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*Supplement of*

## **Evaluation of the CMIP5 models in the aim of regional modelling of the Antarctic surface mass balance**

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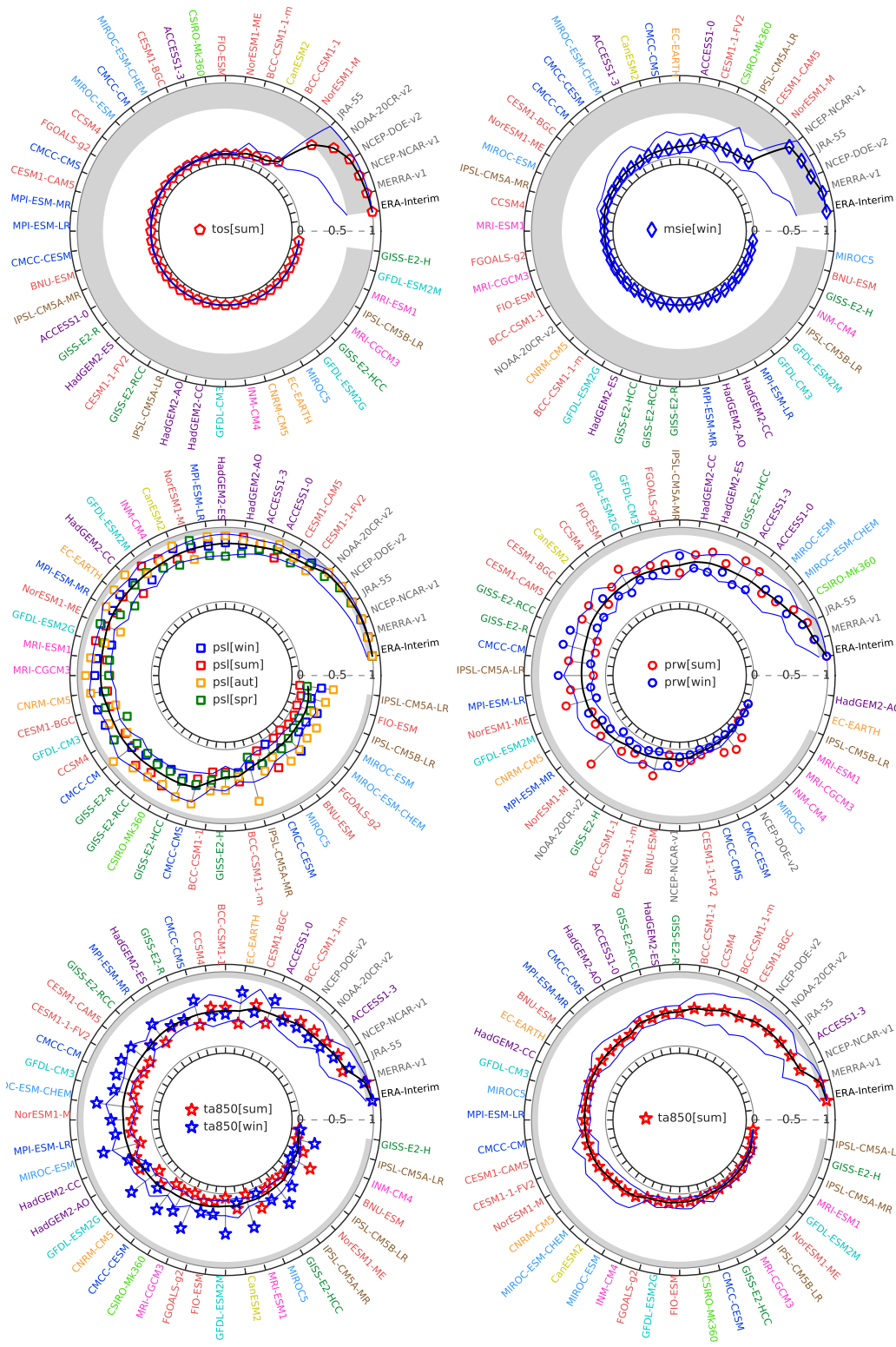


Figure S1: CPI scores, computed as  $\exp(-CPI^2/2)$ , range from 1 (best, external circle) to 0 (null probability of belonging to the ERA-Interim distribution, internal circle). Models are ranked by CPI scores for each variable: summer sea surface temperature, winter meridional sea-ice extent, annual sea-level pressure, summer/winter precipitable water, summer/winter 850hPa air temperature, and summer 850hPa air temperature. Markers are for seasonal CPI scores and solid black line is for combined CPI scores. Blue lines are upper and lower bounds for the combined score taking into account multi-decadal variabilities of seasonal components. The grey crown width is the combination of 90th percentiles of CMIP5 GCMs multi-decadal variabilities. Models with obvious similarities in code or produced by the same institution are marked with the same color (clusters), following Knutti et al. (2013).

