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Some practical applications of the horizontal gradients Txz and Tyz of the gravitational field

G. Strykowski

DTU Space, Dept. of Geodynamics, Copenhagen, Denmark (gs@space.dtu.dk, +45 35 36 24 75)

In practical compilation of the gravity maps for geodetic- or geophysical purposes we argue that the horizontal gradients Txz and Tyz are valuable transformations of the measured gravitational field. One reason is that such transformation can reveal inconsistencies in the collected gravity data which are not easily detectable in the gravity anomalies. For marine areas where the depth to the sea bottom is known, these inconsistencies can sometimes be uniquely diagnosed as intra-survey inconsistencies between the marine data from different sources. Subsequently, this unique diagnose can be used to clean up a given set of gravity data prior to compilation of the gravity maps.

Another possible application of the horizontal gradients is that the relative contribution to the measured surface signal from sources located in different depths is different in Tz as compared to Txz and Tyz. This can be used to separate the contribution generated from larger depths (e.g. the isostatic compensation) from the gravitational signal generated by shallower sources of known geometry (bathymetry and sediment thicknesses). We will demonstrate these ideas in a geological stripping method based on Nettleton's method, i.e. a method of decoupling the known source geometry from source strength (the mass density anomaly) for a study area around the Faroe Islands.

The results were used to support a potential claim by the Danish Government on behalf of the Faroe Islands, under the UNCLOS Article 76, for extended jurisdiction. In the example we will compare to the independent data set created from a DNSC08 model – gravity anomalies from satellite altimetry – which was used as a fill-in data set in the latest global Earth's gravity model EGM08.