Multiscale Analysis of Regional and Temporal Variations in the Earth's Gravitational Potential

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The satellite mission GRACE provides monthly models of the Earth's gravitational potential in terms of spherical Fourier coefficients, which allows to analyse temporal variations. Since they mainly occur locally, spherical scaling functions and wavelets, which can be written as a series in Legendre polynomials, form an appropriate tool for a detailed analysis. We can define a multiresolution analysis by means of these radial basis functions. The convolution with a scaling function Φ_j of scale $j \in \mathbb{N}_0$ yields the j-scale approximation of the potential. The detail information, which is added from one scale to the next, can be computed by convolution with a spherical wavelet Ψ_j and is of special interest. It turns out that the temporal variations in the gravitational potential can be well observed in the detail spaces of certain scales. The analysis of the wavelet coefficients, which in contrast to the Fourier coefficients are space dependent, shows a seasonal trend of the gravitational potential in great river basins like the Amazon rivershed. Since terrestrial water variations are the largest unmodeled phenomena in the GRACE potentials, we compare them to hydrology models. Our numerical results indicate a strong correlation between the time-dependent effects of the GRACE signal and the hydrology models.

[1] Fengler, Martin J.; Freeden, Willi; Kohlhaas, Annika; Michel, Volker; Peters, Thomas: *Wavelet Modelling of Regional and Temporal Variations of the Earth´s Gravitational Potential*, Schriften zur Funktionalanalysis und Geomathematik (preprint, submitted to Journal of Geodesy)
[2] Kohlhaas, Annika: *Multiscale Modelling of Temporal and Spatial Variations in the Earth's Gravity Potential Observed by GRACE*, Diploma Thesis (in preparation)

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