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Editorial

Editorial for Special Issue "Advances in SAR: Sensors, Methodologies, and Applications"

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The Special Issue "Advances in SAR: Sensors, Methodologies, and Applications" aims to give an overview of recent advancements in Synthetic Aperture Radar (SAR) remote sensing. SAR remote sensing is a wide field including sensor technologies—the hardware—as well as algorithms and methods—the software. The sensors and algorithms are, however, just a means to an end, with that end being the applications.

In recent years, SAR remote sensing technology has made huge steps forward. With the increase in available sensors and the tremendous growth of available SAR data, access has become easier and SAR has become more relevant. With this increase in data, we have seen recent advancements in SAR, especially regarding sensors and methodologies, but also in terms of newly developed applications.

The articles in this Special Issue focus on these advancements, while also covering different aspects of SAR remote sensing. The Special Issue starts with a paper from Giudici et al. [1] describing the pre-flight experiments during the outdoor performance assessment campaign for the upcoming SAOCOM-1A SAR mission. Corner reflectors are important for various applications in a SAR sensor's lifecycle. Consequently, Garthwaite discusses design considerations for corner reflectors used for deformation monitoring [2]. In an interesting piece on interferences, Monti-Guarnieri et al. [3] present their work on the radio frequency interferences in C-band based on an analysis of the first 8–10 echo measurements per burst to provide a first radio frequency interference map over Europe.

Another important topic is SAR signal processing. Zhang et al. [4] describe a new accelerated back-projection algorithm. A multiple-input, multiple-output (MIMO) video SAR signal processing approach is presented by Kim et al. [5]. Park et al. [6] demonstrate an efficient correction of ground moving targets from SAR SLC images. Bu et al. [7] present a unified algorithm for the calibration of single-pass multi-baseline TomoSAR systems.

SAR interferometry is one of the most important applications in SAR remote sensing. Furthermore, it is the topic of several papers in this Special Issue. Even and Schulz [8] present a detailed review on the deformation analysis with distributed scatterers. Their review offers an excellent starting point to learn more about recent advancements in distributed scatterer (DS) InSAR. Tian et al. [9] present a method for an improved orbital error modeling relevant to various interferometric applications. Besides orbital errors, atmospheric and ionospheric effects are important error sources. To reduce the ionosphere error, Wang et al. [10] present a method based on the Faraday rotation with polarimetric SAR data. Precise DEM generation is one of the main applications of interferometric SAR. Dong et al. [11] demonstrate a multi-baseline InSAR approach using Maximum Likelihood Estimation.

Infrastructure stability surveillance is an important application, especially for high-resolution SAR sensors. Bridges are especially important in this context. The possibility to measure deformation is shown by a case study of the Lupu bridge in Shanghai [12]. Another case study by Neelmeijer et al. [13] shows the deformation around the Toktogul Reservoir in Kyrgyzstan based on ASAR and Sentinel-1 data over two periods from 2004–2009 and 2014–2016.

As an alternative to differential interferometry, surface motion estimation with SAR pixel-tracking can provide precise motion measurements in the range and azimuth directions. Sun et al. [14] demonstrate this by surveying landslides in the Three Gorges Region. Shi et al. [15] take another look at landslides in the Three Gorges Region with Split-Bandwidth Interferometry. On the other hand, Libert et al. [16] use Split-Band Interferometry to assist in phase unwrapping.

Feature detection from SAR images is another major topic in Microwave Remote Sensing. Ghafouri et al. [17] present a method to better estimate IEM (Integral Equation Model) input parameters for multi-frequency SAR data. Di Martino et al. [18] describe the role of resolution for the estimation of fractal dimension maps. Deng et al. [19] give an overview over different methods for the statistical modeling of polarimetric SAR data. Segmenting polarimetric SAR data is important in understanding and classifying SAR data. For high-resolution PolSAR data, Chen et al. [20] demonstrate a multi-feature segmentation technique based on fractal net evolution approach. Tao et al. [21] show a land cover classification method with polarimetric SAR data based on roll-invariant and selected hidden features in the polarimetric rotation domain.

SAR data can be a very good data source for change detection analysis. Braun and Hochschild [22] use this for detecting landscape changes in the African Savannas. Behnamian et al. [23] report the development of a semi-automated surface water detection technique especially suitable for wetlands. Washaya et al. [24] use coherence change detection to identify and monitor damages caused by natural and anthropogenic disasters, including hurricane, forest fire, and earthquake damage detection, in addition to providing an extensive overview of the damages caused by the Syrian War in Aleppo, Raqqa, and Damascus.

Zhai et al. [25] present a multi-layer model for SAR images that is based on multi-scale and multi-feature fusion. Last but not least, Molan et al. [26] introduce a new temporal decorrelation model for L-band data over Alaska, taking the amplitude and snow depth into account.

