



Analysis of the Performance of Polarimetric PSI on Persistent and Distributed Scatterers with Sentinel-1 Data

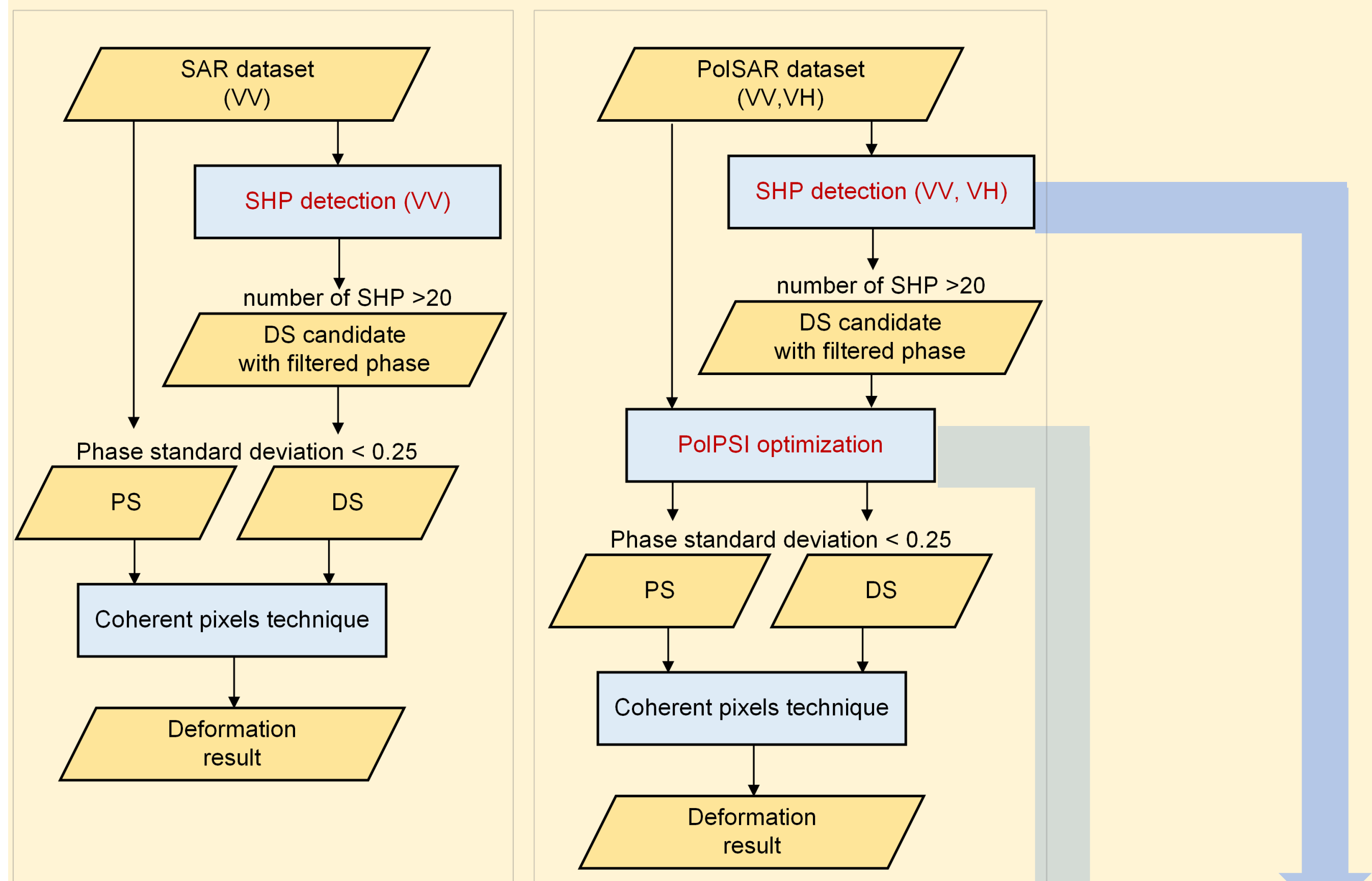
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Introduction

- Polarimetric information can complement persistent scatterer interferometry (PSI) when polarimetric images are available: PolPSI.
- Processing flow chart for Sentinel-1(S1) data: single-pol (VV) and dual-pol (VV and VH).