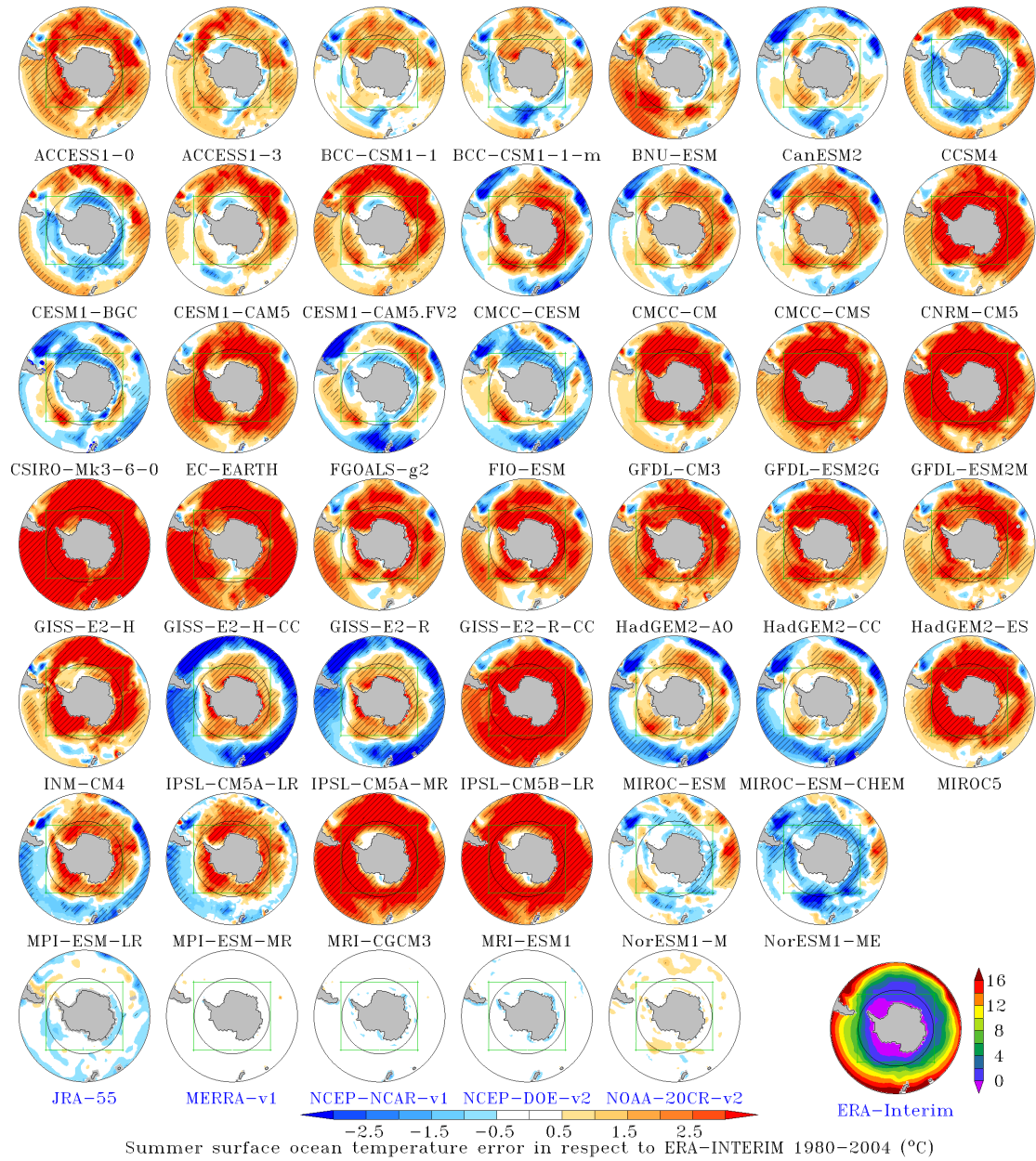


Figure S2: Same as Fig. 1 but for summer sea surface temperature (in °C).

