German Aerospace Center
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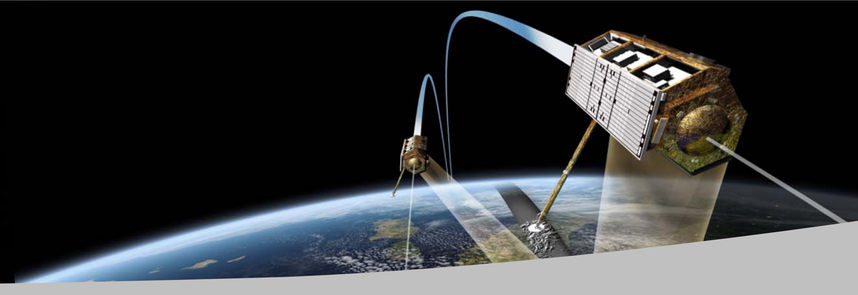
Microwaves and Radar Institute



Change Detection from Extensive Time-Series

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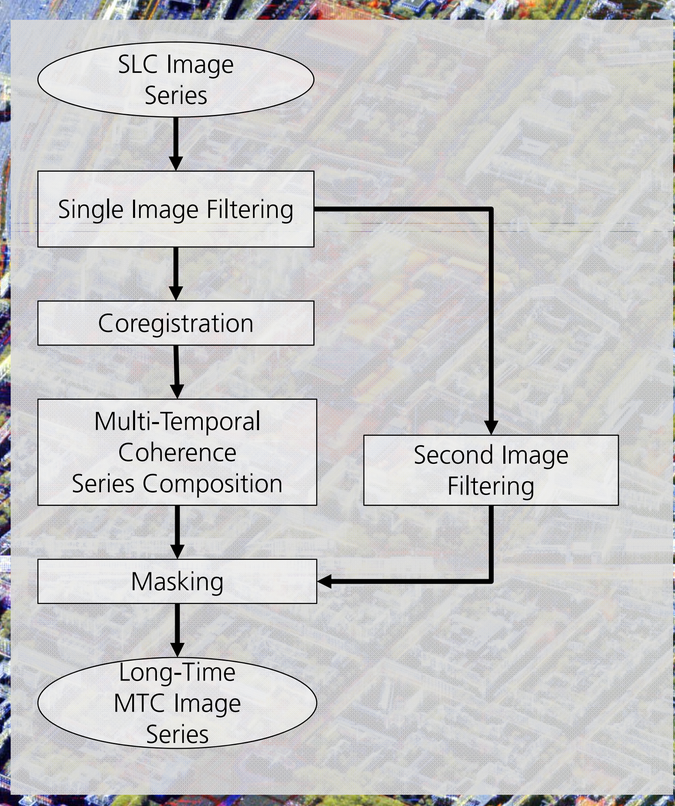
Due to the repeat-pass orbit of the TerraSAR-X mission, time series exploitation is an outstanding capability with a wide range of possible applications. In comparison to electro-optical systems, a space borne radar image's radiometry is hardly influenced by atmospheric conditions resulting in highly robust change information between image pairs. Nevertheless, other radar-specific imaging effects like noise, side lobes or interference are rather disadvantageous for image processing. Especially in urban environment the visual interpretation of radar signatures depicts a challenging task even for experienced radar image analysts. The processing of extensive time series allows a significant de-speckling that can be used e.g. for a more robust change detection.

Each Single-Look-Complex (SLC) image is filtered by tools of DLR-RADIAN to suppress sidelobes and noise while maintaining the full spatial resolution. The filtered images becomes co-registrated and a composite image is generated exploiting the amplitude variation as well as the coherence change in adjacent images. The result is shown as the background image of the poster. The composite image is than broken down to single images by masking with the second filtered single images, delivering a Long Time Multi-Temporal Coherence (MTC) Image Series. Thus, each image of this series represents only the current situation, but enhanced by information of the whole series.

The image details in the lower left illustrate distinct states in the imaging process. Fig. A shows an unfiltered raw image. Fig. E is the same detail in the Multi-Temporal Coherence Composite. For radiometric comparison the corresponding gray-scale image is visible in Fig. B. Fig. C and Fig. D give the final result for the single image of Fig. A as grayscale image and in MTC coloring, respectively. The result is an image in original resolution but with suppressed noise while differentiating between static objects (blue), rural signatures (green) and changes related to the series (red).

These images can then be then exploited for automated information extraction, as described in [1] and [2].



Single original image	MTC composite image (grayscale)	Single MTC composite image (grayscale)	Single MTC composite image
A	B	C	D

E MTC composite image

Munich
50 TS-X images
ST mode
(2016 – 2019)

LEGEND:

- **No change**
- **Amplitude change**
- **Coherence loss change**

REFERENCES:

[1] H. Anglberger, T. Kempf, "A simulation-based approach towards automatic target recognition of high resolution space borne radar signatures," Proc. SPIE Remote Sensing, 2016.

[2] C. Villamil, U. Stilla, "Object-based SAR change detection for security and surveillance applications using density based clustering," *EUSAR 2018.*