The global height datum problem, namely the determination of biases of different height systems referred to different origins (i.e., to different equipotential surfaces), is typically reduced to a least squares systems where GPS derived ellipsoidal heights are compared with orthometric heights and geoid undulations derived from suitable global models. Recent achievements of the GOCE mission allow to consider combined global models affected by an irrelevant bias. Nevertheless, the quantities used as observations, i.e., both the GPS ellipsoidal heights and the geoid undulations derived from a model, clearly have a quite pronounced covariance structure. Its influence on the achievable accuracy is studied by means of simulated examples.