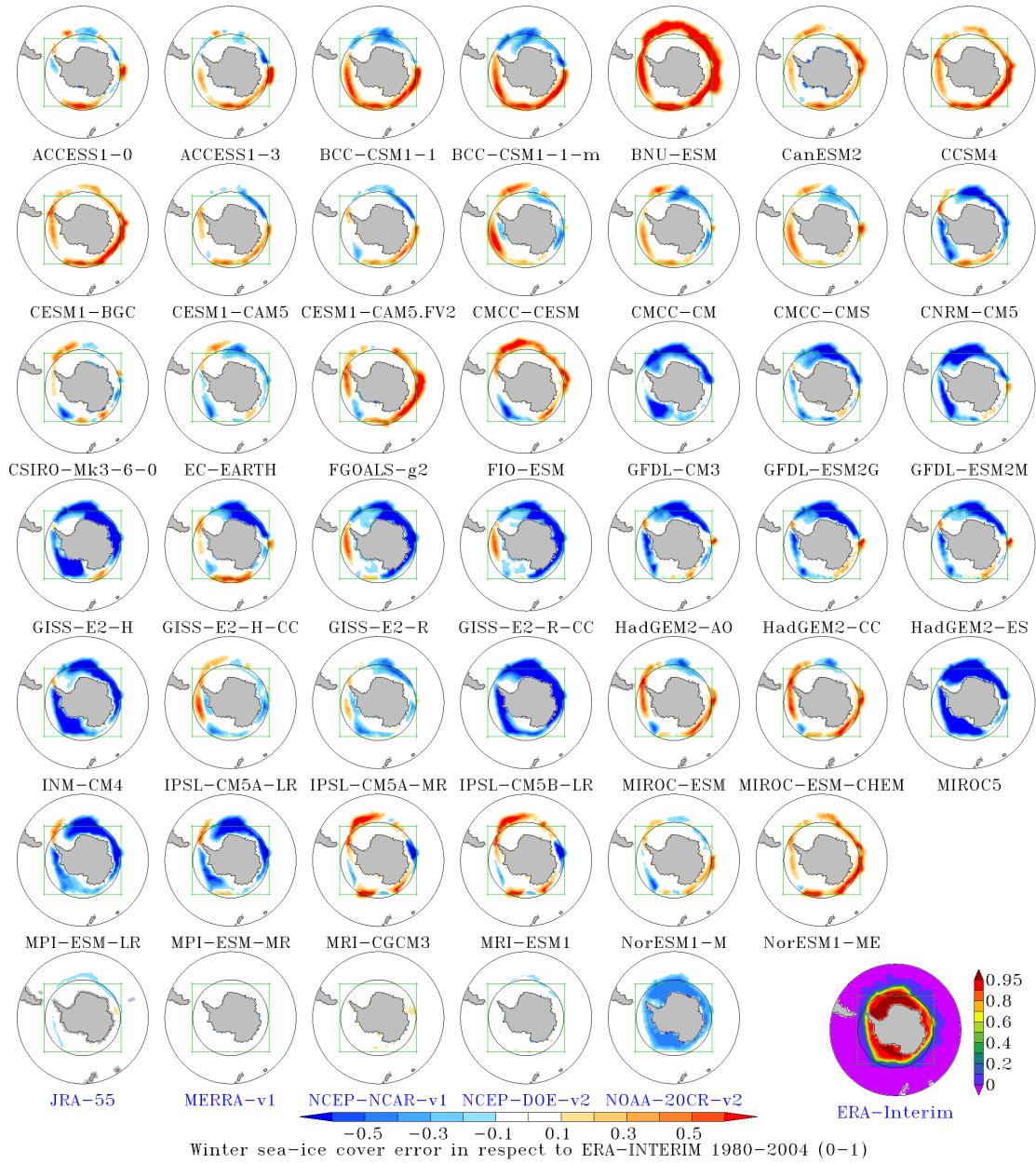


Figure S3: Same as Fig. 1 but for winter sea-ice concentration.

