A NEW SCALLOPING FILTER ALGORITHM FOR ScanSAR IMAGES

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Due to its specific way of recording signals from multiple sub-swaths in an alternating manner, a ScanSAR (scanning synthetic aperture radar) does not permit a continuous sampling of Doppler histories [1][2]. This can cause an artifact in processed images known as scalloping – a wave-like modulation of the image intensity in azimuth direction throughout the entire image. Although the formation of scalloping patterns is theoretically understood and descalloping techniques for compensating the effect right in the SAR processor have been developed [3], some ScanSAR images are still showing pronounced scalloping patterns, which hampers their successful use for certain applications, such as the retrieval of two-dimensional wind fields and surface wave spectra from ocean scenes. To be able to work with such images, we have developed a descalloping algorithm that can be applied as a post-processing tool. The algorithm identifies the scalloping pattern in an image and eliminates it in an efficient way without changing other image properties, such as local mean intensities and noise statistics. This is done partly in the spatial domain and partly in the Fourier domain. So far it has been tested successfully with a number of ScanSAR images from RADARSAT-1 and ENVISAT. We explain how the algorithm works and show example results. To illustrate the importance of descalloping, we apply the directional wind field retrieval algorithm WiSAR [4] to unfiltered and filtered images. For the unfiltered images, WiSAR often interprets the scalloping pattern as wind-induced streaks and therefore comes up with wind directions close to the radar look direction and corresponding underestimated wind speeds. The results obtained after descalloping are much more realistic. The same applies to ocean wave spectrum retrievals from the ScanSAR images.

Fig. 1 shows an example of a large RADARSAT ScanSAR image and its mean image spectrum before and after applying the proposed filter algorithm. Note that the visible scalloping pattern and its signatures in the image spectrum disappear almost completely, while other features of the image are not affected by the filtering. This will be examined in more detail in the full paper and in the presentation.

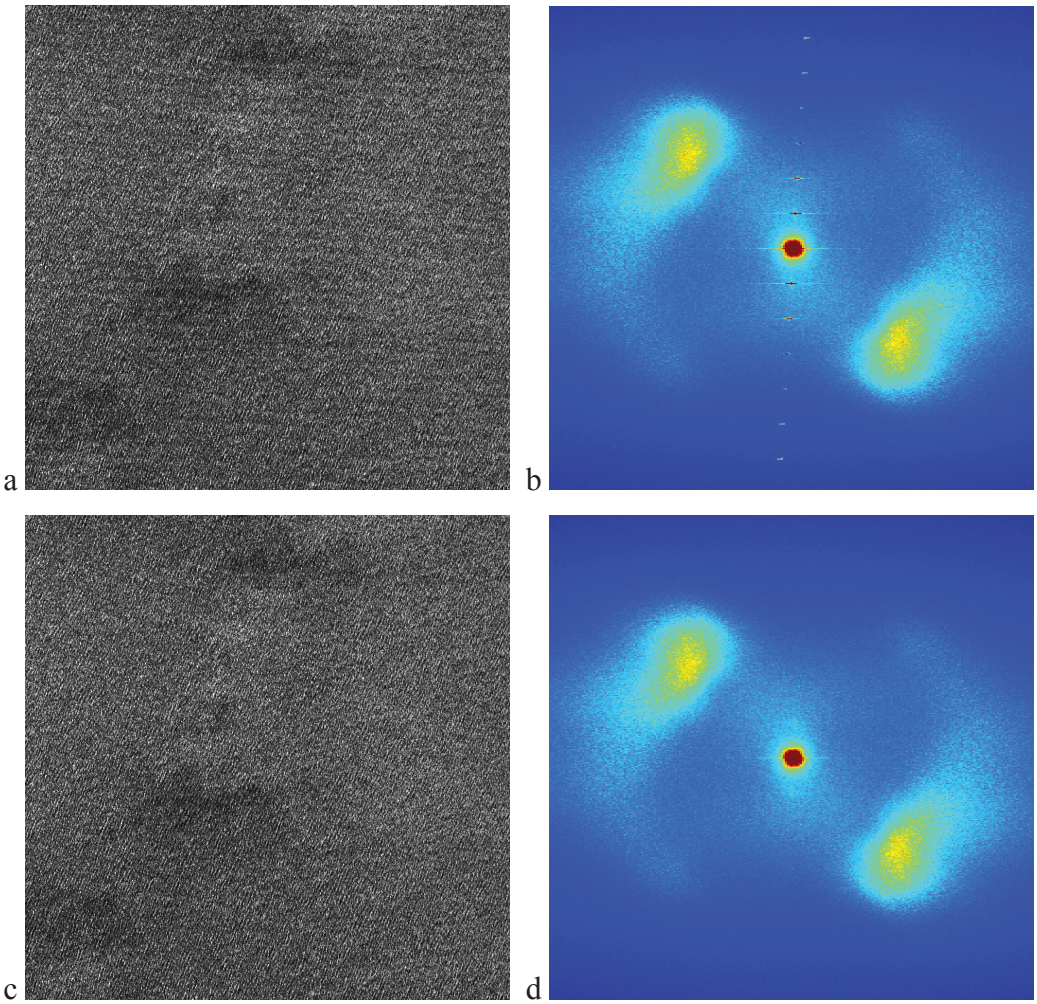

Fig. 1: Demonstration of the proposed filter: (a) subsection (50 km × 50 km) of a RADARSAT ScanSAR image with pronounced scalloping pattern, (b) central part of mean image spectrum, (c) subsection of image after filtering, (d) central part of mean image spectrum after filtering.

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