Contents

List of Tables

List of Figures

S1 Blocking frequency bias for the ANOM index, boreal winter, and (a) high-resolution forced, (b) high-resolution coupled, (c) low-resolution forced, (d) low-resolution coupled PRIMAVERA simulations, and (e) CMIP5, (f) CMIP6 simulations. Stippling shows agreement on the sign of the bias by at least (a,c) 6 of 6, (b,d) 6 of 7, (e) 19 of 29, and (f) 10 of 13 simulations. 3

S2 Blocking frequency bias for the ANOM index, boreal summer, and (a) high-resolution forced, (b) high-resolution coupled, (c) low-resolution forced, (d) low-resolution coupled PRIMAVERA simulations, and (e) CMIP5, (f) CMIP6 simulations. Stippling shows agreement on the sign of the bias by at least (a,c) 6 of 6, (b,d) 6 of 7, (e) 19 of 29, and (f) 10 of 13 simulations. 4

S3 Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal winter, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 5

S4 Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal summer, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 6

S5 Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the AGP index and boreal winter, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 7

S6 Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the AGP index and boreal summer, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 8

S7 Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal winter, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 9

S8 Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal summer, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 10

S9 Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal winter, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 11

S10 Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal summer, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 12

S11 Persistence of blocking events (a,b - median, c,d - 90th percentile) for the AGP index and boreal winter, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 13

S12 Persistence of blocking events (a,b - median, c,d - 90th percentile) for the AGP index and boreal summer, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 14

S13 Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal winter, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 15

S14 Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal summer, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text). 16

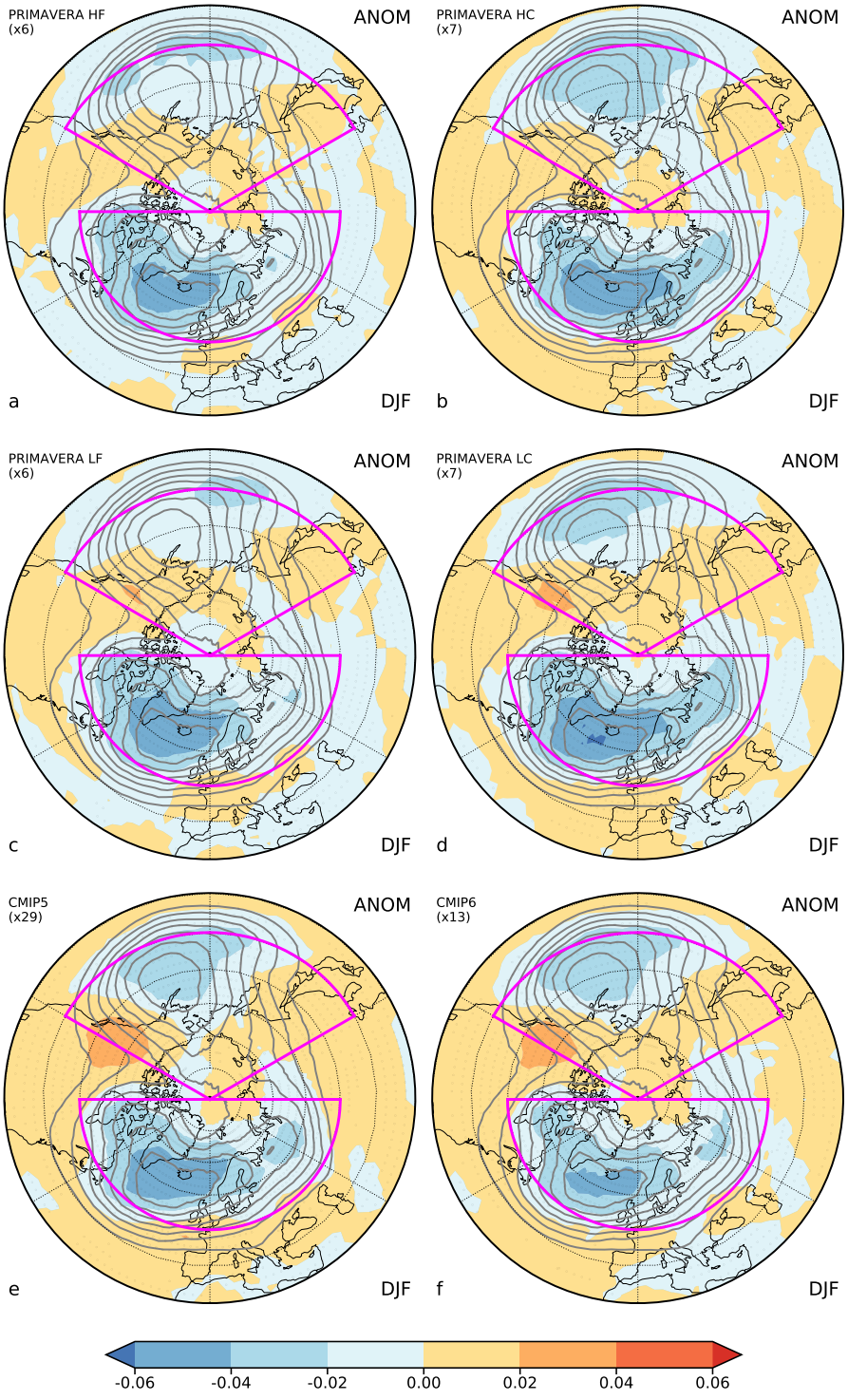

Figure S1. Blocking frequency bias for the ANOM index, boreal winter, and (a) high-resolution forced, (b) high-resolution coupled, (c) low-resolution forced, (d) low-resolution coupled PRIMAVERA simulations, and (e) CMIP5, (f) CMIP6 simulations. Stippling shows agreement on the sign of the bias by at least (a,c) 6 of 6, (b,d) 6 of 7, (e) 19 of 29, and (f) 10 of 13 simulations.

