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*Parameter Choices for Fast Multipole Accelerated Spline Approximation.*

The Runge-Walsh approximation allows the construction of the solution of boundary value problems in geoscience in terms of harmonic splines. Moreover, due to their localizing properties regional modeling or the improvement of a global model is possible. Fast multipole methods have been developed for some cases of the occurring kernels to obtain a fast matrix-vector multiplication with linear numerical effort. The application of the fast multipole method to approximating splines that also allow the treatment of noisy data requires the choice of a smoothing parameter. We investigate different methods to (ideally automatically) choose this parameter with and without prior knowledge of the noise level. Thereby, the performance of these methods is considered for white as well as colored noise. It should be pointed out that due to the localizing nature of the splines this can be seen as local regularization. Applications to gravitational field modeling and spherical denoising are presented as well as the extension to boundary value problems where the boundary is the known surface of the Earth itself. (Received September 11, 2014)