POLARIMETRIC COHERENCE OPTIMIZATION FOR INTERFEROMETRIC DIFFERENTIAL APPLICATIONS

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1. ABSTRACT

The two main factors limiting the performance of any advanced differential interferometric SAR (ADInSAR) technique are the number of trustful points within the area to be analyzed and the quality of corresponding phase information.
Two criteria are mainly employed for the estimation of the pixels' quality: the *amplitude* dispersion and the *coherence* stability. In the first case, the quality of the phase information along the whole interferograms stack is associated to the dispersion index D_A, which has been defined in [1] as the ratio between the mean and the standard deviation of pixels' amplitude. Namely, the lower the value of D_A, the more reliable the phase information of the pixel.
The second approach invokes the ergodicity and the spatial homogeneity of the scattering process and estimates the accuracy of the interferometric phase information by performing a spatial correlation between each pair of datasets in the acquisitions stack [2][3]. The higher the interferometric coherence, the more reliable the interpretation of the corresponding phase in terms of scatterers' position in time.
Owing to the lack of long-time collections of polarimetric satellite-SAR data, the mathematical formulation of the techniques implementing both criteria has been limited to the single-polarization case. In fact, scarce polarimetric data are available in the remote sensing scientific community and they mostly come from airborne SAR sensor. The instability of this type of platform has not made possible to fruitfully employed PolSAR acquisitions for differential purposes.
As a matter of fact, during the last years the polarimetric interferometric (PolInSAR) studies have been mainly focused on the retrieval of geophysical parameters from repeated pass short-time-delayed SAR acquisitions. One of the main conclusions drawn from these studies is that the scattering mechanisms maximizing the interferometric coherence represent a key-factor in order to optimize the quality of the phase information related to the scatterers' properties [4][5][6].
In this paper, we present a first attempt to fulfill the gap between these two up-to-now independent topics: the differential interferometry and the polarimetric SAR interferometry. The objective is to investigate the potentials of the main coherence-optimization methods for the improvement of the performance of the coherence-based ADInSAR techniques.
For this purpose, the zero-baseline (*0B*) polarimetric SAR measurements acquired by UPC ground-based sensor during the one-year measurement campaign in Sallent (Spain) [7] will be employed.
The three main approaches available in literature and described in [4][5][6] will be briefly described and extended to the *0B* case. Special emphasis will be given to the statistical hypothesis each optimization method relies on. In order to correctly interpret the retrieved phase information, simulations will be also employed. Then, real *0B* interferometric GBSAR data sets will be studied in details to stress the advantage and drawbacks of the different optimization techniques.
In [8], the selection of the scattering matrix's channel providing the highest pixel-by-pixel coherence value made it possible to improve significantly the overall quality of the

differential phase information. This technique will be employed to detect pixels belonging to different coherence-quality layers and to quantitatively analyze the performance of each optimization approach.
In the end, the preliminary deformation-rate maps obtained by applying the Coherent Pixel Technique (CPT) [2] to the different stacks of optimized interferograms will be presented.

2. REFERENCES

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