

Zahra Dabiri^{1,2*}, Lukas Scharf², Daniel Hölbling², Vanessa Streifeneder²

¹ Department of Artificial Intelligence and Human Interfaces (AIHI), University of Salzburg, Salzburg, Austria

(*corresponding author: zahra.dabiri@plus.ac.at)

² Department of Geoinformatics - Z_GIS, University of Salzburg, Salzburg, Austria

SAFE CITY

Actionable Data space for Urban Climate Adaptation and related socio-ecological, local Transformation (ADUCAT) project tackles urban climate challenges with solutions such as green space management, infrastructure monitoring, and temperature forecasting. It includes three main pillars: Cool City, Green city, and Safe City.

Safe City: Monitoring change, Safeguarding infrastructure.

Vienna is growing and becoming denser. Interferometric Synthetic Aperture Radar (InSAR) technology aim to detect surface deformation such as subsidence or uplift and structural risk at an early stage automatically, helping to prevent damage.



METHODOLOGY

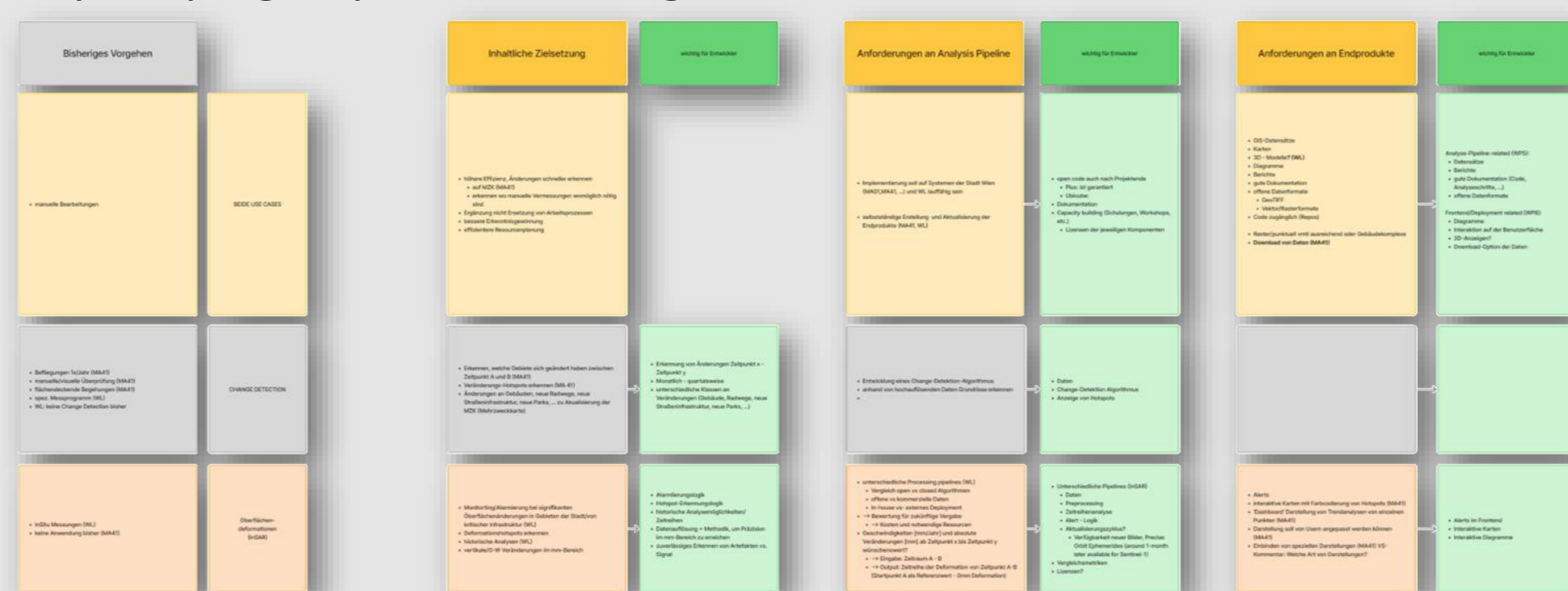
- Interferogram stack generation using ISCE
- InSAR analysis using open-source tools

MAIN OBJECTIVES



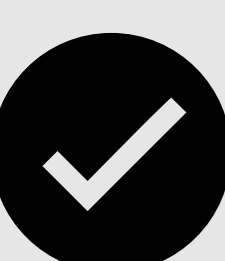
USER REQUIREMENT ANALYSIS

- Documentation of the current workflows used
- Identifying the needs and their prioritisation



IDENTIFYING THE BEST METHODS FOR SURFACE DEFORMATION

- What are the best open-source solution for operational surface deformation within the city of Vienna?
- What are the most promising parameters for InSAR analysis?
- What are the most promising SAR data to be used within the urban environment in an operational settings?



