Attachment to the paper:

"Two-dimensional wavelet variance estimation with application to sea ice SAR images"

by

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Use of Matlab code

The described theory is mostly programmed in Matlab. The functions "myfilter.m" and "modwt.c" (slightly modified) originate from the "WaveCov" package by Whitcher (2002). Before first use, the c-function ("modwt.c") has to be compiled once in Matlab. Browse to the directory with the source code files and run "mex modwt.c" from the Matlab command window.

The main function "Image2wvar" takes as input a gray-scale image "im" (i.e., a matrix of numbers), the basic wavelet filter "wfilter" (possible choices: *'haar'* [default], *'d4'*, *'la8'* and *'la16'*), significance level "alpha" [default: "alpha" = *0.05*] needed for $(1-\alpha)$ CI calculations. With variable "mediancalc" (choices: *true*, *false* [default]) one decides on calculation of the median estimates additionally to the mean ones. Last but not least variable "plot_result" (choices: *true* [default], *false*) is responsible whether to display some plots of the results, and variable "filename" [default: 'wvar_image'] is set to the filename of the resulting ".mat"-file. The output contains matrices for all combinations of levels j, j' (see Table 1). If calculated, the names of the resulting matrices for the estimations based on the median correspond to the ones in Table 1, appended with "_median".

One of the sea ice images used in this paper is included as example ("seaice.gif") together with its correct wavelet variance estimation results ("seaice-result.mat") for the function call "*Image2wvar(im,'haar',0.05,true,true,'seaice-result')*". The computational time on a

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dual core Intel i5-2410M CPU @ 2.30GHz notebook with 4GB RAM running on Linux Ubuntu 12.04 (64-bit) with Matlab version 7.12.0 (R2011a) is 153 seconds for the entire calculations (mean and median) or 130 seconds if only the mean wavelet variance estimates and their CI are calculated. Note that the sea ice images are under copyright of the Canadian Space Agency (CSA) and any publication should credit this SAR data set described in Stern and Moritz (2002).

wwvar	wavelet-wavelet variance
swvar	scaling-wavelet variance
wsvar	wavelet-scaling variance
df_ww	degrees of freedom used for CI calculation (wavelet-wavelet)
CI_low_ww	lower CI (wavelet-wavelet)
CI_up_ww	upper CI (wavelet-wavelet)
df_sw	degrees of freedom used for CI calculation (scaling-wavelet)
CI_low_sw	lower CI (scaling-wavelet)
CI_up_sw	upper CI (scaling-wavelet)
df_ws	degrees of freedom used for CI calculation (wavelet-scaling)
CI_low_ws	lower CI (wavelet-scaling)
CI_up_ws	upper CI (wavelet-scaling)

Table 1: Matlab output variables (mean case)

References

Stern, H. L., Moritz, R. E., 2002. Sea ice kinematics and surface properties from RADARSAT synthetic aperture radar during the SHEBA drift. Journal of Geophysical Research 107 (8028).

Whitcher, B., 2002. Software from B. Whitcher. http://www2.imperial.ac.uk/~bwhitche/software/, [accessed November 16, 2012].