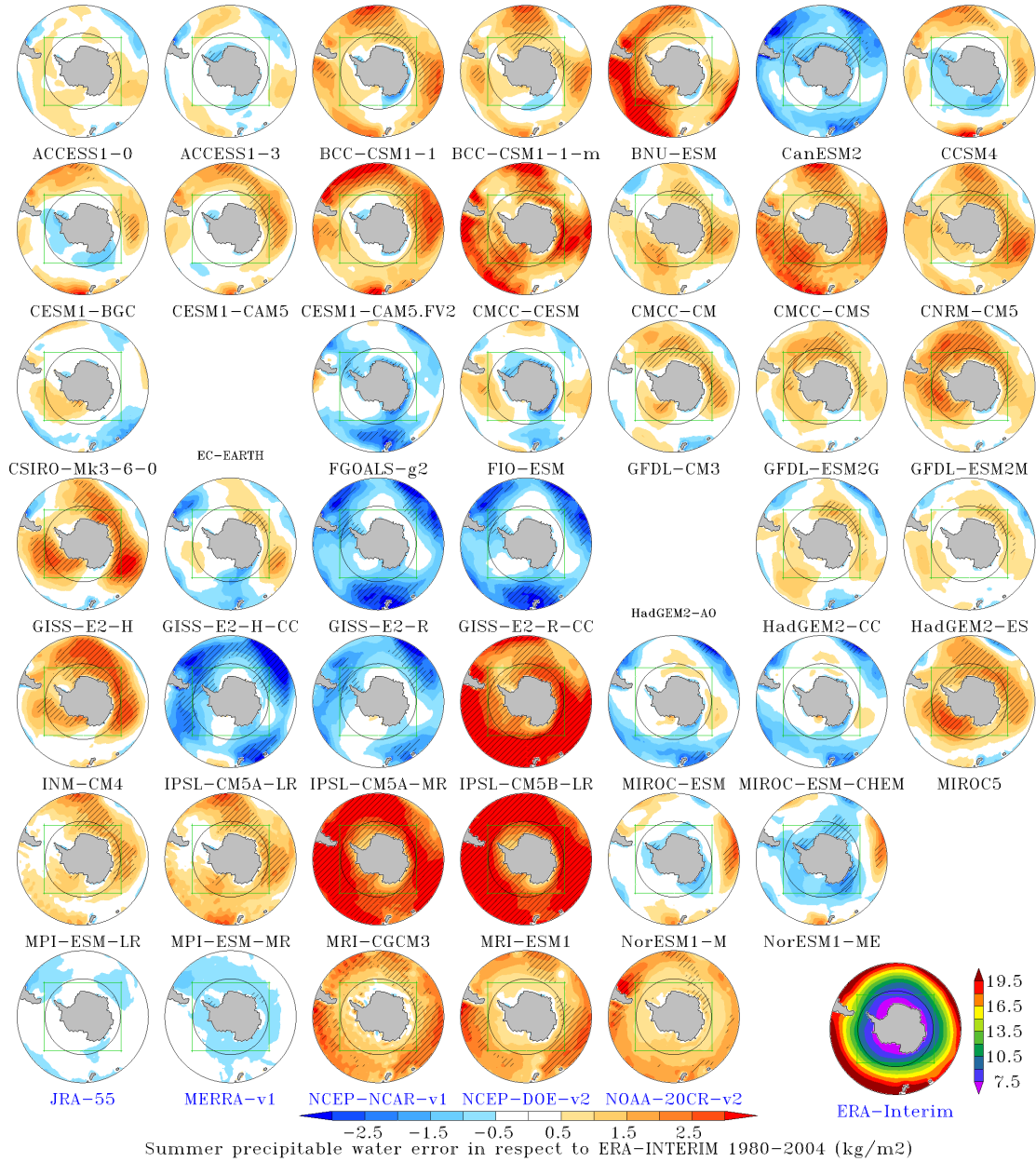


Figure S4: Same as Fig. 1 but for summer precipitable water (in  $\text{kg m}^{-2}$ ).



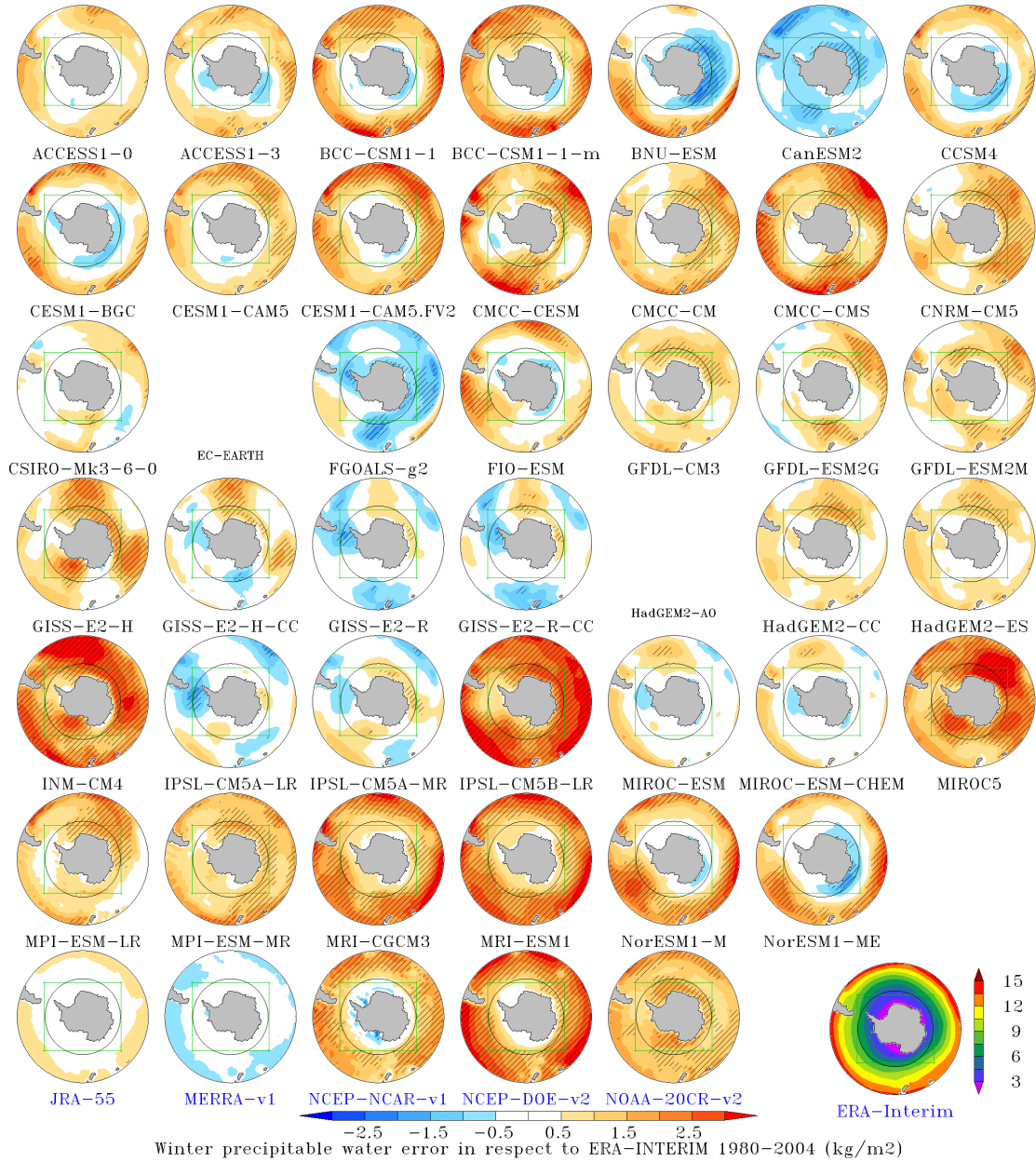


Figure S5: Same as Fig. 1 but for winter precipitable water (in kg m<sup>-2</sup>).