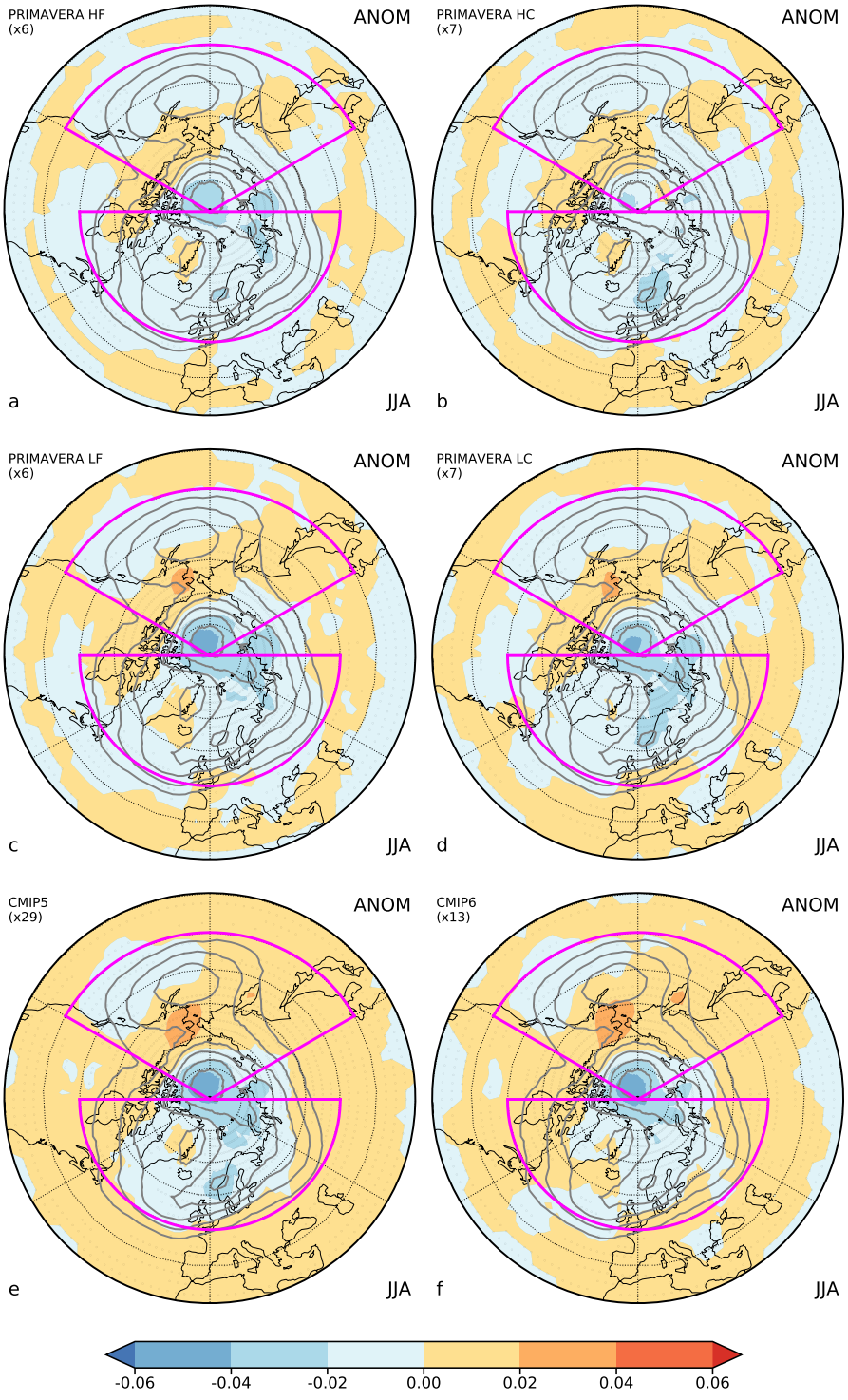

Figure S2. Blocking frequency bias for the ANOM index, boreal summer, and (a) high-resolution forced, (b) high-resolution coupled, (c) low-resolution forced, (d) low-resolution coupled PRIMAVERA simulations, and (e) CMIP5, (f) CMIP6 simulations. Stippling shows agreement on the sign of the bias by at least (a,c) 6 of 6, (b,d) 6 of 7, (e) 19 of 29, and (f) 10 of 13 simulations.