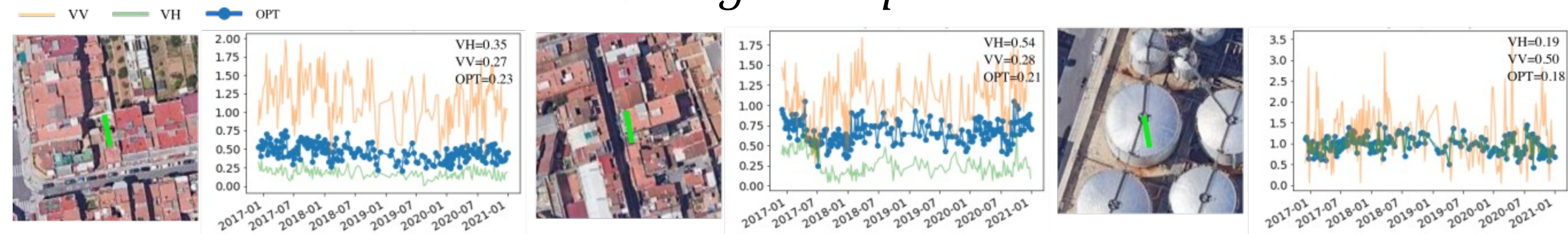


- The introduction of the VH channel influences the identification of the SHP group for each pixel, and then the PS and DS selection.

