In glaciated areas, the Earth is responding to the ongoing changes of the ice sheets, a response known as glacial isostatic adjustment (GIA). GIA can be investigated through observations of gravity change. For the ongoing assessment of the ice sheets mass balance, where satellite data are used, the study of GIA is important since it acts as an error source. GIA consists of three signals as seen by a gravimeter on the surface of the Earth. These signals are investigated in this study. The ICE-5G ice history and recently developed ice models of present day changes are used to model the gravity change in Greenland. The result is compared with the initial measurements of absolute gravity (AG) change at selected Greenland Network (GNET) sites. We find that observations are highly influenced by the direct attraction from the ice and ocean. This is especially evident in the measurements conducted at the GNET station near the Helheim Glacier. The effect of the direct attraction diminishes at sites that are more than one degree from the source. Here, the dominant signal is the effect of the elastic signal from present day ice mass changes. We find agreement between the measured and modelled gravity changes at all but one site. This agreement only holds when the direct attraction is considered. For one site, there is no agreement, indicating that some improvements to the modelling results or the processing of the gravity data are needed. In addition, more AG measurements are needed to strengthen the time series of gravity change.