



Tensor Slepian Functions on the Spherical Cap for the Analysis of CMB Polarization

Katrin Seibert (1), Alain Plattner (2), Frederik J. Simons (3), and Volker Michel (1)

(1) University of Siegen, Geomathematics Group, Mathematics, Siegen, Germany, (2) California State University Fresno, Department of Earth and Environmental Sciences, Fresno, USA, (3) Princeton University, Department of Geosciences, Princeton, USA

Slepian functions are spatially concentrated and spectrally limited, or spatially limited and spectrally concentrated functions. For scalar and vectorial data on the sphere they have proven to be a viable and versatile tool. 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 GOCE mission, by means of Slepian functions. For tensorial data, Slepian functions have already been constructed by Eshagh (2009) in the basis of the tensor spherical harmonics of Martinec (2003). We designed an alternative construction with numerical advantages by use of the spin-weighted spherical harmonics of Newman and Penrose (1966).

Furthermore, we present a method for an efficient construction of these 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. As an additional feature, this enables us to separate the polarization into an electric and a magnetic component.