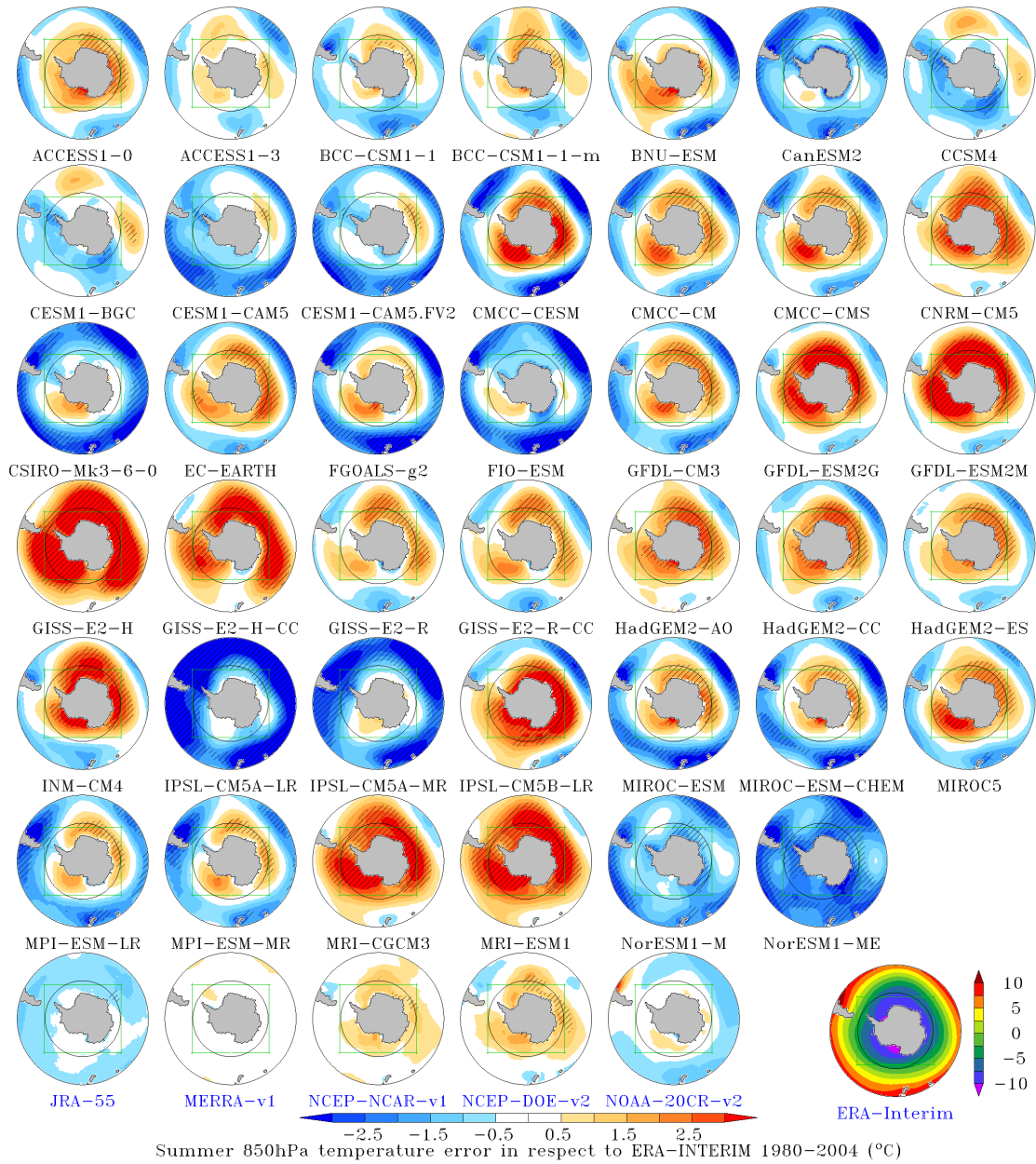


Figure S6: Same as Fig. 1 but for summer air temperature at 850hPa (in °C).

