Normalization of Power Spectral Density

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Abstract

The purpose of this vignette is to provide an overview of the normalization used by `rlpSpec` and compare it to other estimators.

Contents

1 Background

First load the package into the namespace:

```
> library(rlpSpec)
```

1.1 `stats::spectrum`

Included in the core distribution of R is `stats::spectrum`, which accesses `stats::spec.ar` or `stats::spec.pgram` for either parametric and non-parametric estimation, respectively. The user can optionally apply a single cosine taper, and/or a smoothing kernel. Our method is non-parametric; hence, we will compare to the latter.

```
> spec.pgram(X, pad=1, taper=0.2, detrend=FALSE, demean=FALSE, plot=FALSE)
```

However, the logical arguments `detrend` and `demean` to `psdcore` are passed to `spec.pgram`; they are, by default, both TRUE.

As a matter of bookkeeping, we must deal with the working environment accessed by `rlpSpec` functions. Specifically, we should ensure `psdcore` does not access any inappropriate information by setting `refresh=TRUE`. We can then re-calculate the multitaper PSD and the raw periodogram with `plotpsd=TRUE`. The results are shown in Figure 1.1.

1.2 `multitaper::spec.mtm`

1.3 `SDF::sapa`

```
> data(magsat)
> psdcore(magsat$clean, ntaper=10, refresh=TRUE, plotpsd=TRUE)
```

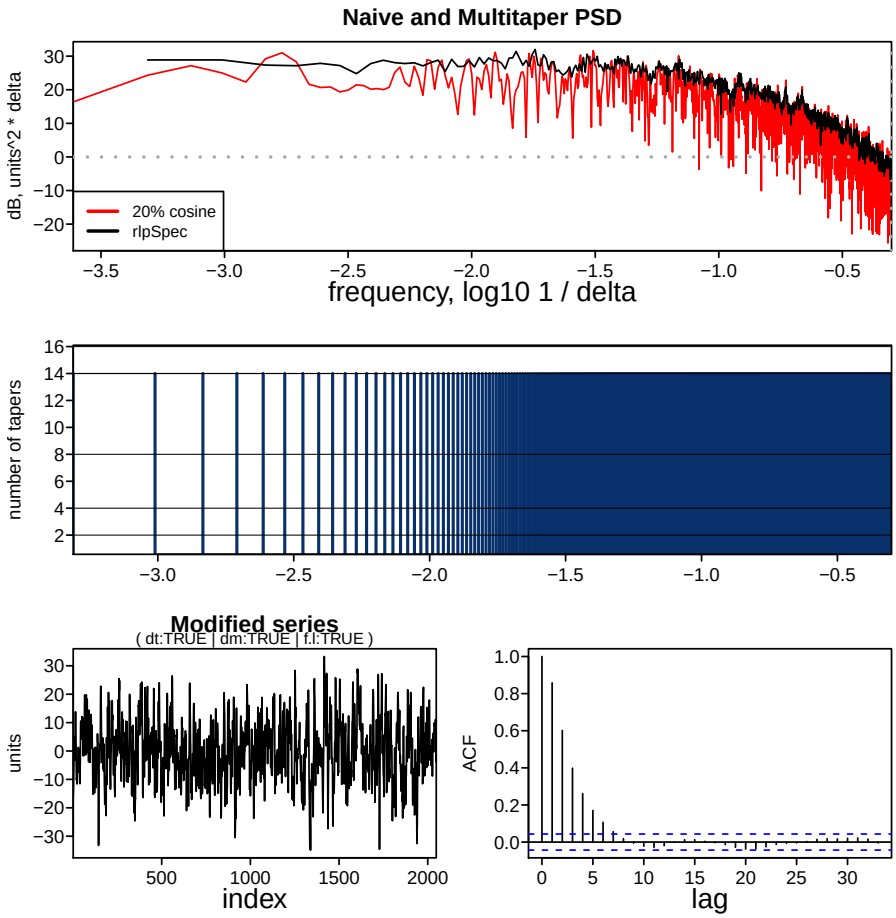

Figure 1: Top: Comparison between naïve and multitaper PSD estimators for the clean `MAGSAT` data. The frequency axis is in units of $\log_{10}$ km^{-1}, and power axis is in decibels. Bottom: The spatial series used to estimate the PSDs.