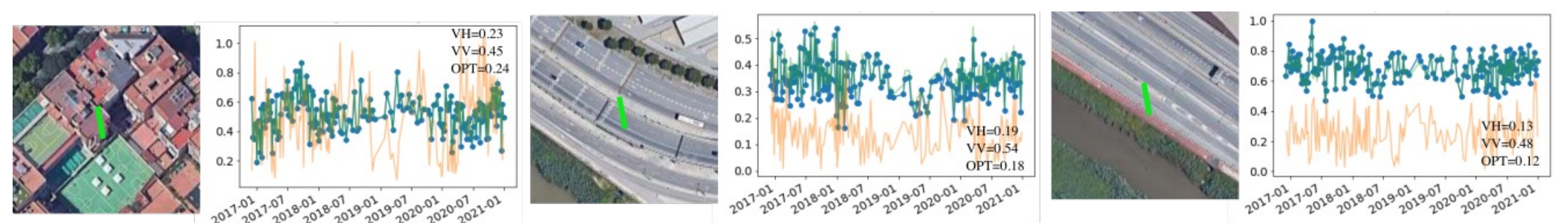
Objectives and Results

1. How does VH help improve the PS through D_A ?

$$D_A = \frac{\text{amplitude standard deviation}}{\text{averaged amplitude}}$$



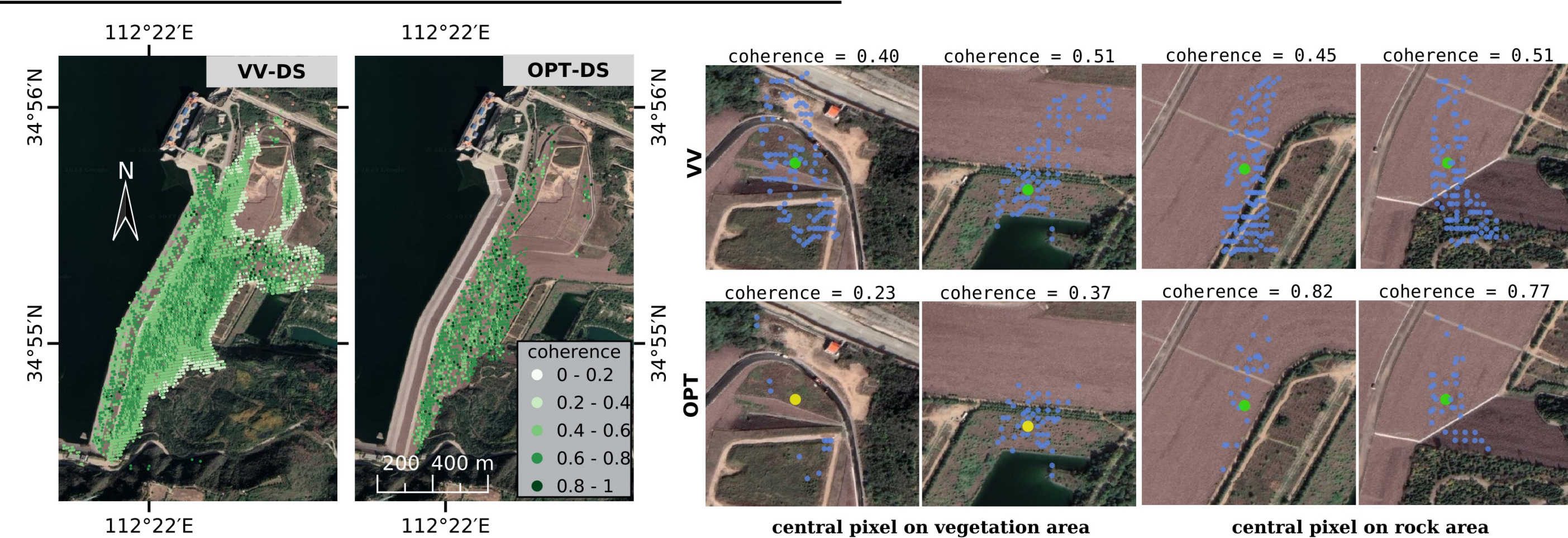
- VH amplitude is low but stable in areas where VV fluctuates.



- VH response is high (scatterers rotated with respect to the incidence plane).

Selected pixels over Barcelona and time series of amplitude (with D_A value for three channels).

