Final Report

Gravity Estimation at Large African Data Gaps Employing Moho Depths

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Africa, the second largest world's continent, suffers from lack of gravity data reaching in some cases large data gaps. This represents the main challenge facing most of the geodetic and geophysical applications in the continent.

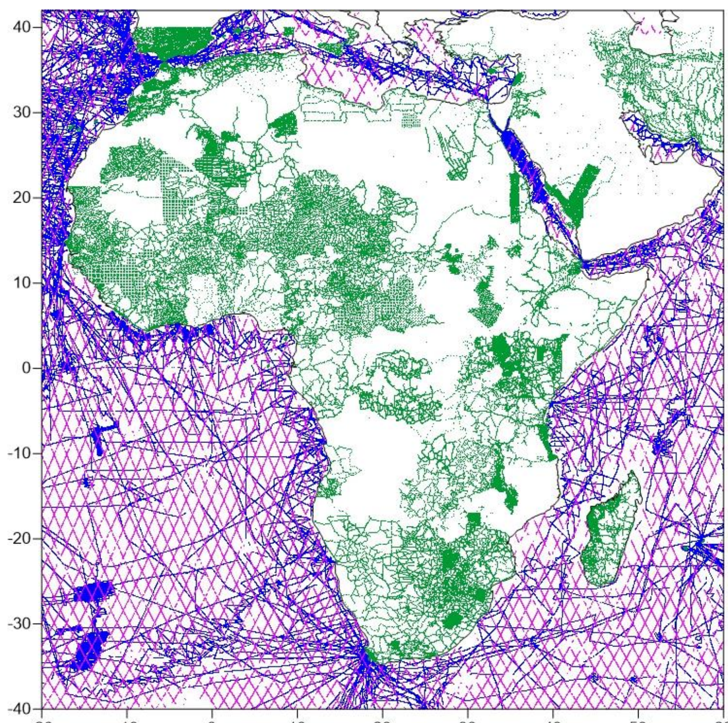

Fig. 1: Distribution of the gravity data for Africa.

Figure 1 shows the irregular gravity data distribution with very large gaps, especially on land, which is extremely challenging. The total number of gravity data stations on land is about 130,000 stations and on sea is about 1.3 million.

As simple interpolation of the existing gravity data does not add new information at the large data gaps, the current research proposal implements the usage of the Moho models in order to better estimate the gravity values at the African large data gaps, which serves for various geodetic/geophysical applications. Moho models are now exist, where a combination between seismic, gravity and satellite data takes place. The following Moho models were used in the current research:

- Čadek and Martinec
- GEMMA
- CRUST 1.0
- MOHV21

A Moho model for Africa has been created using the above four models as data implementing the least-squares interpolation technique with trend remove-restore approach and covariance function fitting. Figure 2 shows the created Moho model for Africa. The Moho depths for Africa range between 6.8 km and 73.4 km with an average of 24.2 km and a standard deviation of about 11.5 km.

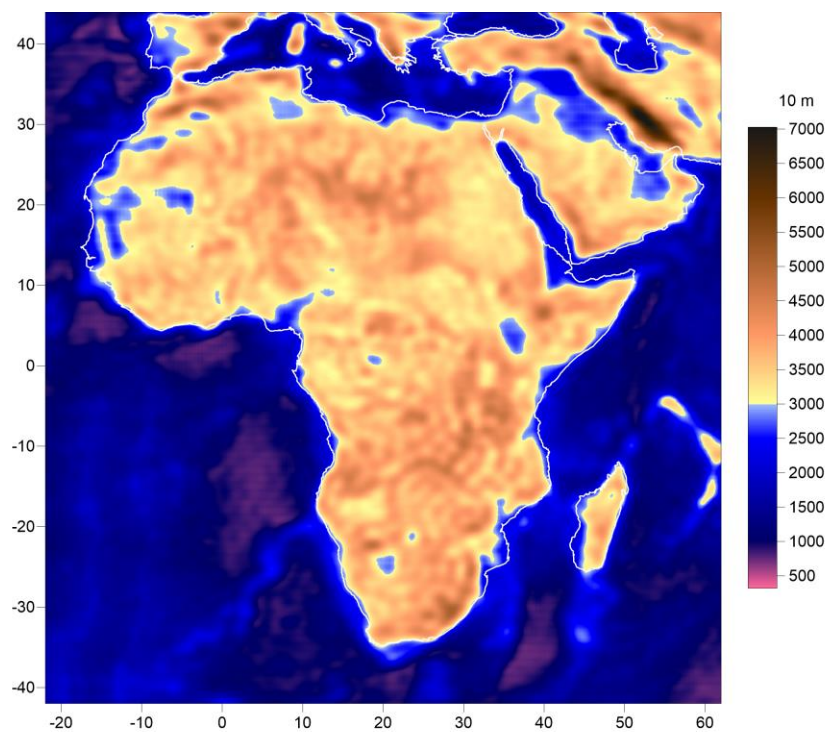

Fig. 2: The created Moho model for Africa.

The window remove-restore technique has been used. The implementation of the Moho depths took place at three different cases; they are:

1. Assuming constant density contrast between the lower crust and the upper mantle,
2. Assuming a variable density contrast between the lower crust and the upper mantle. The variable density contrast has been computed by applying the mass balance principle between the topography and the Moho depths.
3. Using the plate loading theory to generate Moho depths simulating the available Moho models.

Best results were found when assuming constant density contrast between the lower crust and the upper mantle. Comparable results were obtained when assuming a variable density contrast between the lower crust and the upper mantle computed by applying the mass balance principle.

Further cooperation with the host professor, Prof. Dr. Hansjörg Kutterer, and his institute is planned at different scales. One of which is that we are going to apply for a Material Resources Grant funded by DAAD. Another one is that we are going to submit a joint project proposal supported by the DFG.

Finally, I would like to express my thanks to the KIT for supporting this research project. I wish also to thank Prof. Dr. Hansjörg Kutterer and his co-workers, in particular Dr. Kurt Seitz and Dr. Thomas Grombein, for their cooperation and the friendly atmosphere I have had during my stay in Karlsruhe.