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Two modes of the Silk Road pattern and their inter-annual variability simulated by IAP/LASG AGCM SAMIL2.0

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The basic characteristics and inter-annual variability of the two modes of the Silk Road are investigated by using the NCEP2 reanalysis and observed sea surface temperature (SST) driven AGCM simulation of IAP/LASG SAMIL2.0. Two modes of the Silk Road pattern are identified as the leading two modes of 200-hPa meridional wind both in the NCEP2 and SAMIL2.0. The horizontal distribution of the Silk Road pattern is reasonably reproduced by SAMIL2.0, having a pattern correlation coefficient of 0.63 (0.62) with the NCEP2 for the first (second) mode. Analysis on the wave-activity flux shows that tropical sources are evident in the second mode and this feature is well captured by SAMIL2.0. In the wave-train centers, the first mode is tilted eastward with height slightly while the second mode is tilted westward, accompanied by upward wave activity flux. These features are evident in both the NCEP2 and SAMIL2.0.The wave-train maintains and develops through extracting the energy from the mean flow by barotropic energy conversion (CK) and barolinic energy conversion (CP). Different from the first mode,$CK$is nearly anti-symmetrical around the jet in the second mode. When integrated spatially, the zonal component of$CK(CK_x)$ is more efficient than that of meridional component (CK_y) in the second mode but opposite in the first mode.$CP$is smaller and more westward in the second mode than that in the first mode. The distribution and efficiency ofCKcan't be reproduced realistically in the SAMIL2.0, butCPcan be reproduced well. Due to the determination ofCP, so the two modes of the Silk Road pattern can be well reproduced in the SAMIL2.0. In the inter-annual variability aspect, the temporal phase of the second mode is well captured in the SAMIL2.0, contrasting with the first mode. Based on regression analysis in the observations, the first mode tends to appear in the decaying phase of ENSO, while the strongest SST signals associated with the second mode appear in the summer, with the strongest centers in the equatorial eastern Pacific Ocean (ENSO-like) and northern Atlantic Ocean (AMO-like).