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References

1. Giudici, D.; Monti-Guarnieri, A.; Cuesta Gonzalez, J. Pre-flight SAOCOM-1A SAR performance assessment by outdoor campaign. *Remote Sens.* **2017**, *9*, 729. [CrossRef]
2. Garthwaite, M. On the design of radar corner reflectors for deformation monitoring in multi-frequency InSAR. *Remote Sens.* **2017**, *9*, 648. [CrossRef]
3. Monti-Guarnieri, A.; Giudici, D.; Recchia, A. Identification of C-Band radio frequency interferences from sentinel-1 data. *Remote Sens.* **2017**, *9*, 1183. [CrossRef]
4. Zhang, H.; Tang, J.; Wang, R.; Deng, Y.; Wang, W.; Li, N. An accelerated backprojection algorithm for monostatic and bistatic SAR processing. *Remote Sens.* **2018**, *10*, 140. [CrossRef]
5. Kim, S.; Yu, J.; Jeon, S.-Y.; Dewantari, A.; Ka, M.-H. Signal processing for a multiple-input, multiple-output (MIMO) video synthetic aperture radar (SAR) with beat frequency division frequency-modulated continuous wave (FMCW). *Remote Sens.* **2017**, *9*, 491. [CrossRef]
6. Park, J.-W.; Kim, J.; Won, J.-S. Fast and efficient correction of ground moving targets in a synthetic aperture radar, single-look complex image. *Remote Sens.* **2017**, *9*, 926. [CrossRef]
7. Bu, Y.; Liang, X.; Wang, Y.; Zhang, F.; Li, Y. A unified algorithm for channel imbalance and antenna phase center position calibration of a single-pass multi-baseline TomoSAR system. *Remote Sens.* **2018**, *10*, 456. [CrossRef]
8. Even, M.; Schulz, K. InSAR deformation analysis with distributed scatterers: A review complemented by new advances. *Remote Sens.* **2018**, *10*, 744. [CrossRef]

9. Tian, X.; Malhotra, R.; Xu, B.; Qi, H.; Ma, Y. Modeling orbital error in InSAR interferogram using frequency and spatial domain based methods. *Remote Sens.* **2018**, *10*, 508. [CrossRef]
10. Wang, C.; Chen, L.; Zhao, H.; Lu, Z.; Bian, M.; Zhang, R.; Feng, J. Ionospheric reconstructions using faraday rotation in spaceborne polarimetric SAR data. *Remote Sens.* **2017**, *9*, 1169. [CrossRef]
11. Dong, Y.; Jiang, H.; Zhang, L.; Liao, M. An efficient maximum likelihood estimation approach of multi-baseline SAR interferometry for refined topographic mapping in mountainous areas. *Remote Sens.* **2018**, *10*, 454. [CrossRef]
12. Zhao, J.; Wu, J.; Ding, X.; Wang, M. Elevation extraction and deformation monitoring by multitemporal InSAR of lupu bridg in Shanghai. *Remote Sens.* **2017**, *9*, 897. [CrossRef]
13. Neelmeijer, J.; Schöne, T.; Dill, R.; Klemann, V.; Motagh, M. Ground deformations around the toktogul reservoir, kyrgyzstan, from envisat ASAR and sentinel-1 data-A case study about the impact of atmospheric corrections on InSAR time series. *Remote Sens.* **2018**, *10*, 462. [CrossRef]
14. Sun, L.; Muller, J.-P.; Chen, J. Time series analysis of very slow landslides in the three gorges region through small baseline SAR offset tracking. *Remote Sens.* **2017**, *9*, 1314. [CrossRef]
15. Shi, X.; Jiang, H.; Zhang, L.; Liao, M. Landslide displacement monitoring with split-bandwidth interferometry: A case study of the shuping landslide in the three gorges area. *Remote Sens.* **2017**, *9*, 937. [CrossRef]
16. Libert, L.; Derauw, D.; d'Oreye, N.; Barbier, C.; Orban, A. Split-band interferometry-assisted phase unwrapping for the phase ambiguities correction. *Remote Sens.* **2017**, *9*, 879. [CrossRef]
17. Ghafouri, A.; Amini, J.; Dehmollaian, M.; Kavoosi, M. Better estimated IEM input parameters using random fractal geometry applied on multi-frequency SAR data. *Remote Sens.* **2017**, *9*, 445. [CrossRef]
18. Di Martino, G.; Iodice, A.; Riccio, D.; Ruello, G.; Zinno, I. The role of resolution in the estimation of fractal dimension maps from SAR data. *Remote Sens.* **2018**, *10*, 9. [CrossRef]
19. Deng, X.; López-Martínez, C.; Chen, J.; Han, P. Statistical modeling of polarimetric SAR data: A survey and challenges. *Remote Sens.* **2017**, *9*, 348. [CrossRef]
20. Chen, Q.; Li, L.; Xu, Q.; Yang, S.; Shi, X.; Liu, X. Multi-feature segmentation for high-resolution polarimetric SAR data based on fractal net evolution approach. *Remote Sens.* **2017**, *9*, 570. [CrossRef]
21. Tao, C.; Chen, S.W.; Li, Y.Z.; Xiao, S. PolSAR land cover classification based on roll-invariant and selected hidden polarimetric features in the rotation domain. *Remote Sens.* **2017**, *9*, 660. [CrossRef]
22. Braun, A.; Hochschild, V. A SAR-based index for landscape changes in african savannas. *Remote Sens.* **2017**, *9*, 359. [CrossRef]
23. Behnamian, A.; Banks, S.; White, L.; Brisco, B.; Millard, K.; Pasher, J.; Chen, Z.; Duffe, J.; Bourgeau-Chavez, L.; Battaglia, M. Semi-automated surface water detection with synthetic aperture radar data: A. wetland case study. *Remote Sens.* **2017**, *9*, 1209. [CrossRef]
24. Washaya, P.; Balz, T.; Mohamadi, B. Coherence change-detection with sentinel-1 for natural and anthropogenic disaster monitoring in urban areas. *Remote Sens.* **2018**, *10*, 1026. [CrossRef]
25. Zhai, A.; Wen, X.; Xu, H.; Yuan, L.; Meng, Q. Multi-layer model based on multi-scale and multi-feature fusion for SAR images. *Remote Sens.* **2017**, *9*, 1085. [CrossRef]
26. Eshqi Molan, Y.; Kim, J.-W.; Lu, Z.; Agram, P. L-band temporal coherence assessment and modeling using amplitude and snow depth over interior alaska. *Remote Sens.* **2018**, *10*, 150. [CrossRef]