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studies on the potential of using a combined wavelet-torus algorithm for global gravity field analysis

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The main objective of this research is to evaluate the use of multiresolution analysis power of wavelets in the decomposition of the global geopotential models into different spatial resolutions for pattern recognition, which can help in the investigation of different geophysical phenomenon. This technique is faster than the traditional spherical wavelets because it requires one interpolation step for all levels of decomposition, while the traditional spherical wavelets requires a new grid (interpolation) per each level of decomposition. The wavelet-torus based techniques local properties helps in overcoming one of the limitations of the spherical harmonic base functions, which is being only globally supported. The main problem for using the first generation wavelet transform for global applications is that it requires an equi-distance grid. To overcome this problem, the new combined computational scheme using the first generation wavelet transform and the torus-based representation is introduced. The space-borne gravimetry observations can be projected naturally on a torus using the two orbital coordinates (the argument of latitude and the right ascension of ascending node). The projection on the torus with a regular grid allows the use of two-dimensional first generation wavelets for global gravity field analysis. The torus-based gravity data are approximated in finite multiresolution analysis subspaces. Each subspace represents a level of wavelet detail coefficients or approximation coefficients. Different numbers of decompositions (subspaces) and wavelet base functions are tested. Numerical examples are given to illustrate the potential use of the combined wavelet-torus algorithm for the analysis of global gravity data. Conclusions and recommendations are given

with respect to the suitability, accuracy, and efficiency of this method.