2. How does VH help improve the DS?

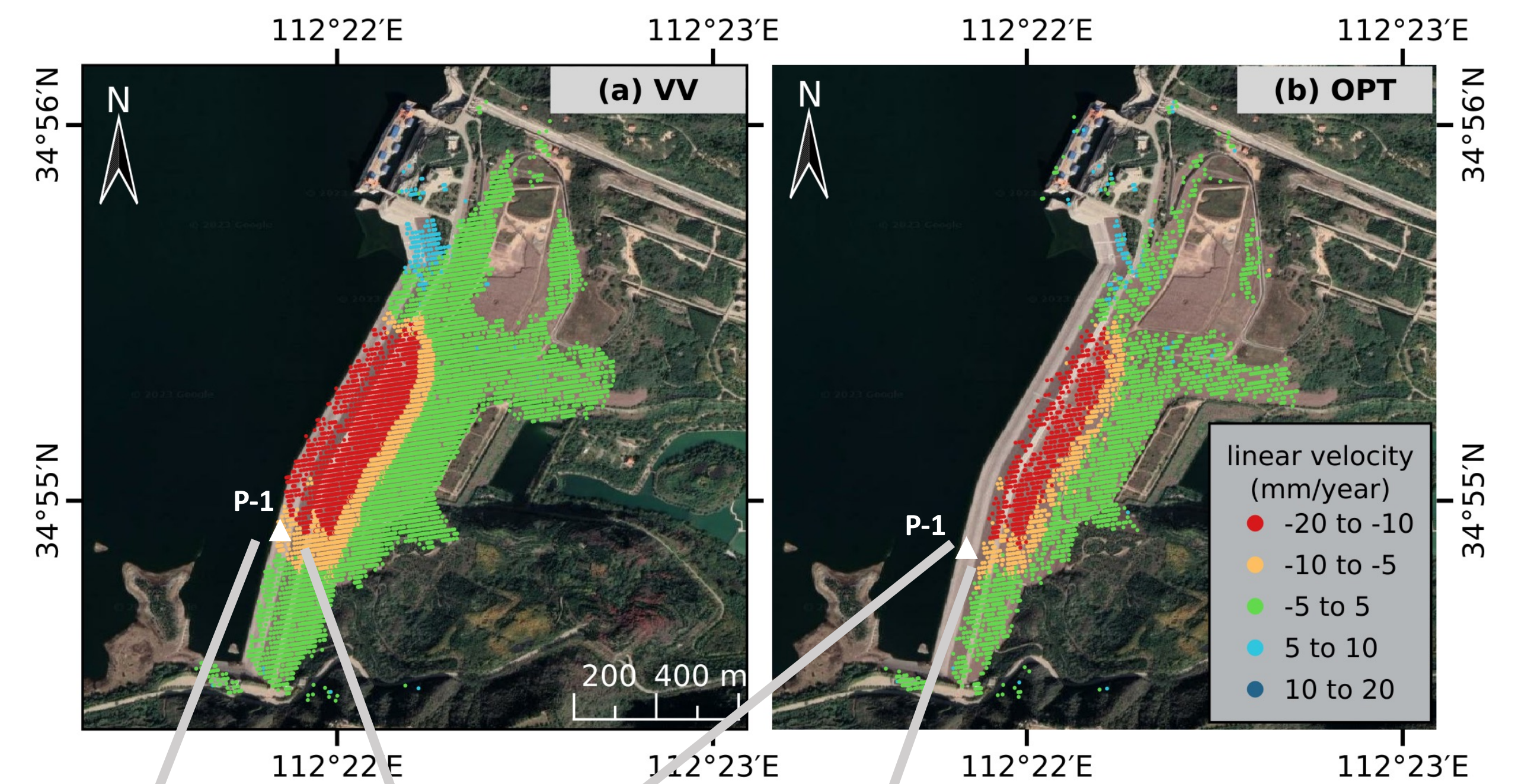


Distribution of DS with coherence value over Xiaolangdi Dam.

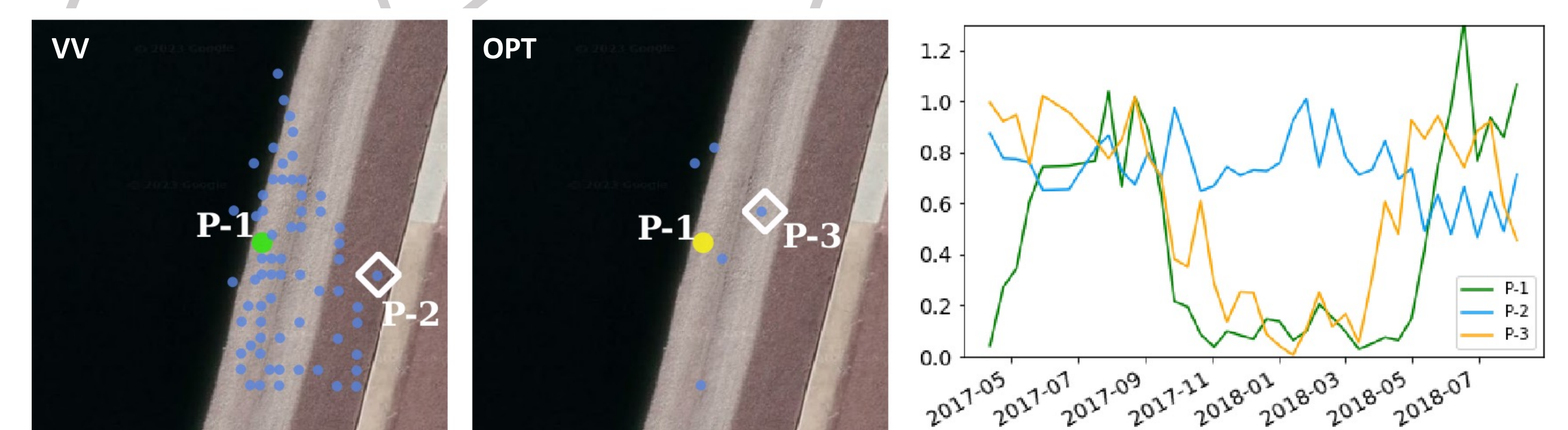
SHP map for selected pixels. DS are marked in green. Points not selected as valid measurement points are marked in yellow.

