Complex-valued wavelet lifting and applications

C Supplementary Material: Filter choice

This document discusses the construction of the filters used in the complex lifting scheme. The proposed construction of prediction filters $\mathbf{L}$ and $\mathbf{M}$ involves the orthogonality requirement. While intuitively justified, in this section we provide an insight into this choice by considering the effect of increasing the dependence between the prediction filters.

Instead of the prediction filter $\mathbf{M}$ orthogonal on $\mathbf{L}$, we design a new prediction filter, denoted by $\mathbf{N}$ and constructed as $\mathbf{N} = d_f\mathbf{L} + \sqrt{1-d_f^2}\mathbf{M}$. Here d_f acts as a measure of dependence between the two filters $\mathbf{L}$ and $\mathbf{N}$. Note that when $d_f = 0$, $\mathbf{N} = \mathbf{M}$ and the filters $\mathbf{L}$ and $\mathbf{N}$ are orthogonal, while when $d_f = 1$, $\mathbf{N} = \mathbf{L}$ and the two prediction filters coincide.

The effects of varying the amount of dependence between the prediction filters have been explored in the context of phase and coherence estimation, and are demonstrated for the simulated dataset $\{(\underline{x}, \underline{f}^1, \underline{f}^2)\}$ from Section 3.3.1 in the main article. The estimates of coherence and phase for different choices of d_f are shown in Figure C.1. Note how with the increasing dependence in the prediction filters, the estimates of coherence and phase gradually become less pronounced and lose essential features. The filter orthogonality constraint thus ensures that the two prediction schemes represent different signal local information.

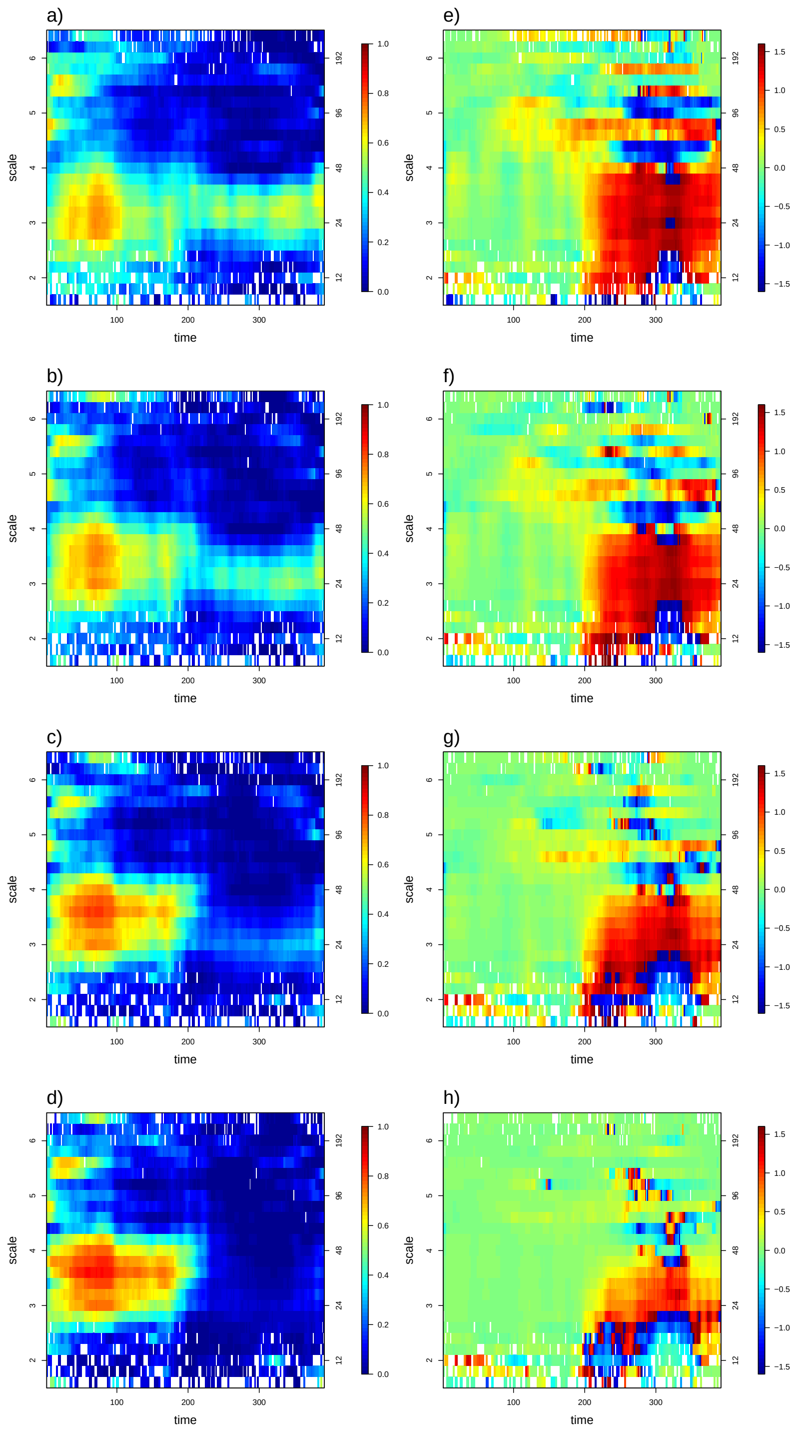

Figure C.1: Coherence and phase estimation corresponding to an increasing prediction filter dependence for simulated data $\{(\underline{x}, \underline{f}^1, \underline{f}^2)\}$ described in Section 3.3.1. Scale gets coarser from bottom upwards.