VALIDATION

- Systematic validation and error analysis using in-situ data acquired by the city of Vienna and Vienna local train.
- Which methods should be used?
- What are the strengths and limitation of the methods and results?



AUTOMATISATION OF PROCESS WITHIN THE CITY INFRASTRUCTURE

- Leveraging cloud-based solution, focusing on EOx-Hub.
- Integration into the city information system.



Functional WORKFLOW FOR CITY EARLY WARNING SYSTEM

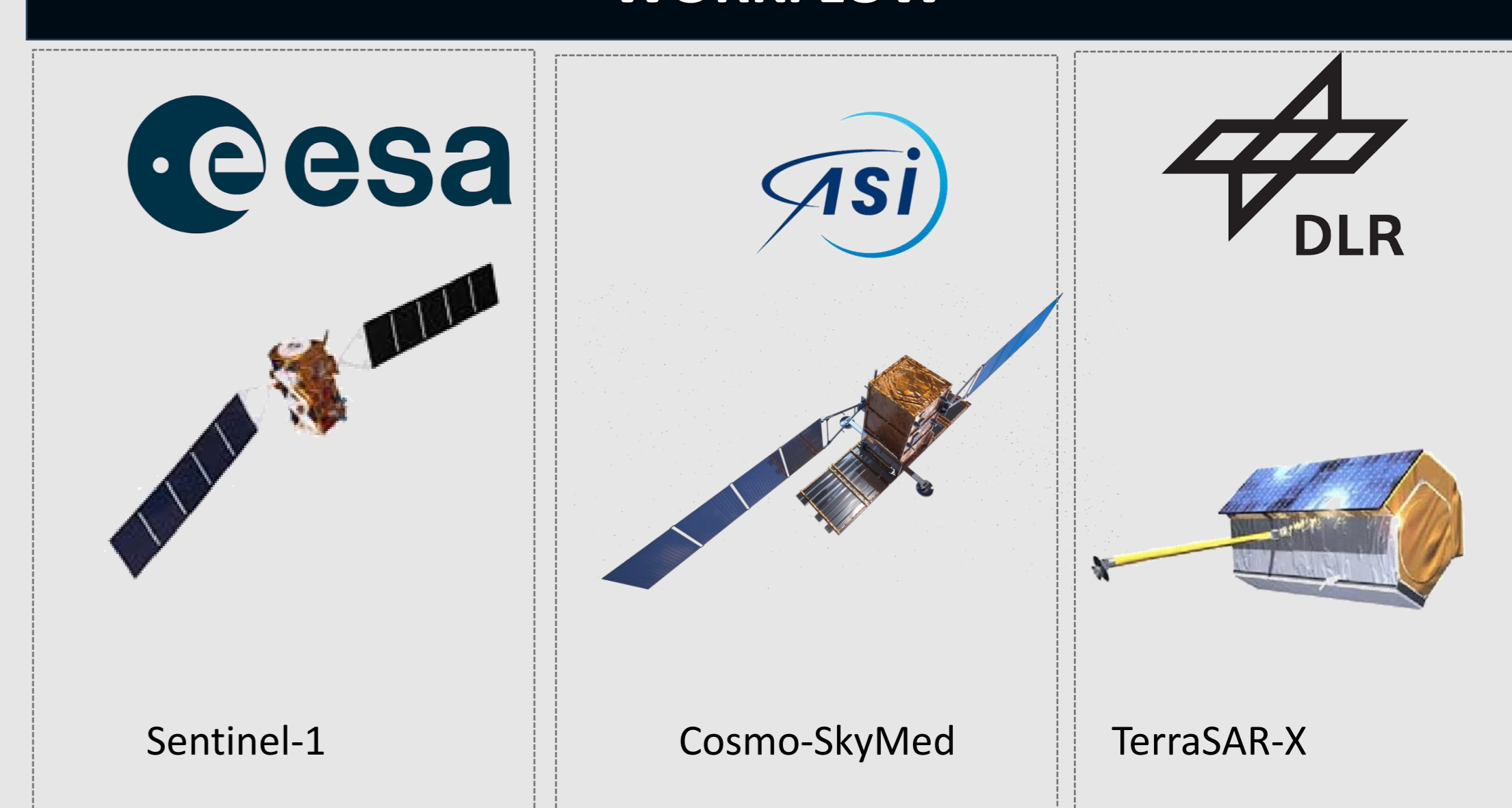
- To what extent can current InSAR solutions be integrated into the daily city-analysis workflow to identify surface-deformation hotspots?
- What are the limitations and bottlenecks?