- The utilization of the VH results in a reduction in the number of DS in which different land covers were mixed, leading to an improvement in the overall quality of the DS.

3. What is the impact on the deformation results based on the improved PS and DS?



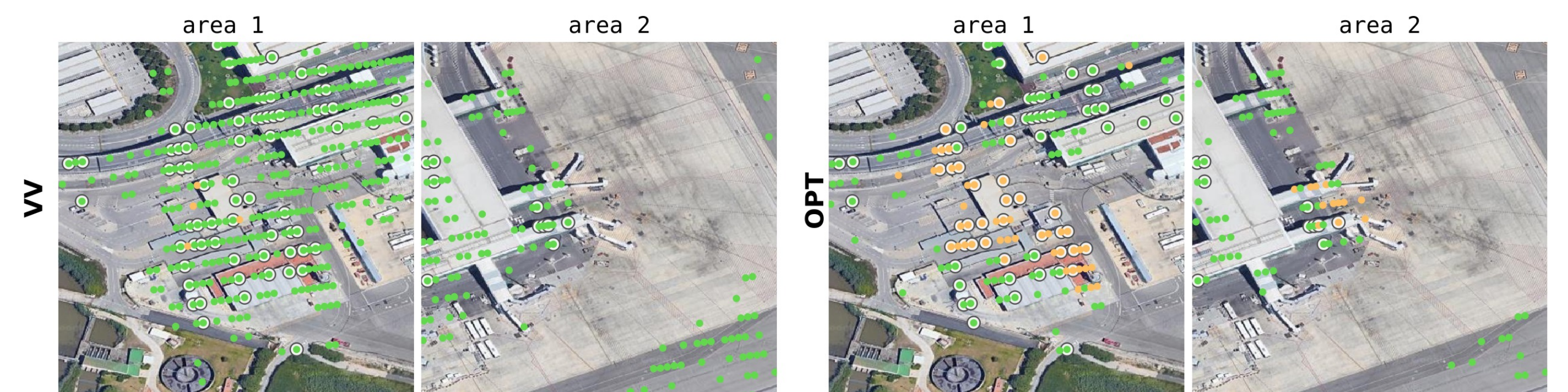
Linear velocity map for VV and OPT channel over Xiaolangdi Dam.



SHP map for VV and OPT channel at P-1. P-2 and P-3 are similar pixels with respect to P-1 in VV and OPT channel, respectively.

The time series amplitude plot of VV channel.

- The increased PS and decreased DS in OPT channel serve to identify the same deformation areas as VV. Pixels in the border of the dam were not selected as measurement points in OPT channel because they are not stable in the time series.



Two areas with different deformation results given by VV and OPT over Barcelona.

- DS with a large number of SHPs detected by the VV channel may lead to loss of deformation details due to the averaging with wrong neighbours.

Conclusion

By using dual polarization S1 data with PolPSI methods,

1. The number and quality of PS increase.
2. The number of DS decreases. However, the reduction in DS is accompanied by an improvement in their quality (different land covers are not mixed).
3. The total coverage of the measurement area has decreased, but the deformation areas are well preserved.
4. Fine details and values of deformation are better estimated than with VV alone.

Acknowledgement

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Reference

J. Luo, J. M. Lopez-Sanchez, F. De Zan, J. J. Mallorqui and R. Tomás, "Assessment of the Contribution of Polarimetric Persistent Scatterer Interferometry on Sentinel-1 Data," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 15, pp. 7997-8009, 2022, doi: 10.1109/JSTARS.2022.3206550.