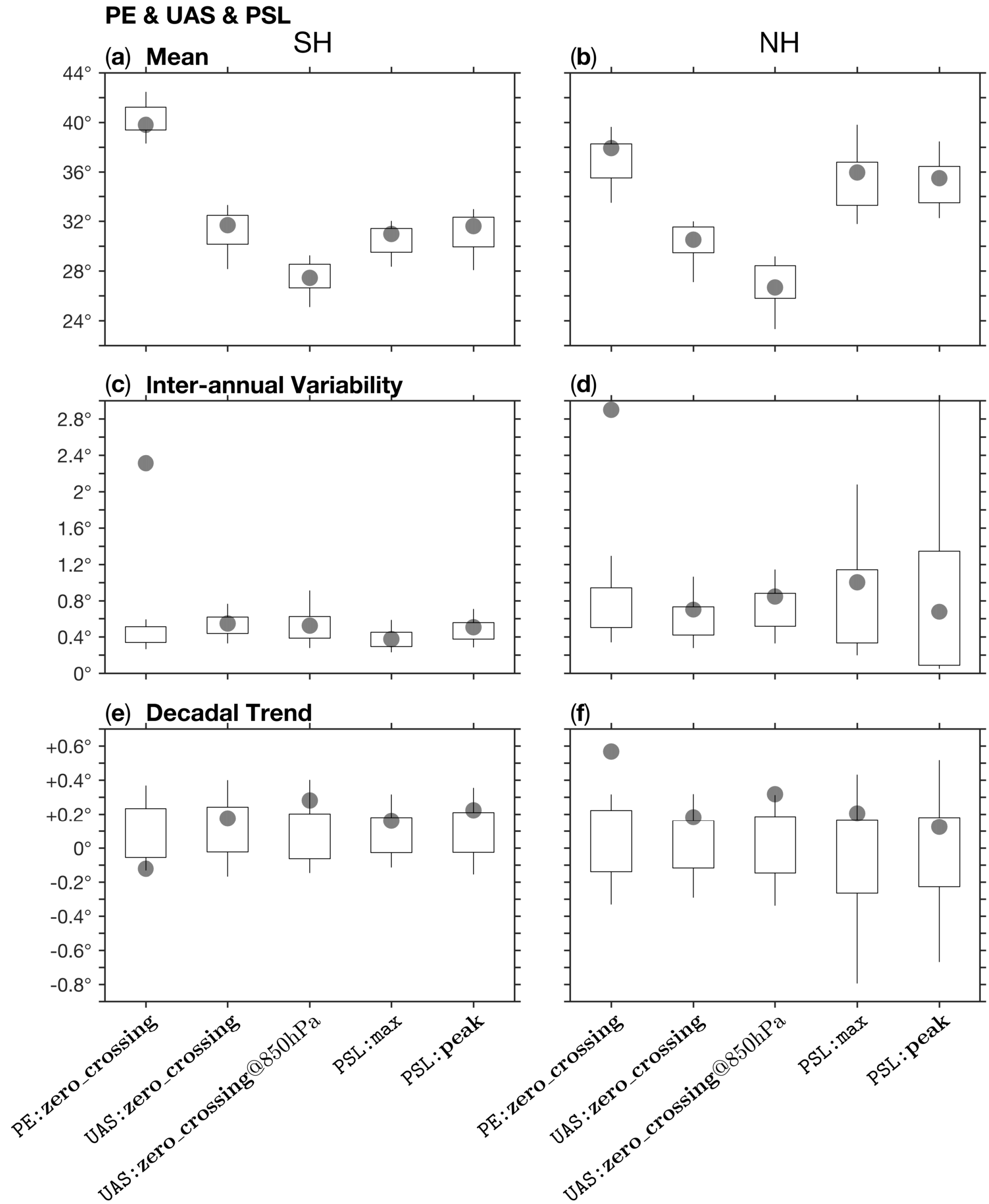

Figure S9. As in Fig. S5 for the PE, UAS, and PSL metrics. For UAS, the default and only method, `zero_crossing`, is shown for both the surface wind and the zonal-mean wind at the 850 hPa level. The input parameter `Lat_Uncertainty` is set to zero (default) in all of the methods.