The influences of El Niño and La Niña sea surface temperature anomalies on the middle atmosphere were analyzed using a chemistry climate model (the Whole Atmosphere Community Climate Model: WACCM3) and the ERA-40 reanalysis data set. Monthly mean data were used to conduct statistical and dynamical analyses. Temperature anomalies were found in the stratosphere in both El Niño and La Niña years. These anomalies exhibited diverse distribution patterns, which we ascribed to the different scales of planetary wave action. In the El Niño winter, wave action was concentrated in December and January, leading to more disturbances of the stratospheric polar vortex and higher frequencies of stratospheric sudden warming (SSW) in these periods. Moreover, on the basis of three-dimensional Eliassen-Palm (E-P) flux, we revealed that the main wave action was located in the eastern hemisphere and pushed the polar vortex to the opposite side. These vortex movements were closely connected to the weather and climate in the corresponding areas. In contrast, in the La Niña winter, February and March were the major active months for planetary waves, and most SSW events took place in these phases. Distributions of E-P flux indicated that the wave fluctuations were centralized between 90°E and 180°E, resulting in a shift of the polar vortex and some variations in related atmospheric circulations. In addition, the mesospheric residual circulation (RC) exhibited a reversal between February and March in both the El Niño and La Niña years.