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Study on parameter choice methods for the RFMP with respect to downward continuation

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The Regularized Functional Matching Pursuit (RFMP) is a greedy algorithm for linear ill-posed inverse problems. The idea is to expand the signal with the help of trial functions. These functions are picked up from a large set of functions (called dictionary), where arbitrary ansatz functions can be combined, e.g. global and local functions. Furthermore, it is possible to handle large sets of data points or scattered data, because there is no need to solve a system of equations or do any integration. Up to now the algorithm has been used especially for modelling and inversion of the gravitational potential.
This algorithm incorporates the Tikhonov-Phillips regularization which implies the necessity of a parameter choice. We present some known parameter choice methods and evaluate them with respect to their performance in the RFMP. Furthermore, we discuss these methods with regard to an enhancement of this algorithm, the regularized orthogonal functional matching pursuit (ROFMP).
As an example of a linear inverse problem, the downward continuation of gravitational field data from the satellite orbit to the Earth's surface is chosen, because it is exponentially ill-posed. For the test scenarios, we combine different satellite heights with several noise-to-signal ratios, kinds of noise and data grids. The performances of the parameter choice strategies in these scenarios are analyzed to obtain a first orientation which methods could be most appropriate for the RFMP and ROFMP.