TRANSFERIBILITY TO THE OTHER CITIES

- Can the proposed solutions be transferred to the other cities?
- Which adaptations are necessary, considering the different user requirement<

WORKFLOW

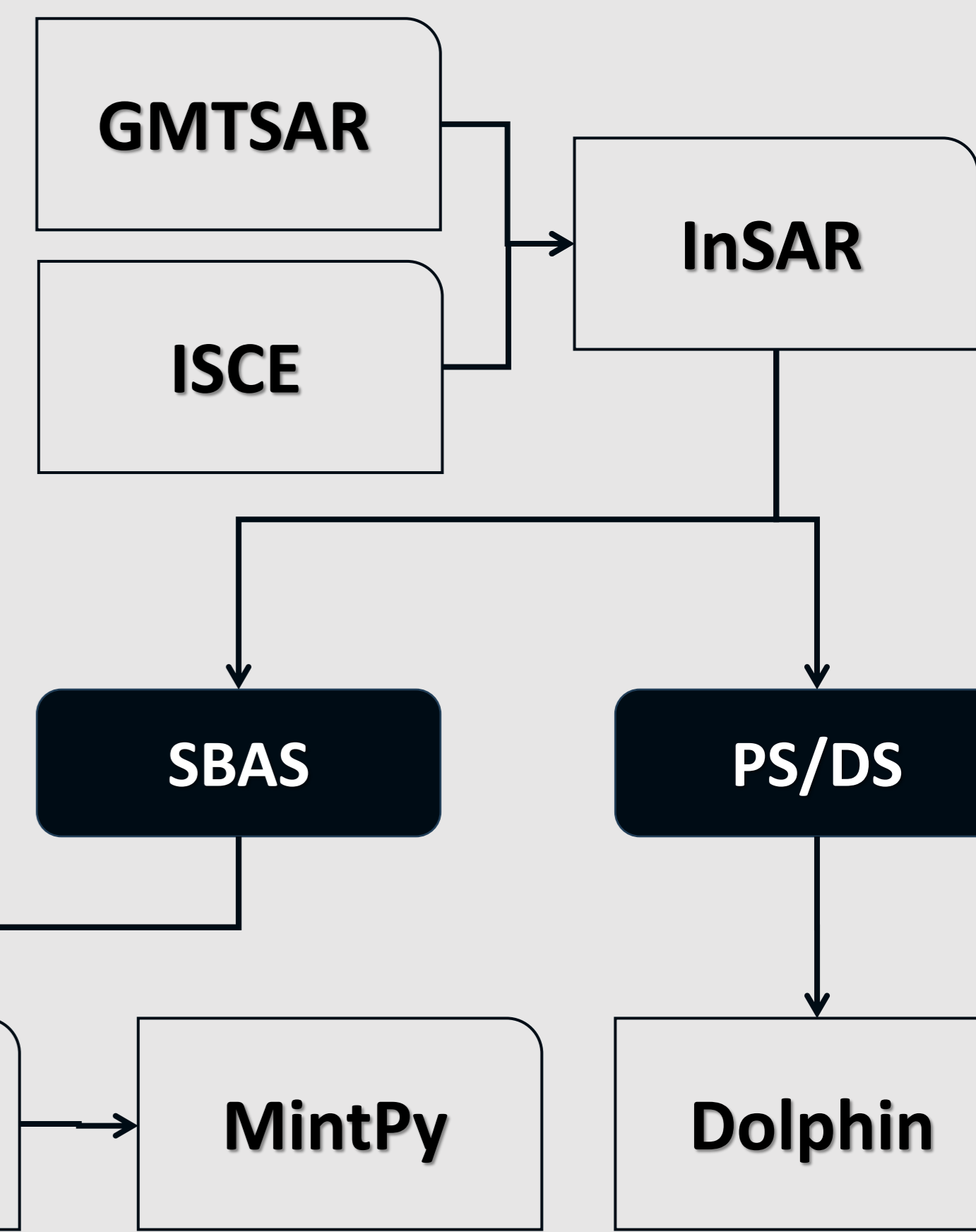


InSAR SBAS Using MintPy

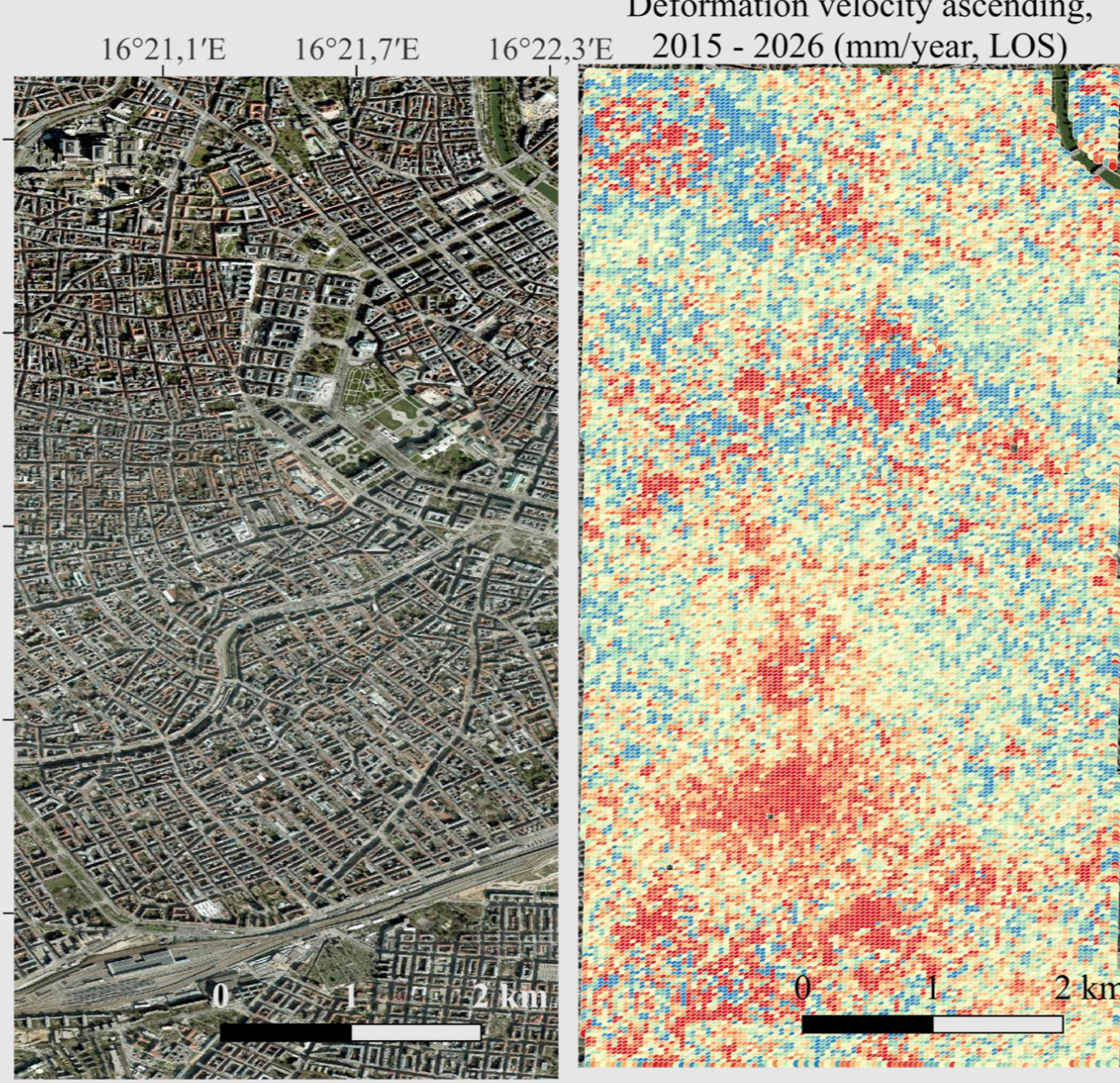
Preprocessing: ISCE
InSAR method: Mintpy
Time period: 2015 - 2026
Ascending

