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首都圈上地壳高精度三维P波速度模型——基于石油地震叠加速度和人工地震测深剖面

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High precision 3D P-wave velocity model of the upper crust under the Chinese capital region based on oil seismic stack velocity and deep seismic sounding

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摘要

本文收集了首都圈地区40个测点的石油地震叠加速度资料,经常规处理后得到各测点下方速度随深度变化的曲线;对9条人工地震测深剖面的解释结果进行数字化处理获得各剖面下方离散的速度数据;应用上述资料和专业地质建模软件构建了首都圈地区(115.50° E—117.60° E,38.40° N—40.75° N)范围内上地壳高精度三维P波速度模型.结果表明:华北盆地为隆坳相间区,从东至西依次是黄骅坳陷、沧县隆起和冀中坳陷,上地壳速度结构十分复杂;结晶基底的埋深变化剧烈,冀中坳陷下最深处可达10 km,沿构造走向整体呈西南深、东北浅的趋势,沧县隆起下埋深约2～4 km,黄骅坳陷下最深处则达9 km,剧烈的基底起伏反映出盆地内部不同次级构造单元的差异沉降和中、新生代以来强烈的拉张构造运动.太行山、燕山隆起下的基底埋深较盆地区浅,体现出隆起区新生代以来的抬升构造运动.本文首次将石油地震叠加速度资料用于首都圈地壳速度模型的构建,与以往用人工地震测深资料得到的模型相比,本文结果对华北盆地复杂的上地壳结构刻画得更为细致.

关键词 首都圈, 石油地震叠加速度, 人工地震测深, 上地壳速度结构, 结晶基底

Abstract:

We collected oil seismic stack velocities of 40 survey points in the Chinese capital region and processed them to obtain curves which reveal the variations of velocity depend on the depth at each point, digitized 9 profile results of Deep Seismic Sounding(DSS) to get discrete velocities under the each profile, built up high precision 3D P-wave velocity model of the upper crust under the Chinese capital region(115.50° E—117.6° E, 38.40° N—40.75° N) by using above data and geologic modeling software. The results show that the North China basin is an area with alternating uplifts and depressions, they are Huanghua depression, Cangxian uplift, Jizhong depression from east to west, and the upper crust velocity structures are quite complex. The depth of crystalline basement varies dramatically under the North China basin. Under the Jizhong depression, the depth of crystalline basement can reach to 10km at the deepest part, and it is deep in the southwest and sallow in the northeast along the structural orientation as a whole. Under the Cangxian uplift, the depth of crystalline basement is about 2～4 km, and under the Huanghua depression, it can reach to 9 km at the deepest part. The great relief of basement indicates the difference of settlement of these three secondary tectonic units and the strong extension tectonic movement since Mesozoic and Cenozoic era. The crystalline basement is shallower under the Taihangshan uplift and Yanshan uplift than under the North China basin, which suggests the raising tectonic movement of uplift area since Cenozoic era. It is the first time to use oil seismic stack velocities on the establishment of the crust velocity model under the Chinese capital region in this study, comparing with models obtained from DSS profiles, our present model are better to reflect the complex upper crust structures under the North China basin.

Keywords Chinese capital region, Oil seismic stack velocity, Deep seismic sounding, Velocity structure of the

upper crust, Crystalline basement

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