Supporting Information for

Interhemispheric synchronization between the AO and the AAO

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Text S1. Evidence of AO–AAO Synchronicity in AGCM Simulation Results

It might be possible to ascribe the AO and AAO synchronicity seen in the reanalysis dataset to mere coincidence, although we reject that possibility. The results of an AGCM simulation support the reliability of our analysis results. We used the product of a 150-year run of an AGCM developed by the Center for Climate System Research of the University of Tokyo and the National Institute for Environmental Studies. This model has a T42L20 horizontal resolution, with an upper boundary at the 10-hPa level (Ogata et al., 2013). At the lower boundary of the domain, SST was set during this simulation run to the climatological monthly mean annual value. Therefore, the model did not include any interannual variation of SST, and any influence of SST variations, such as ENSO, on the atmospheric fields was excluded.

Using the simulation output, we carried out regression analyses like those conducted using the reanalysis data (see Figure 4). The resulting regression maps (Figure S2) show patterns quite similar to those obtained with the reanalysis dataset. When zonal-mean geopotential height was regressed against the AAO index in October, a significant SAM signature was seen in the troposphere and stratosphere of the Southern Hemisphere (left panel). In the Northern Hemisphere, a significant NAM signature (i.e., blue shades at higher latitudes and red and yellow shades at lower latitudes) was also seen in the troposphere. When geopotential height was regressed against the AO index in October, the SAM pattern was also seen in the Southern Hemisphere (right panel). The similarity between the AGCM results and the reanalysis dataset results implies that the synchronicity of the AO and AAO is not merely a coincidental response to anomalous SSTs.

References

Ogata K, Y. Tachibana, Y. Udagawa, K. Oshima, and K. Yoshida (2013), Influence of sea ice anomaly in the Pacific sector of the Southern Ocean upon atmospheric curculation uysing AGCM, *Umi to sora*, **89**, 19–23, http://dl.ndl.go.jp/info:ndljp/pid/10116137

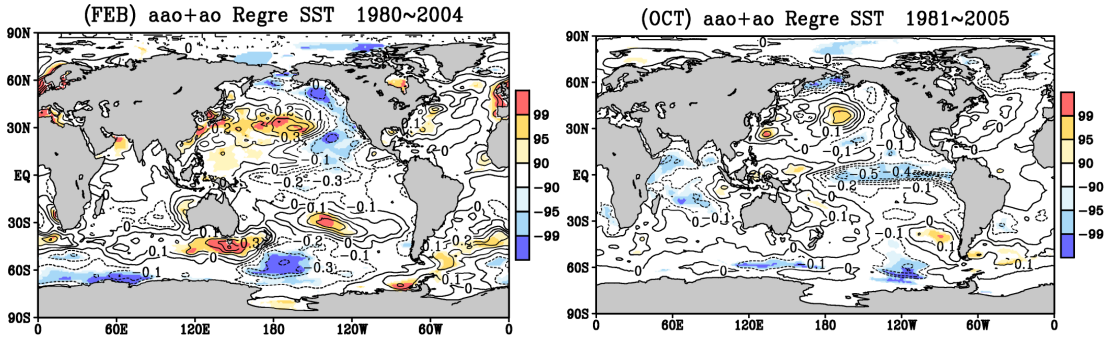

Figure S1. Regression map of monthly mean SST against the AO+AAO index in February (left) and October (right). Contour interval is 0.1°C. Color shading indicates the level of statistical significance; red and yellow shades indicate positive correlations, and blue shades indicate negative correlations.

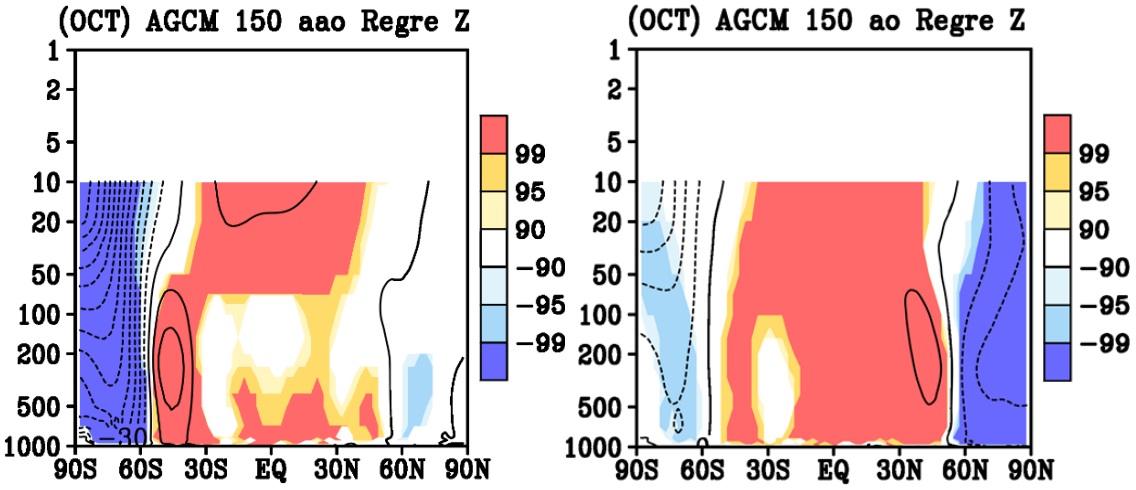

Figure S2. Meridional–vertical patterns of zonal-mean geopotential height regressed against the (left) AAO and (right) AO indices in AGCM simulation results. Units, contour interval, and shading are the same as in Figure 4.

