This study examines the interdecadal variability of the Pacific Subtropical Cell (STC) with Meteorological Research Institute Community Ocean Model (MRI.COM), focusing on effective ocean optical properties. The model has a global domain, and the resolution is 1 deg. in longitude by 0.5 deg. in latitude with 51 levels in vertical. The model is driven by surface fluxes of momentum, heat, and freshwater derived from CORE ver.2 for the period 1948-2007 after a spin-up integration of about 1,500 years. The model captured features of the observed interdecadal variability: a slowdown from 1960s to mid-1990s and a rebound after mid-1990s. We found that transport variations in interior flow are opposite in phase with those in western boundary current in the upper pycnocline, though the STC intensity, defined as the total transport in the upper pycnocline, is controlled mainly by interior flow. It is shown that the interdecadal variability of the STC intensity corresponds well with that of the Ekman transport. These results suggest that the interdecadal variability of the STC is caused by changes in winds near equator. Sensitivity studies also indicate that the mean STC intensity depends on effective ocean optical properties, including the effect of solar radiation absorption and local heating by the chlorophyll concentration. When an effective attenuation depth decreases, the mean STC strengthens as a result of dynamical response to a reduced mixed layer depth.