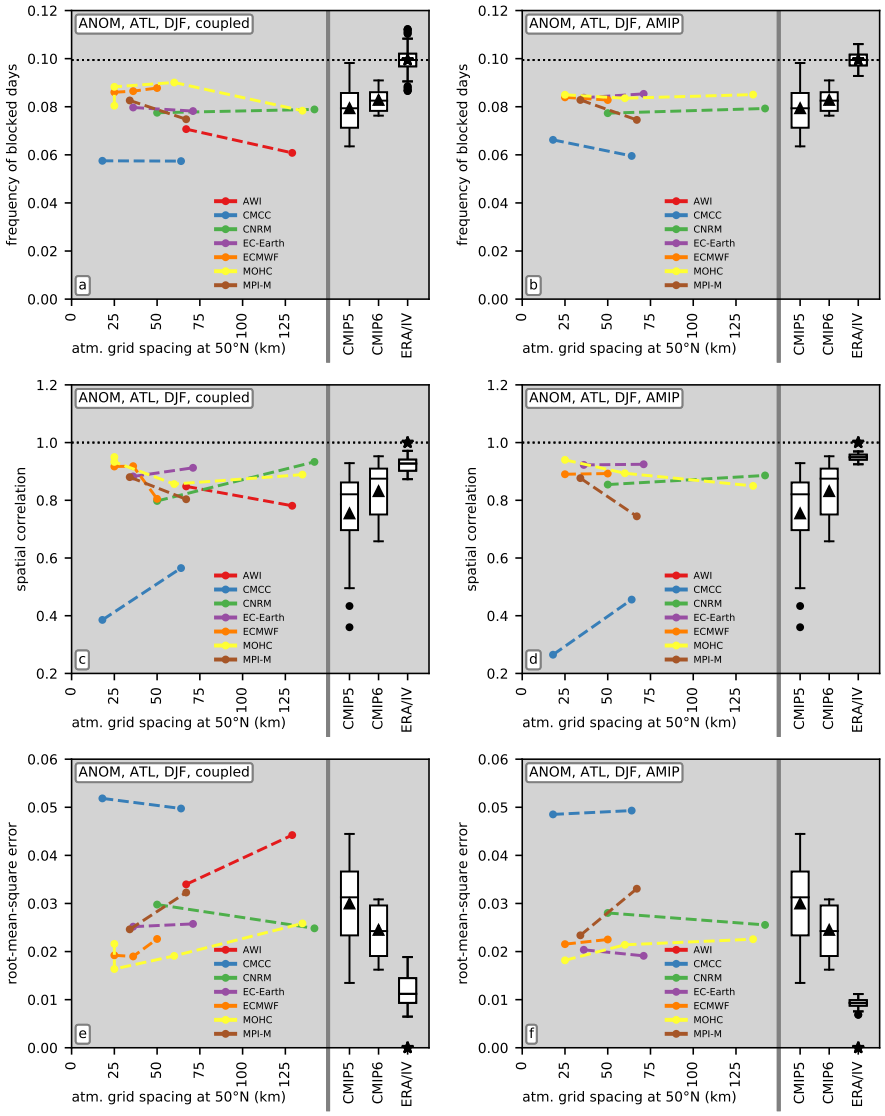

Figure S3. Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal winter, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

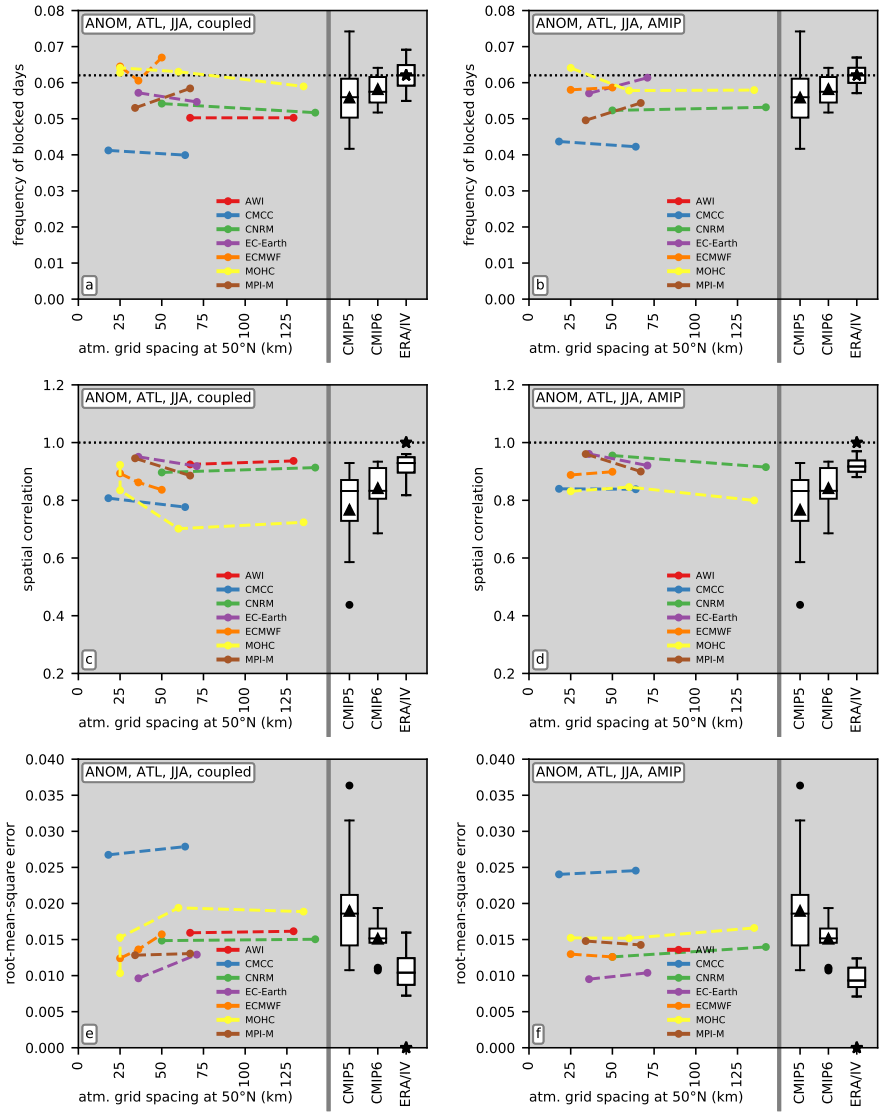

Figure S4. Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal summer, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

