Black carbon (BC) aerosol is the strongest light-absorbing matter of the all aerosols and its accurate simulation is required to properly predict aerosol radiative effects and climate change. The formation process of the BC mixture, that is BC aging process, includes condensation by gases and coagulation of particles. A treatment of these processes in aerosol climate models increases a computational burden, and therefore it is better for these models to use a parameterization of the atmospheric BC aging processes. Although previous studies used a very simple one, in this study we implemented a more physical-based parameterization, which is a function of the following three parameters: BC and total aerosol numbers and condensed H2SO4, into a global aerosol model, SPRINTARS. As a result, this new-type parameterization gave us more realistic results of aged BC mass distribution compared to those obtained by the original SPRINTARS. For example, pure BC particles tend to exist near its sources and fractions of aged BC to pure BC particles increase as a distance from its sources increase. The fractions are estimated to be about 75% near aerosol source regions and more than 90% over outflow regions with a large variability associated with sulfuric acid formed from SO2 oxidation by OH radical. These contrasts of the fraction between source and outflow regions are consistent with the observations. In conclusion, BC aging process depending on BC and total aerosol numbers, and H2SO4 provides a better performance of the BC distribution.