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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Toward the assimilation of images" *by* F.-X. Le Dimet et al.

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We thank the Referee #2 J. Ma for carefully reviewing our work and providing suggestions for improvements.

1 Comment

1.1 Comment from Referee

Eq. (26) can be defined as scale-dependent hard thresholding. The thresholding rules in 1 and 3 in the same page are actually the special cases of Eq. (26).

1.2 Author's response

We agree with the Referee. The rule in 1 is the special case of Eq. (26) where the threshold is set to the same value for all scales. The rule in 3 is the special case of Eq. (26) where the threshold is set to zero for the coarse scale and constant for all other scales.

1.3 Author's changes in manuscript

the paragraph 6.1.5 is changed to

6.1.5 Assimilation procedure

We consider the problem of recovering the initial state of the fluid $U(x,y) = X_0(x,y) = (u,v,h)(0,x,y)$ which constitutes our control variable. Only images are used as observations. We use image to structure operators based on pixels. Edge structures of images are extracted by applying a threshold operator on their curvelet coefficients. More precisely, let $c_{i,j,k}$ be the curvelet coefficients of the expression of a given function f in the frame of curvelets (23): we consider the scale-dependent hard thresholding operator τ as:

$$\tau(c_{j,l,k}) = \begin{cases} c_{j,l,k} & \text{if } |c_{j,l,k}| \geq \sigma_j, \\ 0 & \text{if } |c_{j,l,k}| < \sigma_j, \end{cases} \tag{25}$$

where σ_j is the threshold value for the scale values j. The σ_j are predefined and depend on the problem and on the data. We mention two particular cases:

NPGD

1, C603–C605, 2014

Interactive Comment

1. hard thresholding τ_h with the same threshold for all scales: $\sigma_j = \sigma$ for a given σ,

$$\tau_h(c_{j,l,k}) = \begin{cases} c_{j,l,k} & \text{if } |c_{j,l,k}| \geq \sigma, \\ 0 & \text{if } |c_{j,l,k}| < \sigma, \end{cases} \tag{26}$$

2. hard thresholding zeroing coarse scale coefficients τ_z; this is similar to the hard thresholding with the exception that the coefficient associated with each curvelet function of the coarsest scale is set to zero.

Curvelet thresholding for edge extraction can also be found in (Ma et al., 2006)

Interactive comment on Nonlin. Processes Geophys. Discuss., 1, 1381, 2014.