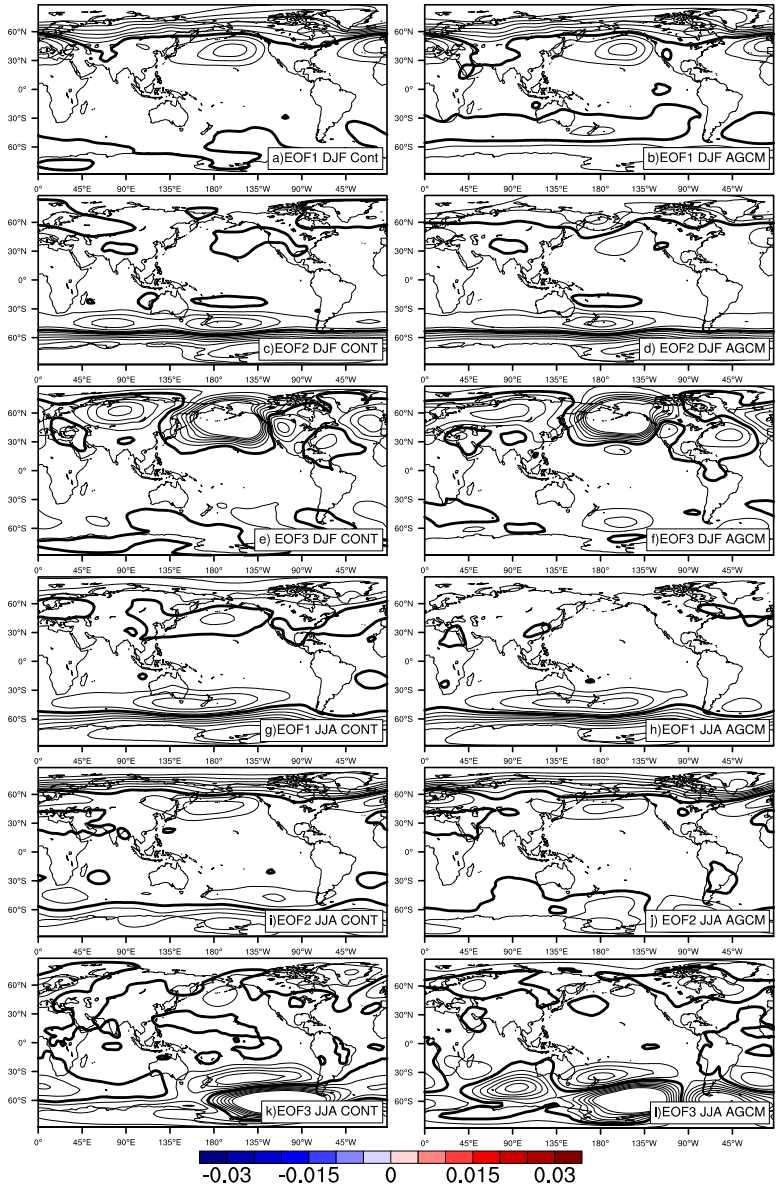
Internal Atmospheric Noise Characteristics in 20th Century Coupled Atmosphere-Ocean Model Simulations



EOFs of surface pressure noise anomalies for the winter (top 3 panels) and summer (bottom 3 panels) EOF1 (a,b,g,h), EOF2 (c,d,i,j) and EOF2 (e,f,k,l) for a Coupled GCM simulation (left column), and the AGCM component forced by the SST of the CGCM simulation (right column).

Colfescu and Schneider (2017) examine the statistical characteristics of the seasonal atmospheric internal variability (hereafter weather noise) for surface pressure in 20th century (1871-1998) simulations made with the Community Climate System Model 3 (CCSM3) coupled general circulation model. The weather noise was determined by removing the SST and externally forced responses from the total fields, where the forced responses are found from atmosphere-only simulations forced by the SST and external forcing of the coupled runs.

The spatial patterns of the main seasonal modes of weather noise variability, shown in the figure at left, are found for boreal winter and summer from empirical orthogonal function (EOF) analyses performed globally and for various regions, including the North Atlantic, the North Pacific, and the equatorial Pacific. The temporal characteristics of the modes are illustrated by power spectra and probability density functions (PDF) of the principal components (PC).

The variability is dominated by large scale spatial structures of the weather noise that resemble observed patterns, and that their relative amplitudes in the CGCM and AGCM simulations are very similar. The regional expression of the dominant global mode, a seasonally dependent AO-like or AAO-like pattern is also found in the regional analyses, with similar time dependence. The PCs in the CGCM and the corresponding SST forced AGCM simulations are temporally uncorrelated, but the spectra and PDFs of the CGCM and AGCM PCs are similar.

The temporal structures of the noise PCs are white at timescales larger than few months, so that these modes can be thought of as temporally stochastic forcings for the climate system. The PDFs of the weather noise PCs are not statistically distinguishable from Gaussian distributions with the same standard deviation. The PDFs do not change substantially between the first and second half of the 20th century.

Colfescu, I. and E. K. Schneider, 2017: *Climate Dyn.*, **49**, 2205-2217, DOI 10.1007/s00382-016-3440-9