Diabatic heating is a fundamental energy source for all atmospheric motions and changes of state. The horizontal and vertical structure of the diabatic heating along with the tropical atmospheric circulations during the El Niño-Southern Oscillation (ENSO) events can exhibit the three-dimensional (3D) atmospheric structure of ENSO variability, therefore, can be used to study the biases of ENSO-related structure in the Coupled Model Intercomparison Project Phase 5 (CMIP5) models. In this study, residually diagnosed ENSO-related diabatic heating are intercompared in three recent reanalyses, the ERA-interim, the MERRA2 and the CFSR, in order to assess agreement and uncertainty in the horizontal distributions, the amplitudes and the vertical structures of diabatic heating and the associated atmospheric circulations. The CMIP5 models are separated into two groups based on the their performances in precipitation climatology and ENSO-related precipitation, and are compared with the reanalyses in these aforementioned aspects. The preliminary results suggest that the ENSO diabatic heating profiles of the ERA-interim, the MERRA2 and the CFSR are very similar, with the MERRA2 and the CFSR ones being stronger in the western Pacific and weaker in the central to eastern tropical Pacific than in the ERA-interim. Both CMIP5 groups exhibit more westward located maximum heating anomaly centers than in the reanalyses. The worse performing group has much weaker heating and circulations over the tropical Pacific than in the other datasets.