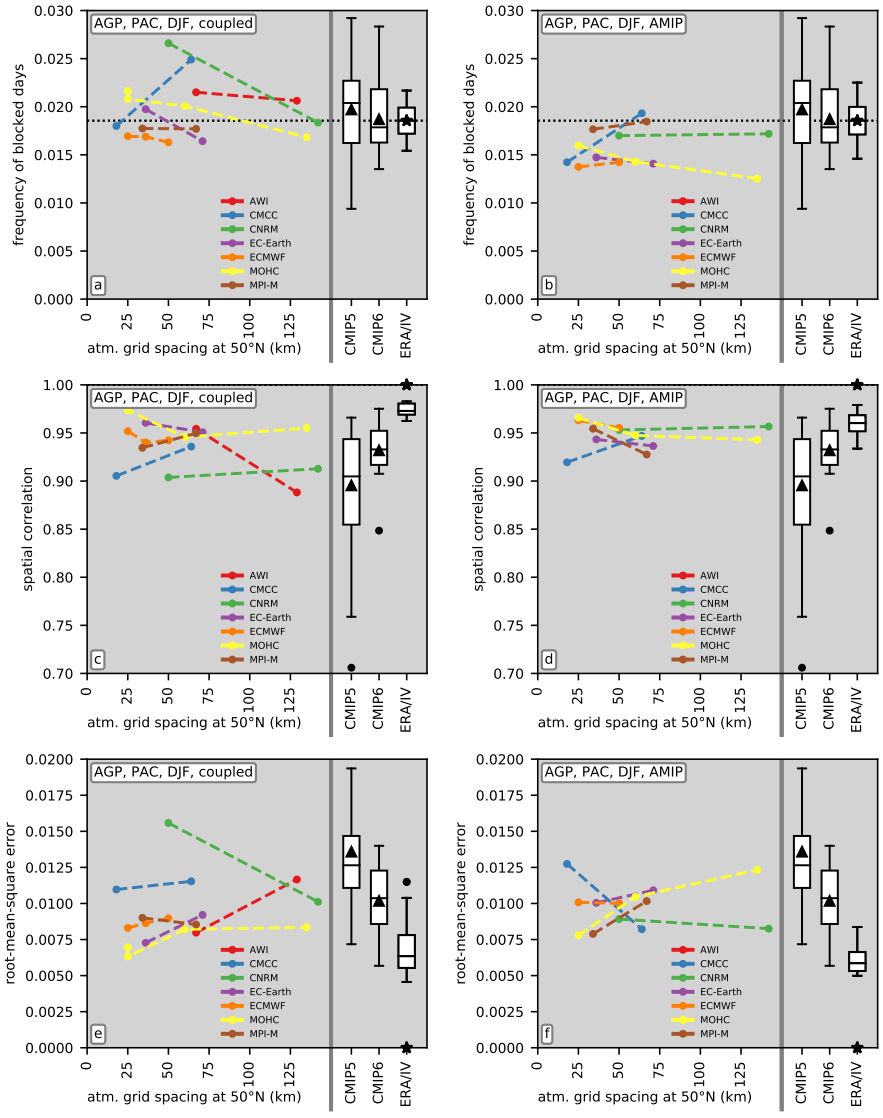

Figure S5. Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the AGP index and boreal winter, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

