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Moho Depth of The South China Sea Basin from Three-dimensional gravity inversion with control points and its characteristic

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We calculate the gravity anomaly due to lateral changes in bathymetry from an independent topography compilation, and the gravity anomaly due to changes in sediment thickness and density. They are subtracted from the free air gravity anomaly to obtain the initial mantle residual anomaly. We typically use the wavenumber domain method described by Oldenburg (1974) to calculate the topography of the Moho surface from the mantle residual gravity anomaly, and estimate the lithosphere thinning factor from the crustal thickness prediction. We then calculate the temperature field (McKenzie, 1978) and the initial lithosphere thermal gravity anomaly, which we subtract from the mantle residual gravity anomaly. The inversion is subsequently a recursive cycle of inverting for Moho depth, calculating the lithosphere thermal gravity anomaly and updating the mantle residual gravity anomaly until convergence is achieved (Figure 1).

Figure 1: The gravity inversion workflow for determining Moho depth incorporating an iterative solution for the lithosphere thermal gravity anomaly

We have obtained the Moho depth of the South China Sea basin using gravity data with the 191 control points from seismic data and sonobuoys (Figure 2). To obtain the residual mantle Bouguer anomaly (RMBA), we deducted the anomaly from lateral changes in bathymetry or topography, the gravity anomaly due to changes in sediment thickness and density from the free air anomaly firstly, and then corrected the lithosphere thermal gravity anomaly from the rifted margin to the spread ridge. According to the relationship between the control points and RMBA, we calculated the initial Moho depth, from which, we done an iterative cycle of gravity inversion to predict the final Moho depth and crustal thickness. To calculate the lithosphere thermal gravity anomaly, we defined a critical thinning factor for the initiation of oceanic crust production, and a maximum oceanic crustal thickness; for this study area, values of 0.5 and 9 km were used respectively (Chappell et al. 2008), consistent with the Moho depth of 20km and 14km respectively, with the initial thickness of continental crust of 32km (Figure 3)(Braitenberg et al. 2008).

We calculate the gravity anomaly due to lateral changes in bathymetry from an independent topography compilation, and the gravity anomaly due to changes in sediment thickness and density. To obtain the Moho depth and the crustal thickness of the South China Sea basinthe 3-D gravity inversion method is employed, which is based on "initial model of fluctuated interface" from the control points from seismic data and sonobuoys. And then, the gravity data is corrected by the lithosphere thermal gravity anomaly within continental margin thinning lithosphere. Over most of the South China Sea basin, the Moho depth ranges between 8∼14km, the crustal thickness is 3∼9km. The NNE trending fossil spreading center of the East and the Southwest Subbasins extend to 112˚E, the Moho depth is more than 12km, the crustal thickness is above 6km in the spreading center. However, The Moho depth of the spreading center at the northwest basin is not obvious thickening. In the northern margin of the southwest basin, south of zhongsha block, there is a crustal thinning belt, near EW trending, crustal thickness is about 9∼10km. The 14km isoline of the Moho depth and the 9km isoline of the crustal thickness are very close to the Continent-Ocean BoundaryCOB, respectively.