This study analyses the significance of the Nash-Sutcliffe efficiency (NSE) and proposes a new method to assess the performance of flood event models. We focus on the specific cases of events difficult to model and characterized by low NSE values, which we call “monsters”. The properties of the NSE were analysed as a function of the calculated hydrograph shape and of the benchmark reference model. The results show that a “monster” can be due solely to a simple lag translation or an homothetic ratio which reproduces the dynamic of the hydrograph, with acceptable errors on other criteria. In the opposite, good simulations characterized by a NSE close to 1 can become “monsters” if the average observed discharge used as a benchmark reference model in the NSE is modified. Finally, a multi-criteria analysis method to assess the model performance on each event is proposed and applied on the Gardon d’Anduze catchment.