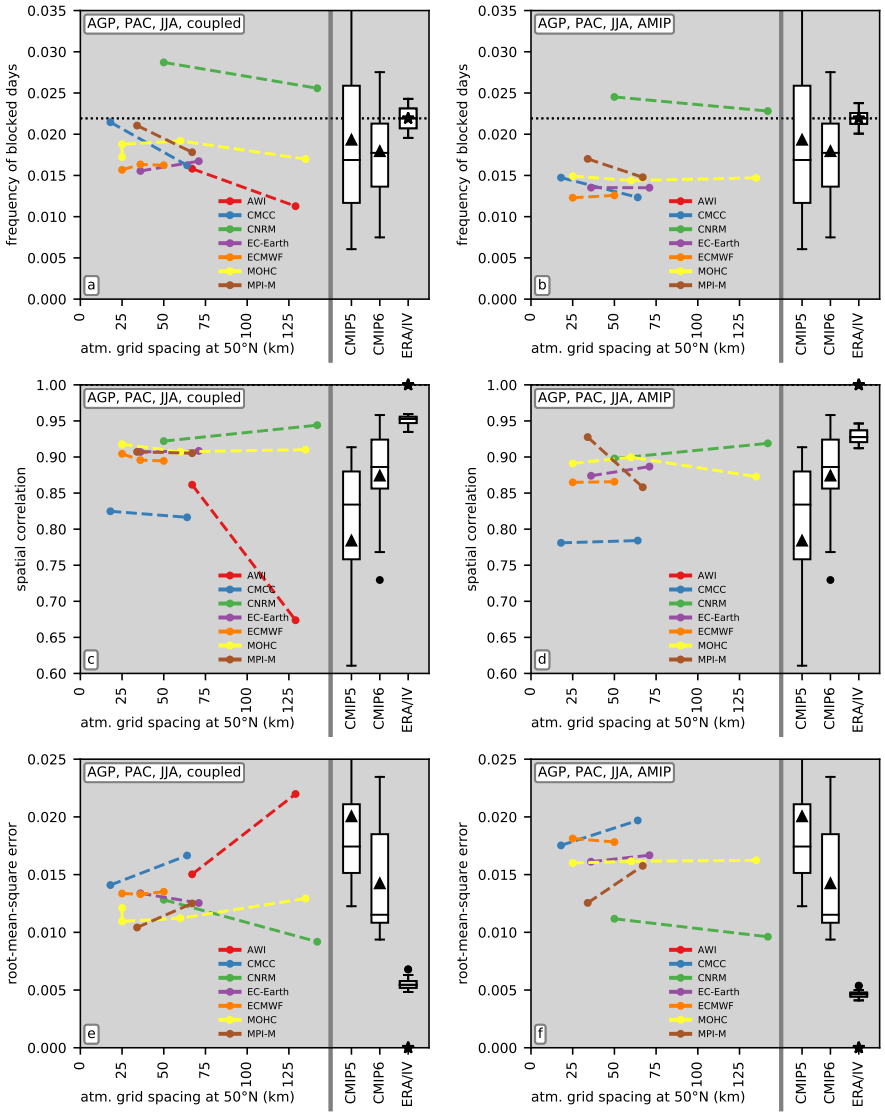

Figure S6. Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the AGP index and boreal summer, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

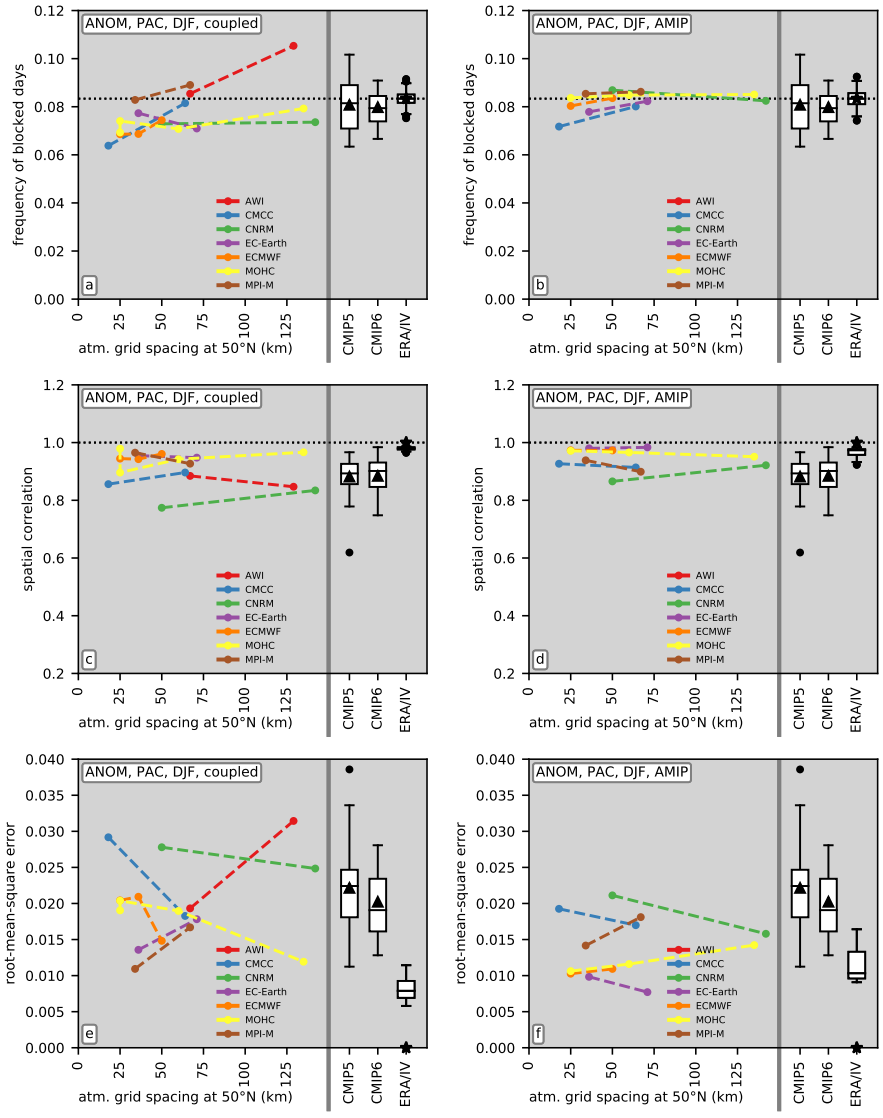

Figure S7. Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal winter, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