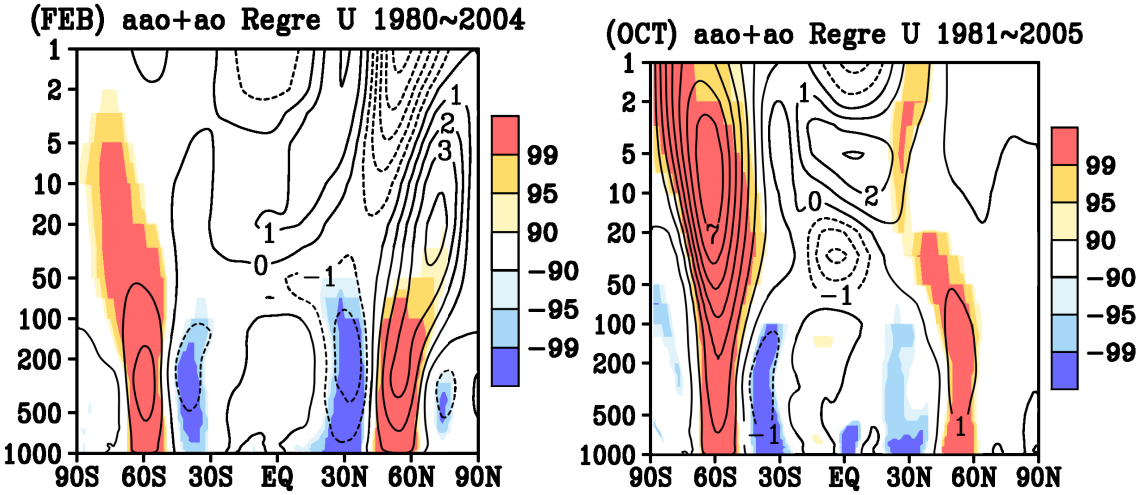

Figure S3. Zonal-mean zonal wind regressed against the AAO+AO index in meridional–vertical plane: (left) February (left) and (right) October. The horizontal and vertical axes show latitude and altitude, respectively. Contour interval is 1 m. Color shading indicates the level of statistical significance; red and yellow shades indicate positive correlations, and blue shades indicate negative correlations.

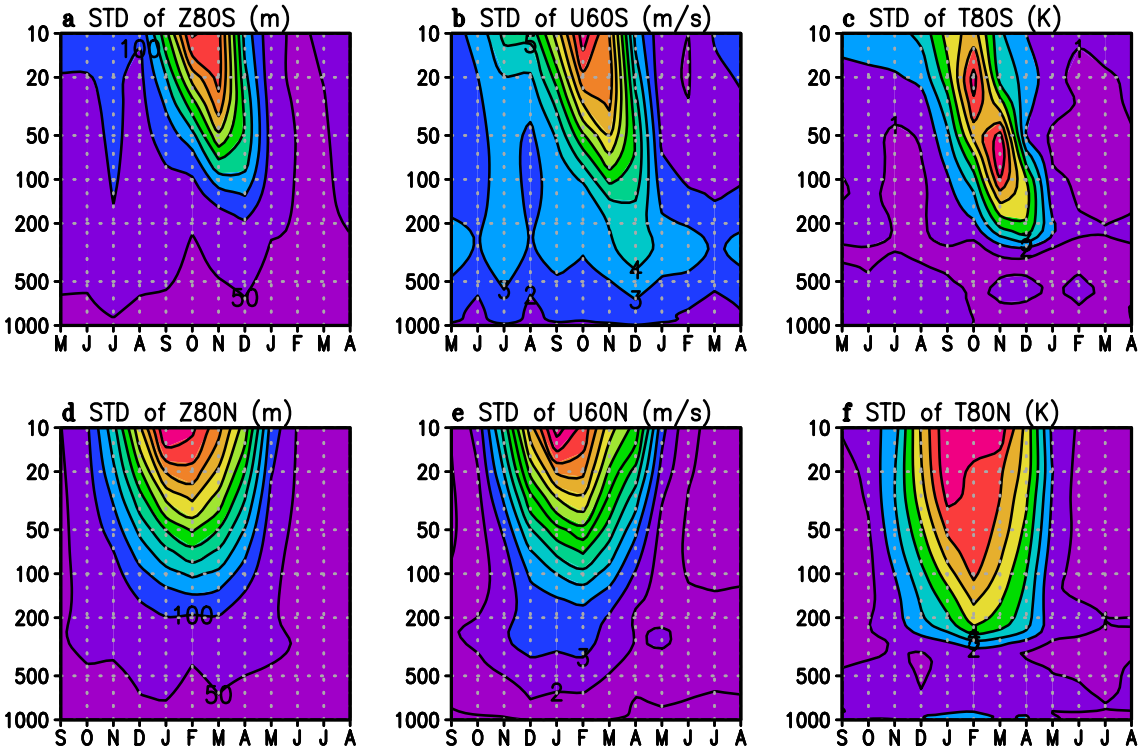

Figure S4. Standard deviations of zonal-mean atmospheric fields with respect to months (horizontal axis) and heights (vertical axis). (a) geopotential height at 80 ^{o} S, (b) zonal wind at 60 ^{o} S, and (c) temperature at 80 ^{o} S, (d) geopotential height at 80 ^{o} N, (e) zonal wind at 60 ^{o} N, and (f) temperature at 80 ^{o} N. Note that horizontal axes of (a), (b) and (c) are from May to April, and those if (d), (e) and (f) are from September to August.