Regional Analysis of Tensor Fields on the Sphere by Slepian Functions

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For scalar and vectorial data on the sphere spatially concentrated and spectrally limited, or spatially limited and spectrally concentrated functions have proven to be a viable and versatile tool. These functions are called Slepian functions. They have been applied in a variety of fields including geodesy, planetary magnetism, cosmology, and biomedical imaging. Their concentration within a chosen region on the planet allows for local inversions, when only regional data are available or are of desired quality, or they enable us to extract regional information. We focus on the analysis of tensorial fields, as they occur e.g. for the GRACE mission, by means of Slepian functions. Furthermore, we present a method for an efficient construction of tensor Slepian functions for symmetric regions such as spherical caps. In this context we are able to construct a localized basis on the spherical cap for the cosmic microwave background (CMB) polarization. Here, we also can separate the polarization into an electric and a magnetic component.