The CSIRO Atmosphere Biosphere Land Exchange (CABLE), served as a community land-surface model, is used in the Australian Climate Community Climate Earth System Simulator (ACCESS). In this study, we focus on exploring the skill of this land model in simulating hydrological cycles at different temporal and spatial scales. At first, we force the model with three-hourly 10-yr meteorological forcing data from the Global Soil Wetness Project (GSWP) and compare the global terrestrial water budget and the composition of evapotranspiration in the model against the GSWP multi-model climatology (GSWP_mmc). At global scale, CABLE offers a very good agreement with GSWP_mmc in partitioning total annual precipitation into surface evapotranspiration and total runoff. Results are also compared favorably with observed evaporation and runoff data. It produced similar features of decomposing total evapotranspiration into bare soil evaporation, canopy interception and dry canopy transpirations as in GSWP_mmc. Then extensive sensitivity experiments are conducted to explore key parameters/processes governing the hydrological cycle in the model and how the model performs in simulating rainfall-runoff relationship against empirical Budyko equations at selected catchments and under different vegetation conditions. At interannual and decadal time scales, we have further conducted 50-yr model offline experiments using another set of six-hourly global forcing data and assessed the model-simulated trends in runoff and evapotranspiration against some observed results over selected regions, including factors contributing to the rapid runoff decline in southwest of Western Australia.