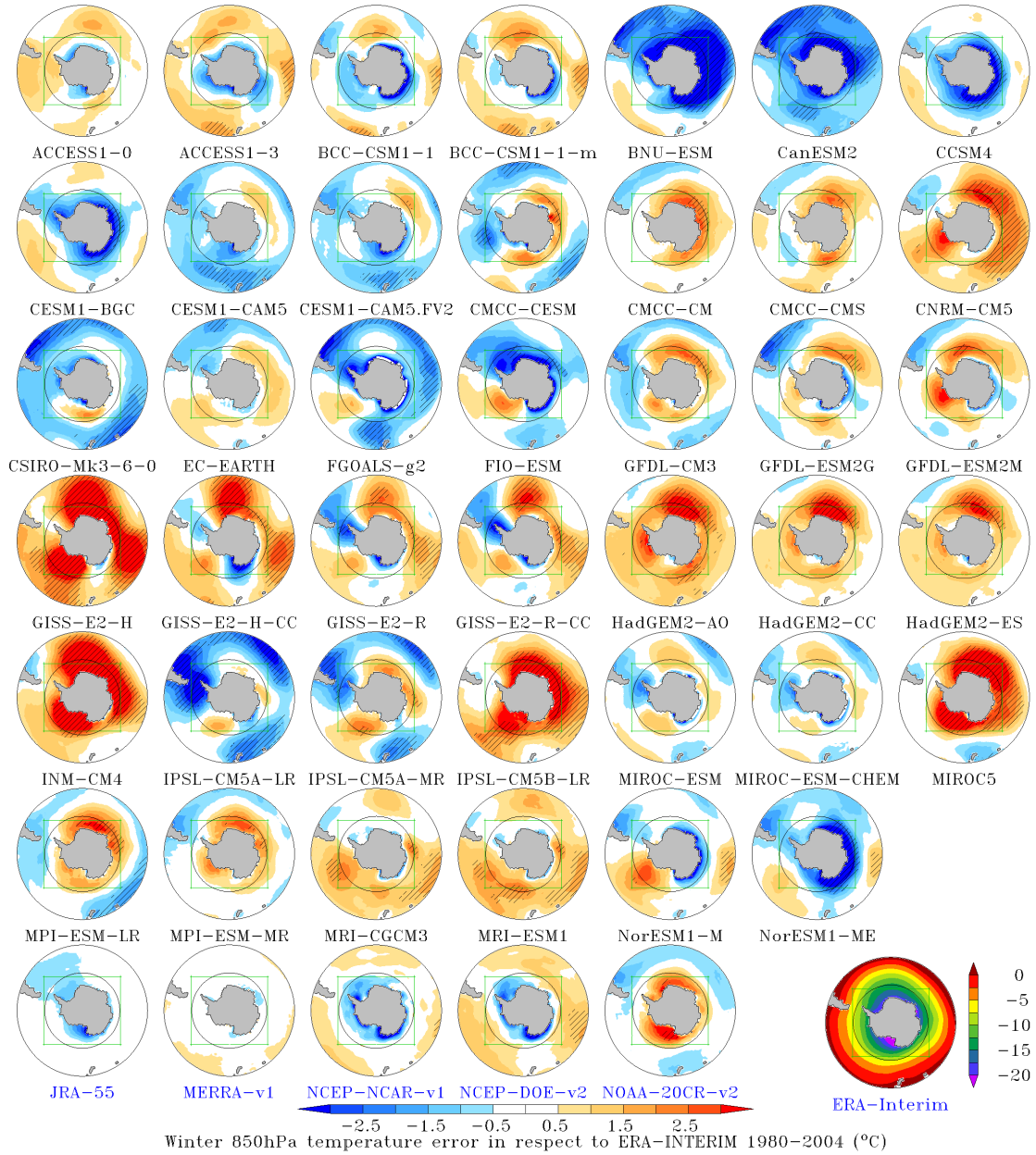


Figure S7: Same as Fig. 1 but for winter air temperature at 850hPa (in °C).



