Correcting airborne gravity data for anomalous effects created from variations in overburden thickness: A case study from the prospective Nechako interior plateau, British Columbia

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Large areas of bedrock in Canada, such as in the interior plateau of British Columbia, are covered by a thick glacial overburden. Lateral variations in overburden thickness can create spurious anomalies in gravity data. These anomalies can be of a similar size and amplitude as that of a mineral body and can be mistaken for a prospective target. A new methodology is introduced that corrects airborne gravity data for changes in overburden thickness through the inversion and interpretation of helicopter transient electromagnetic (HTEM) data. The approach is tested for a 61 x 39 km^2 area from the Quest-West survey in the Nechako interior plateau of British Columbia, Canada. Aerotem III HTEM survey data are inverted using 4- and 5-layer earth models, allowing the overburden-bedrock contact to be mapped in detail. Overburden thickness within the study site was found to range in thickness from 0-265 m with an average of 36 m. The resulting bedrock topography map is then employed to correct airborne gravity data for changes in overburden thickness. The correction methodology is based on Bullard corrections with an additional correction for the gravitational acceleration contribution of the overburden. The overburden and bedrock were modelled as separate layers and assigned constant densities of 1.80 and 2.65 g/cm^3, respectively. The results show that for the examples investigated, the airborne gravity data are insensitive to changes in overburden thickness less than 30 m due to the presence of GPS noise in airborne gravity data, and that overburden thickness variations greater than 100 m (~3 mGal) may contribute to interpretation errors on a Bouguer anomaly map. The methodology has the additional effect of enhancing the intensity of gravity data over conductive anomalies on a Bouguer anomaly map. This effect is a result of the tendency of layered earth models to overestimate overburden thickness over conductive anomalies hosted within the bedrock.