GOCE (Gravity field and steady-state Ocean Circulation Explorer) mission is based on the sensor concepts of high-low satellite-to-satellite tracking (SST) and satellite gravity gradiometry (SGG). The SST data from GPS receiver contains the long wavelengths of gravity field, whereas the SGG data from gradiometer provides more high-frequency information. In order to obtain an optimal GOCE gravity field solution, these two types of observations (SST and SGG) must be combined. The combination strategy is based on the method of least squares spectral combination, which assigns appropriate weights to SST and SGG data according to their spectrum and accuracy. Firstly, the spectrum property of various types of data (such as disturbing potential $T$ from SST, radial gravity gradients $T_r$ from SGG) related to the Earth’s gravity field are discussed. Secondly, the accuracy of harmonic coefficients computed from these data is estimated based on spherical harmonic analysis. It is revealed that the errors of geopotential coefficients derived from $T$ are independent to degree $n$, while those from $T_r$ are inversely proportional to $(n+1)(n+2)$. Thirdly, the spectral weight formulae are derived for determining the geopotential coefficients by combination of $T$ and $T_r$ from GOCE orbital plane. In order to verify the effectiveness and numerical accuracy of the spectral combination method, the computations are done in a closed-loop simulation for GOCE gravity field recovery. The results show that the combined solution from SST and SGG data has an obvious improvement in mid and low degrees compared with the solution from SGG data only.