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Large-scale power loss in ground-based CMB maps

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ABSTRACT

1. INTRODUCTION

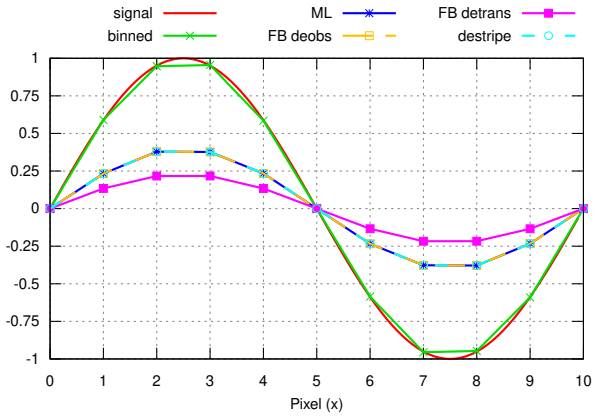

Figure 1. Demonstration of large loss of power in long-wavelength mode caused by the poor subpixel treatment in the standard nearest-neighbor pointing matrix. Figure **??** shows the noise model/inverse weights/inverse filter used in the various methods. **signal**: The input signal, a smooth long-wavelength mode, sampled at 10 samples per output pixel. **binned**: Simple binned map (the unweighted average per pixel). Very suboptimal in the presence of correlated noise, but unbiased. **ML**: Maximum-likelihood map. 2/3 of the signal is lost despite the naive expectation of biaslessness for this estimator. **FB deobs**: Filter+bin map debiased using an observation matrix. Identical to ML. **FB detrans**: Filter+bin map debiased by deconvolving a transfer function measured from simulations. Even more biased than the others due to ignoring mode coupling. **destripe**: Destriper in the limit of 1-sample baselines. Identical to ML.

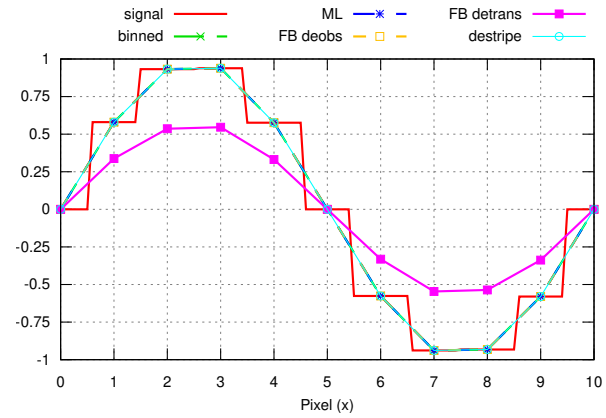

Figure 2. Like figure **??**, but with the input signal having the same nearest-neighbor pixelization as the models. In this case all models except FB detrans are unbiased.

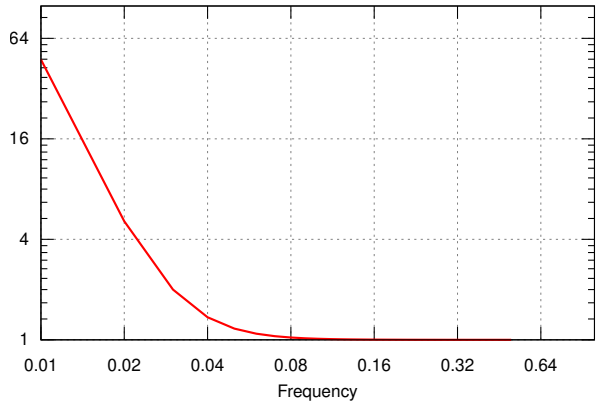

Figure 3. The noise model/inverse weights/inverse filter used in the subpixel bias demonstration in figures **??** and **??**. It is a simple Fourier-diagonal 1/f + white noise spectrum typical for ground-based CMB observations.

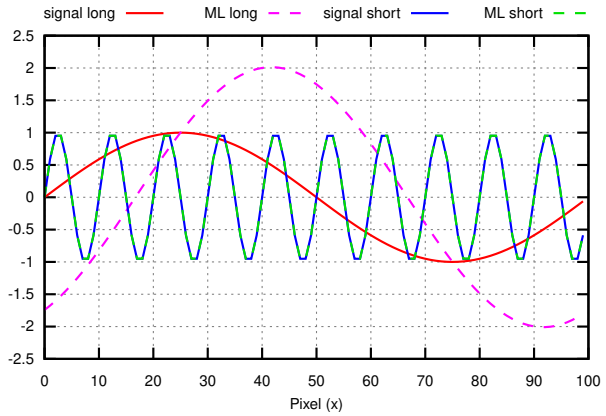

Figure 4. Demonstration of large-scale bias in a multi-detector system due to an interaction between strong large-scale detector correlations in the noise model and large relative gain errors between the detectors. **signal long**: An input long-wavelength signal, with the same pixelization as the output to avoid subpixel bias. **ML long**: Corresponding maximum-likelihood map, which exhibits both an amplitude and phase error. **signal short** and **ML short**: The same, but for a short-wavelength mode. Here the bias is negligible, despite the model's gain errors being scale-independent.