Variation trends of observed evaporation capacity were detected and its key influencing meteorological factors, which result in new changes in evaporation capacity, were identified for different climatic zones in China. Linear regression method and Mann-Kendall method were used to detect the variation trends of E601 pan evaporation over China from 1960~2006. The results show that during the last 50 years, temperature has presented significant increasing trend while E601 pan evaporation presents decreasing trend for most climatic zones of China before the mid-1990s, especially in humid areas, or summer temperature, but after the mid-1990s, pan evaporation has presented insignificant increasing trends for some regions. The physical mechanism of changes in evaporation capacity and the causes of new changing characters were preliminarily analyzed based on the comprehensively considering thermal conditions and dynamic conditions and changing trends of the main influencing factors. The results show that daily temperature range, sunshine duration and average wind speed had well correlation with E601 pan evaporation, and the significantly decreasing trends of these influential factors were the main reason of E601 pan evaporation decreasing before the mid-1990s, and the new variation characteristics of these meteorological factors together with continuously increasing trend of temperature, were the reasons for the new changes in evaporation capacity after the mid-1990s.