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Comparison of genetic algorithm and descend direction algorithm for SST data

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The gravity field of the Earth can be described in two steps to improve the spatial resolution. The global behavior is usually modeled by spherical harmonics with known coefficients and the residual part is analyzed by a second system of localizing base functions.

In this study, the SST data of the GRACE mission are reduced by a reference field and analyzed by radial base functions. The value of each radial base functions depends on the distance to the base center, a scale factor and a shape parameter. To avoid overparameterization, the number of base functions will be minimized and the parameters are determined from the residual signal. This leads to a nonlinear problem for the shape and the position, while the shape is highly correlated with the scale factor.

In general, nonlinear problems can be solved by a global or a local method. In the local method the initial positions are determined by image processing and the scale factors are achieved by a linear adjustment. The values are improved in a descend direction of the squared sum of the residuals.

The genetic algorithm is as global method, which generates a population of possible solutions. Each solution contains all parameters and they are recombined according to biological rules like mutation or combination of two previous ones. Again the squared sum of the residuals can be used as fitness criteria to stop the iterative process.

This contribution aims at a comparison of the local and the global optimization for a simulated signal with respect to the remaining residuals and the performance of the algorithms. Furthermore, the genetic algorithm is used to generate the initial values for the local optimization, to combine the advantages of both methods.