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Alaska/Yukon Geoid Improvement by a Data-Driven Stokes's Kernel Modification Approach

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Geoid modeling over Alaska of USA and Yukon Canada being a trans-national issue faces a great challenge primarily due to the inhomogeneous surface gravity data (Saleh et al, 2013) and the dynamic geology (Freymueller et al, 2008) as well as its complex geological rheology. Previous study (Roman and Li 2014) used updated satellite models (Bruinsma et al 2013) and newly acquired aerogravity data from the GRAV-D project (Smith 2007) to capture the gravity field changes in the targeting areas primarily in the middle-to-long wavelength. In CONUS, the geoid model was largely improved. However, the precision of the resulted geoid model in Alaska was still in the decimeter level, 19cm at the 32 tide bench marks and 24cm on the 202 GPS/Leveling bench marks that gives a total of 23.8cm at all of these calibrated surface control points, where the datum bias was removed. Conventional kernel modification methods in this area (Li and Wang 2011) had limited effects on improving the precision of the geoid models. To compensate the geoid miss fits, a new Stokes's kernel modification method based on a data-driven technique is presented in this study. First, the method was tested on simulated data sets (Fig. 1), where the geoid errors have been reduced by 2 orders of magnitude (Fig 2). For the real data sets, some iteration steps are required to overcome the rank deficiency problem caused by the limited control data that are irregularly distributed in the target area. For instance, after 3 iterations, the standard deviation dropped about 2.7cm (Fig 3). Modification at other critical degrees can further minimize the geoid model miss fits caused either by the gravity error or the remaining datum error in the control points.