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Empirical Mode Decomposition on the sphere with application to the spatial scales of Global surface temperature variations

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Empirical Mode Decomposition (EMD) is applied in two dimensions over the sphere to demonstrate its potential as a data-driven method of separating the different scales of spatial variability in a geophysical (climatological / meteorological) field. After a brief description of the basics of EMD in 1 and then 2 dimensions, the principles of its application on the sphere are explained, in particular via the use of a zonal equal area data partitioning. EMD is first applied to an artificial dataset, demonstrating its capability in extracting the different (known) scales embedded in the field. The decomposition is then applied to a global mean surface temperature data set, and we show qualitatively that it extracts successively larger spatial scales of temperature variations ranging from topographic influences to large-scale, solar radiation forcing. We suggest that EMD on the sphere can be used as a global data-adaptive filter, which will be useful in analyzing geophysical phenomena that arise as the result of forcings at multiple spatial scales.