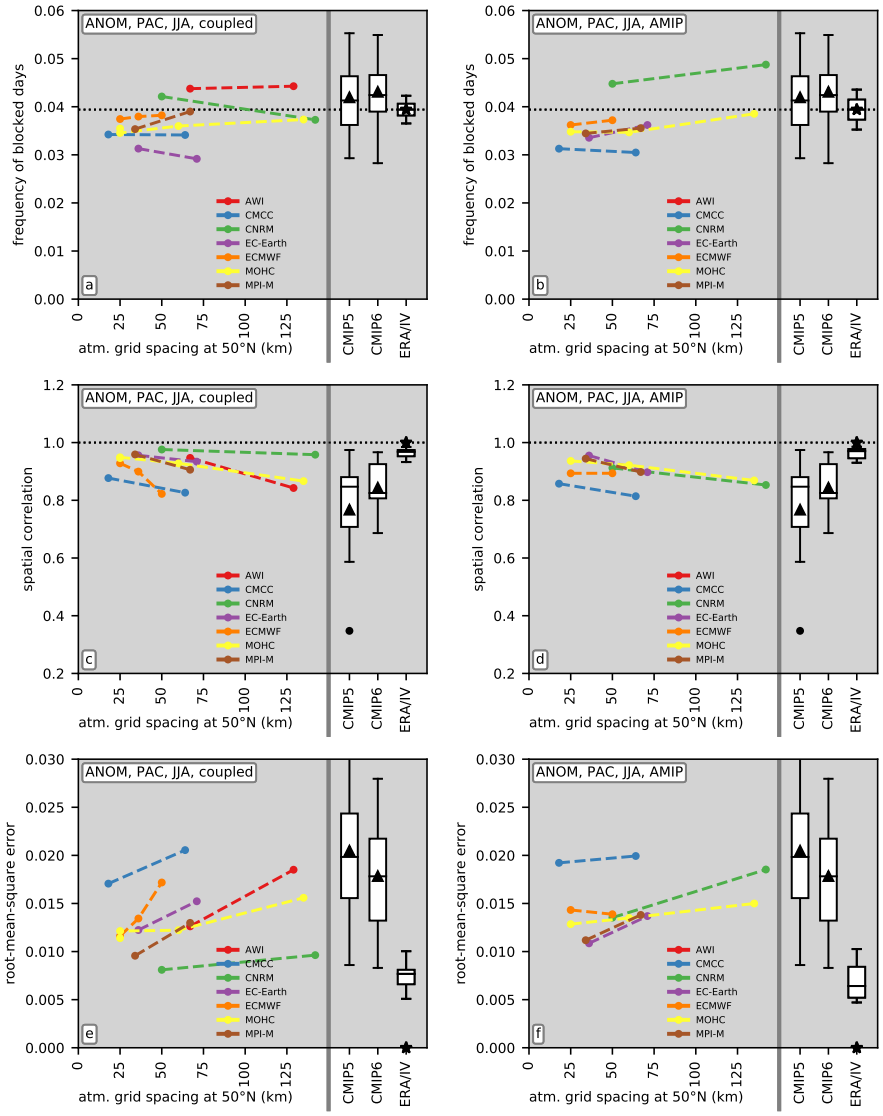

Figure S8. Metrics of blocking performance (a,b - blocking frequency, c,d - spatial correlation, e,f - root-mean-square error) for the ANOM index and boreal summer, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the righ-hand side show distributions of the metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

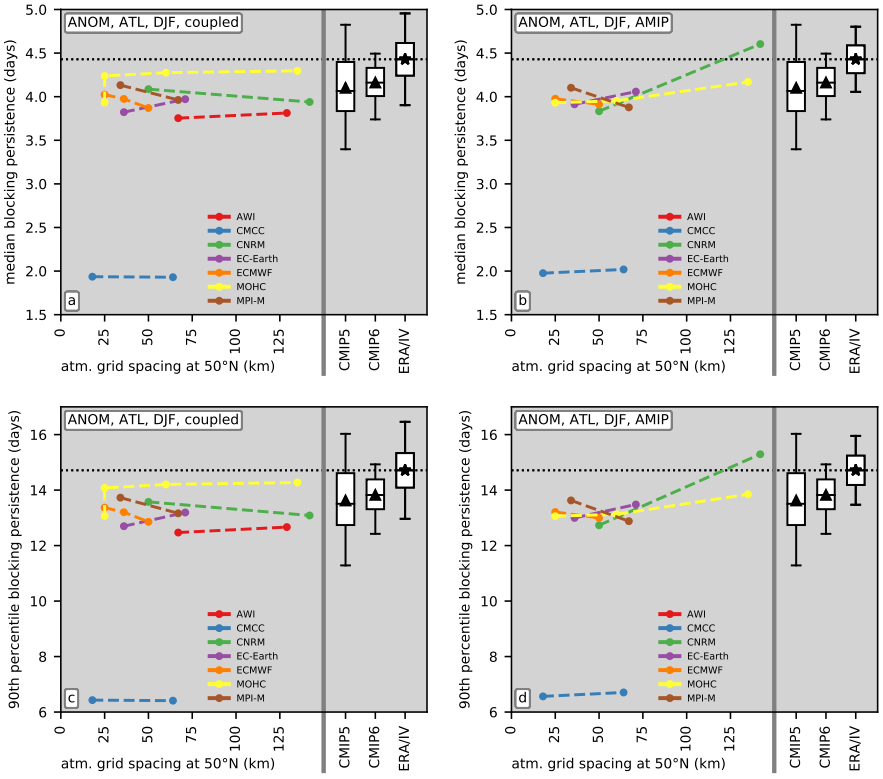

Figure S9. Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal winter, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