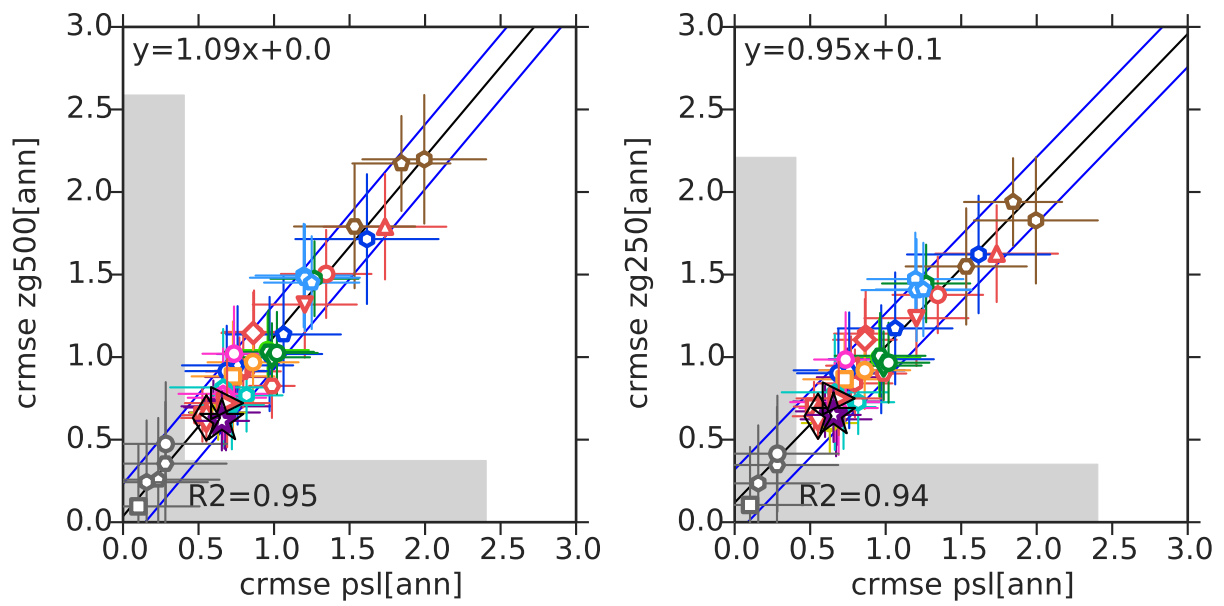


Figure S8: The spatial centered rmse (crmse) is computed for 1980-2010 mean values of models vs. ERA-Interim and scaled by spatially-averaged standard deviation of ERA-Interim annual values. Here we compare annual geopotential heights at 500hPa (zg500[ann], left) and at 250hPa (zg250[ann], right) without masking ice-sheet areas to annual sea-level pressure over the ocean (psl[ann], X-axis). See Fig. 3 for chart details.

