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A new analytical solution for estimating flexural rigidity and application to the Andes

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The classical concept of regional isostasy after Vening-Meinesz proposes that the flexural strength of the lithosphere has to be taken into account for isostatic consideration. The resulting flexure of a thin plate can be described by 4^{th} order differential equation. In the past the problem has been dealt with in the field of frequency space, where the equation was solved with Fourier transformation techniques (e.g. coherence and admittance). However, the spectral approach has some drawbacks, making the results disputable. First, it involves an averaging process; therefore in case of a varying rigidity in space, the variation may be retrieved only to a limited extent. Second, a spatial analyzing window with a large side length ($375km$) is required. Accordingly, only one value of flexural rigidity can be calculated for an area, which has the required side length. Another problem is that the method becomes unstable in areas of low topography.

Some disadvantages of the spectral methods were overcome by a convolution approach. However, this method requires determining a radius of convolution in order to calculate the distribution of the flexural rigidity

We present a new analytical solution for the computation of the flexural rigidity overcoming some of the mentioned disadvantages of the other methods. The new analytical solution allows solving the 4^{th} order differential equation for any irregular shaped topography. We apply the method to the Central (15-33˚S) and Southern Andes (36-42˚S) continental lithosphere. Information from existing three-dimensional density

models provide constrains about the reference depth and the geometry of the crust mantel interface: two important input parameters for the calculation process of the flexural rigidity distribution. Using this information allows the calculation of flexural rigidity with a higher space resolution than any other spectral method. The results of the spatial rigidity variation are characterized by a good correlation with the location of tectonically units and fault systems.