We investigate the performance of various methods to extract a low-resolution part of a signal from data given on a region of the sphere. A well-known example is the calculation of the ocean’s mean dynamic topography (MDT) from a high-resolution mean sea surface (MSS) and a low-resolution gravimetric geoid. Whereas the MSS is given along the groundtracks of radar altimeter satellites with typical point distances of a few kilometres, the geoid is most naturally expressed in terms of spherical harmonics complete to some maximum degree, which comprises spatial scales much coarser than represented by the MSS data. Hence, before the MDT is calculated as the difference between MSS and geoid, small scales missing from the geoid must be removed from the MSS data. Standard low-pass filter techniques suffer from the fact that the MSS is only defined over the oceans leaving artifacts along the land-sea boundaries far exceeding the accuracy of both data sets. Here, we investigate the use of spherical Slepian functions and compare them with alternative techniques proposed in literature such as the iterated spherical harmonic approach and a direct least-squares fitting of truncated spherical harmonic expansions. We show that Slepian functions do not provide consistency between MSS and geoid and explain why. We also show that a Gram-Schmidt orthogonalization of spherical harmonics over the oceans provides the correct solution to the problem. However, the numerical instabilities do not allow to construct an orthonormal basis over the oceans with a spatial resolution comparable with the latest satellite-based geoid models.