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Mapping Moho Undulations Using Marine Gravity Data Based on Upper Mantle Density Modelling: Case Study on Atlantic

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Moho undulations are related to crustal thickness, isostatic state, sea-bottom topography in oceanic regions. Seismic profiles are with limited coverage even though they could provide precise crustal structure. Moho as a density contrast interface, could be imaged by gravity inversion; and the advantages for marine gravity data is with high coverage and improved resolution. For isolating gravity anomaly induced by Moho undulations, we used three different methods for upper mantle density modelling. Constant mantle density results in opposite Moho variation phase comparing with CRUST1.0 model along the mid-ocean ridge in the Atlantic Ocean. This Moho inversion result is with 4.8 km root mean square (RMS) with Moho depth from CRUST1.0 model. For improving this situation, we used velocity-density conversion method and temperature-pressure based method to model upper mantle density respectively, three different scaling ratios and also different thermal expansion coefficient models are inputted for each method. On the whole, temperature-pressure based method is more effective for improving Moho inversion accuracy. The result based on this method with most suitable parameters is with 3.3 km RMS with CRUST1.0 model. The comparison between this inversion result with CRUST1.0 model shows that temperature-pressure based method could reproduce Moho geometries in the main part of the Atlantic Ocean, especially in the region close to the mid-ocean ridge. But in the regions with low-velocity and low-density mantle also away from the ridge, the velocity-based method could provide more accurate inversion result than temperature-pressure based method, because age grid could not reflect these mantle density perturbations but the shear-wave velocity could.
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