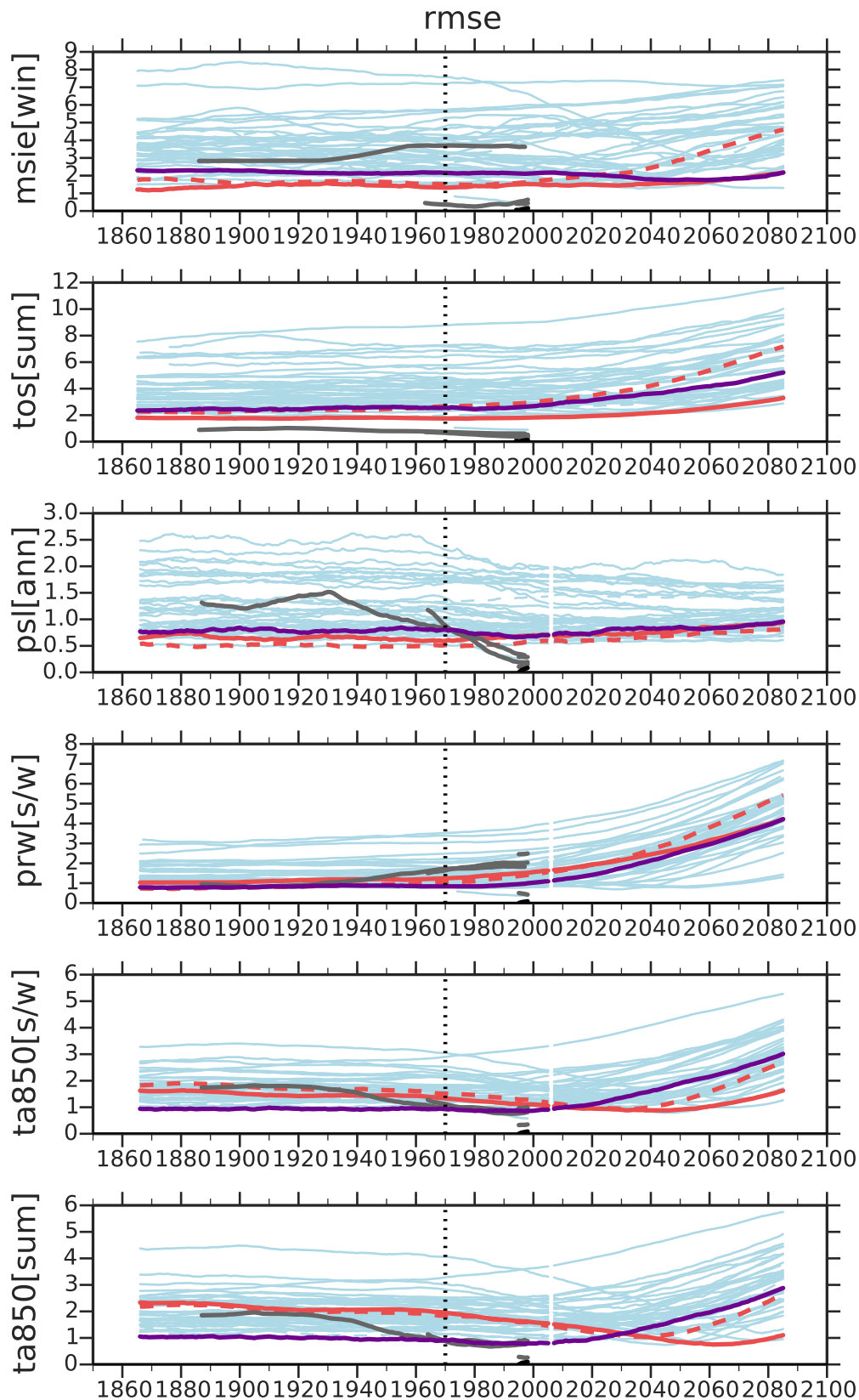


Figure S9: 31-years time-averages running CPIs between 1950 and 2100. The field of reference is ERA-Interim for the period 1980-2010. Thin light blue lines are for the 41 CMIP5 GCMs (historical+RCP85) and thick dark grey lines are for the reanalyses. Three GCMs are highlighted with thick colored lines: ACCESS1-3 in purple, CESM1-CAM5 in dashed red and NorESM1-M in solid red. Each point of a line is the central year of the 31-year period.

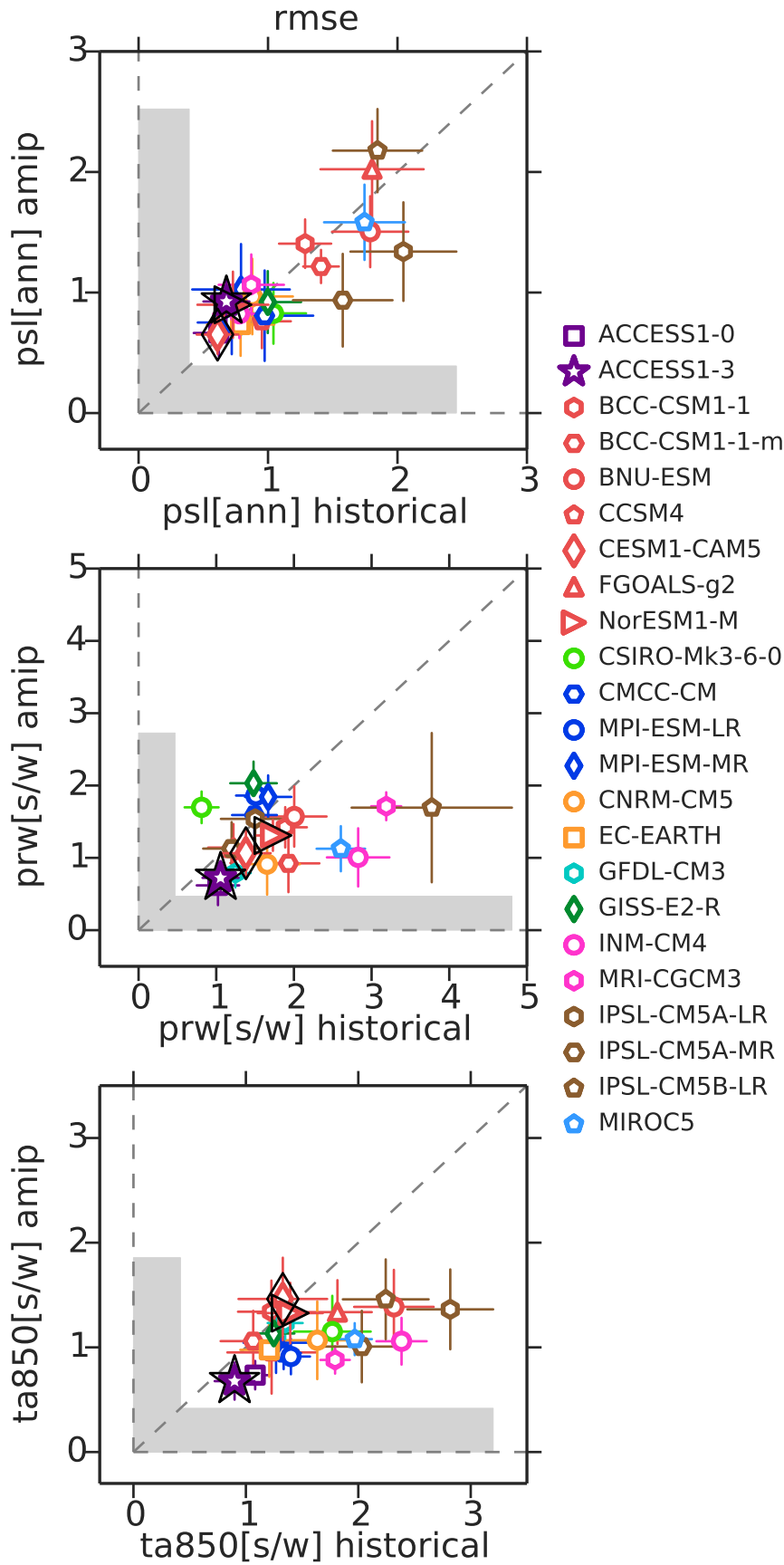


Figure S10: Comparison of Amip (y-axis) versus Historical (x-axis) for the six selected metrics. For Amip, the averaged period is 1980-2008 (29 years) whereas for ERA-Interim and Historical runs the averaged period is 1980-2010 (31 years). See Fig. 3 for chart details.