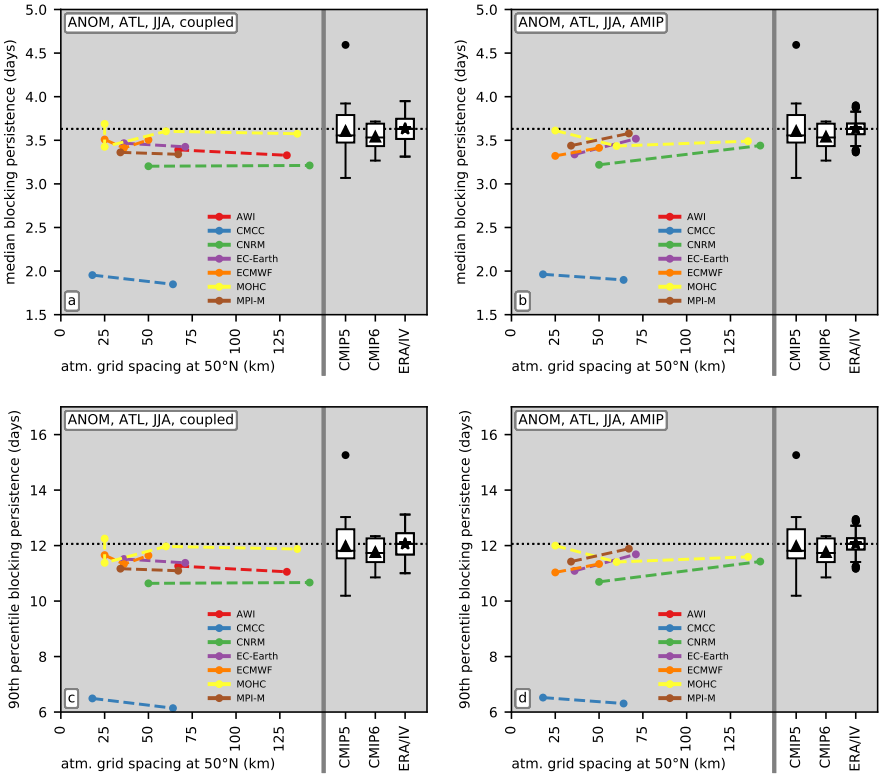

Figure S10. Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal summer, for the ATL domain (-90-90E, 50-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

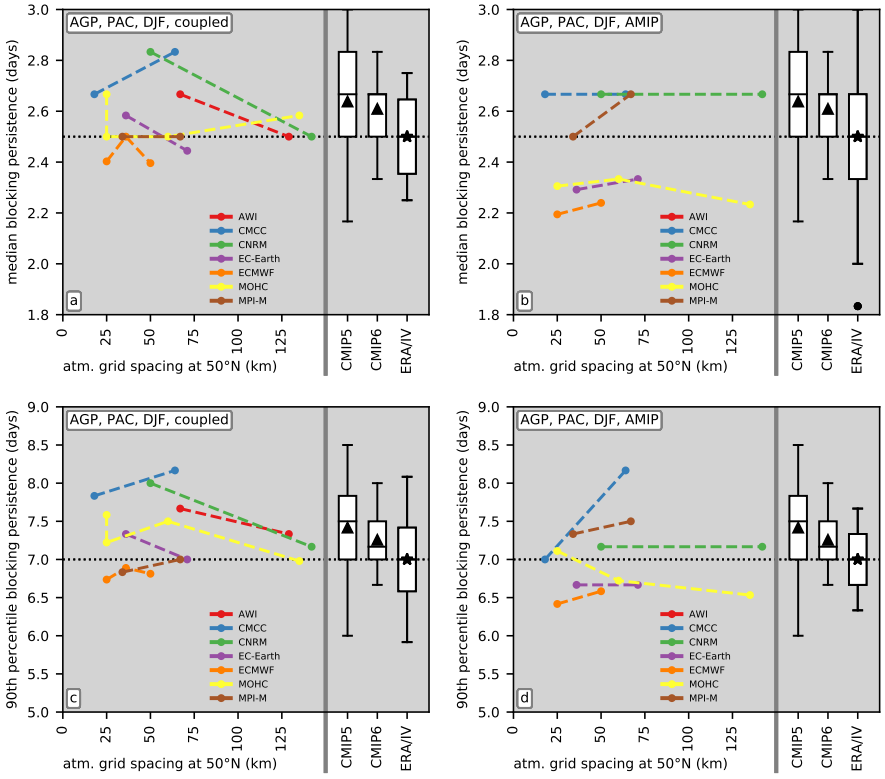

Figure S11. Persistence of blocking events (a,b - median, c,d - 90th percentile) for the AGP index and boreal winter, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

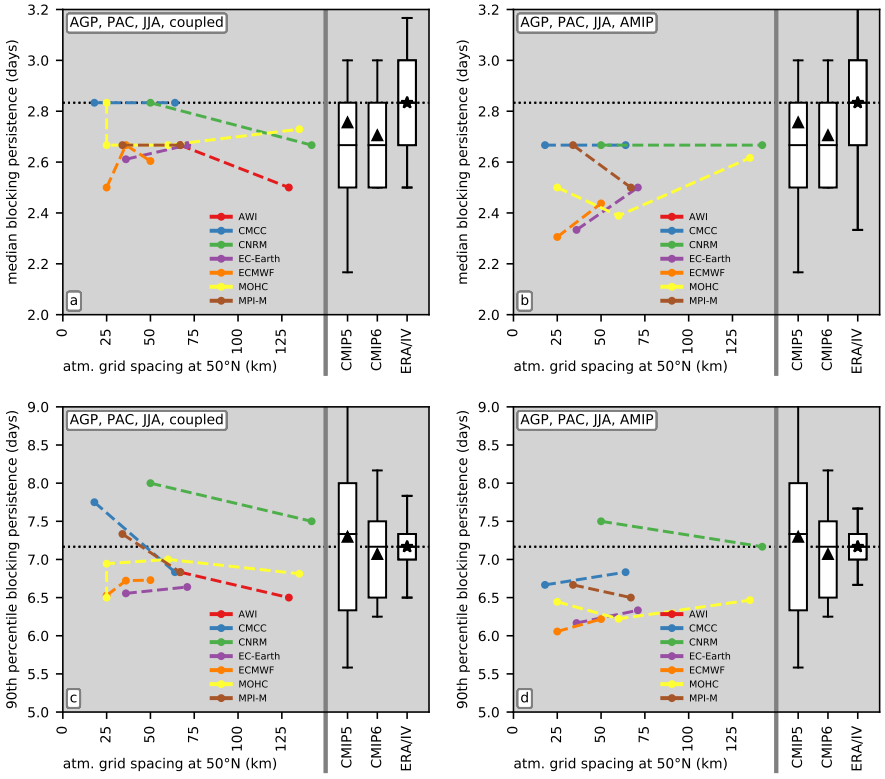

Figure S12. Persistence of blocking events (a,b - median, c,d - 90th percentile) for the AGP index and boreal summer, for the PAC domain (90-270E, 50-75N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

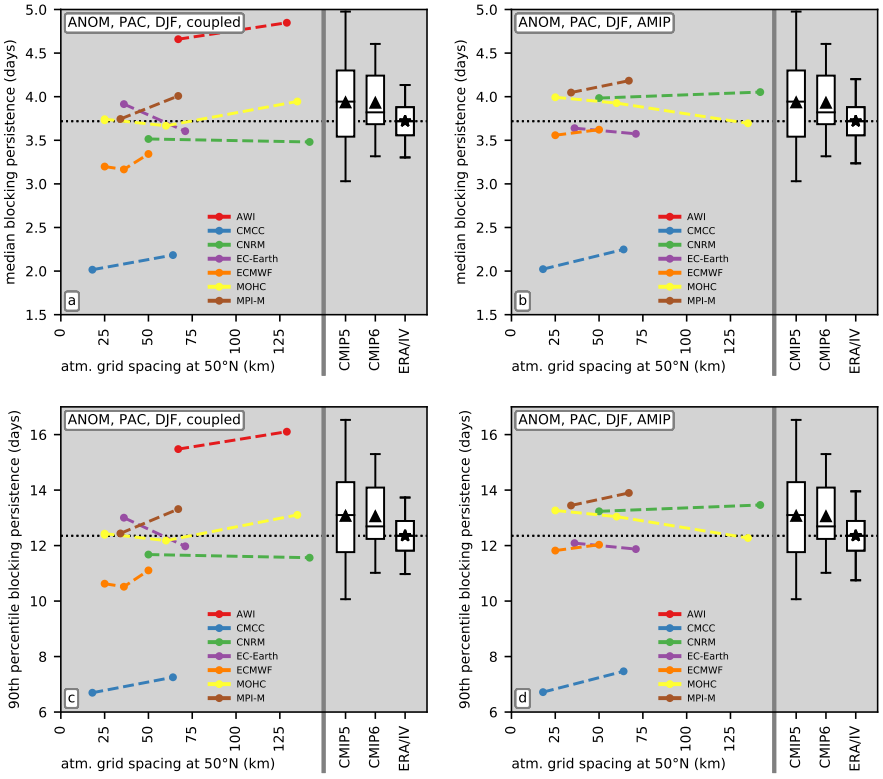

Figure S13. Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal winter, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).

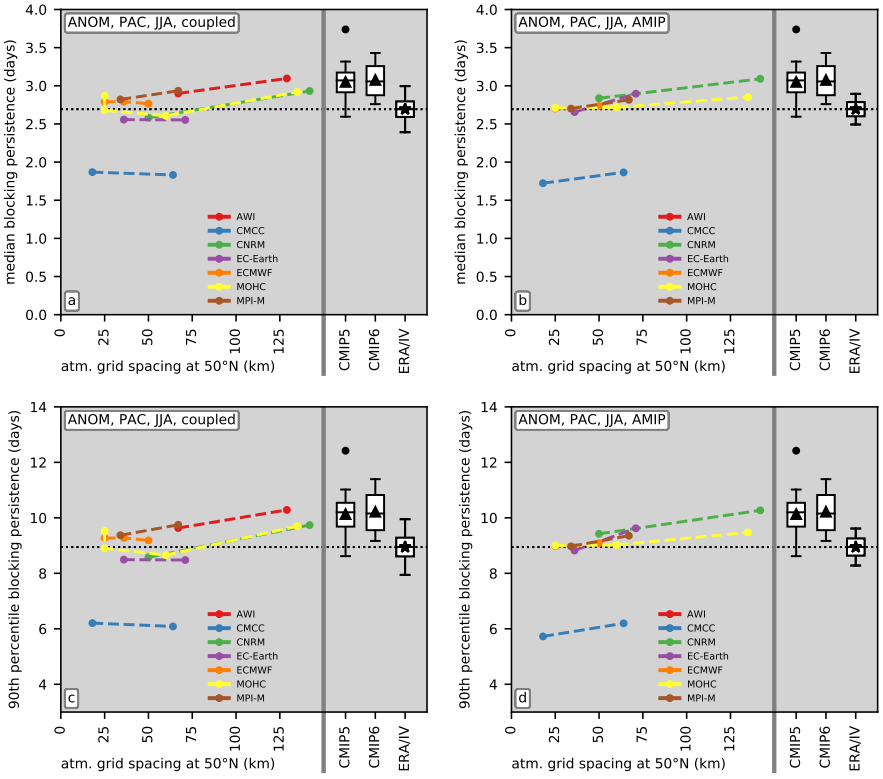

Figure S14. Persistence of blocking events (a,b - median, c,d - 90th percentile) for the ANOM index and boreal summer, for the PAC domain (120-240E, 40-90N). The left-hand side of each panel shows metrics for PRIMAVERA simulations at different grid spacings (resolutions). Boxplots on the right-hand side show distributions of the persistence metric across CMIP5 and CMIP6 simulations. The '*' symbol in the column 'ERA/IV' shows the reanalysis estimate and the boxplot is an estimate of the expected agreement given internal variability (see text).