Comparison of Difenet Pipelines

- Statistik
- Coherence
- Identifying correct surface deformation

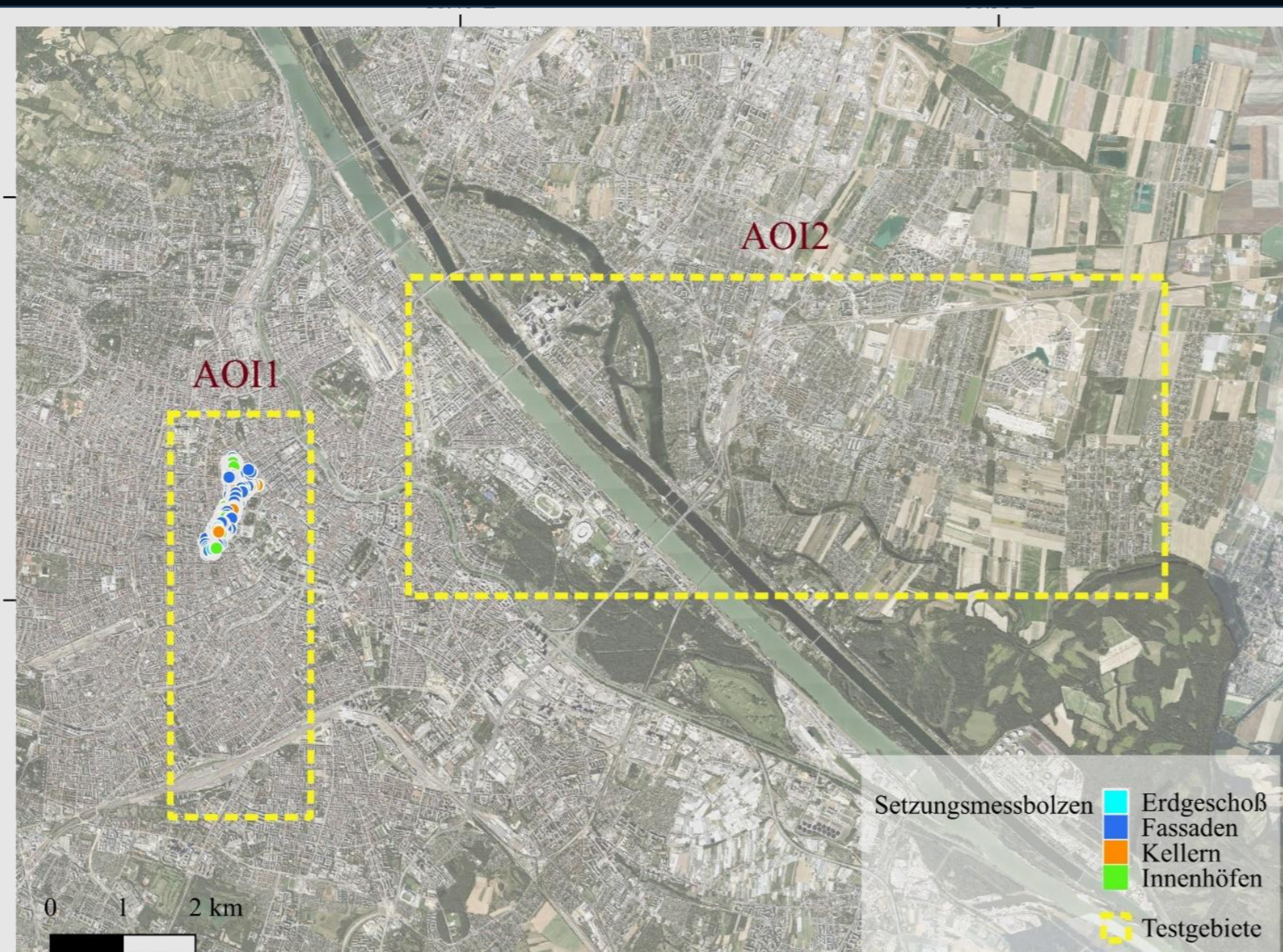
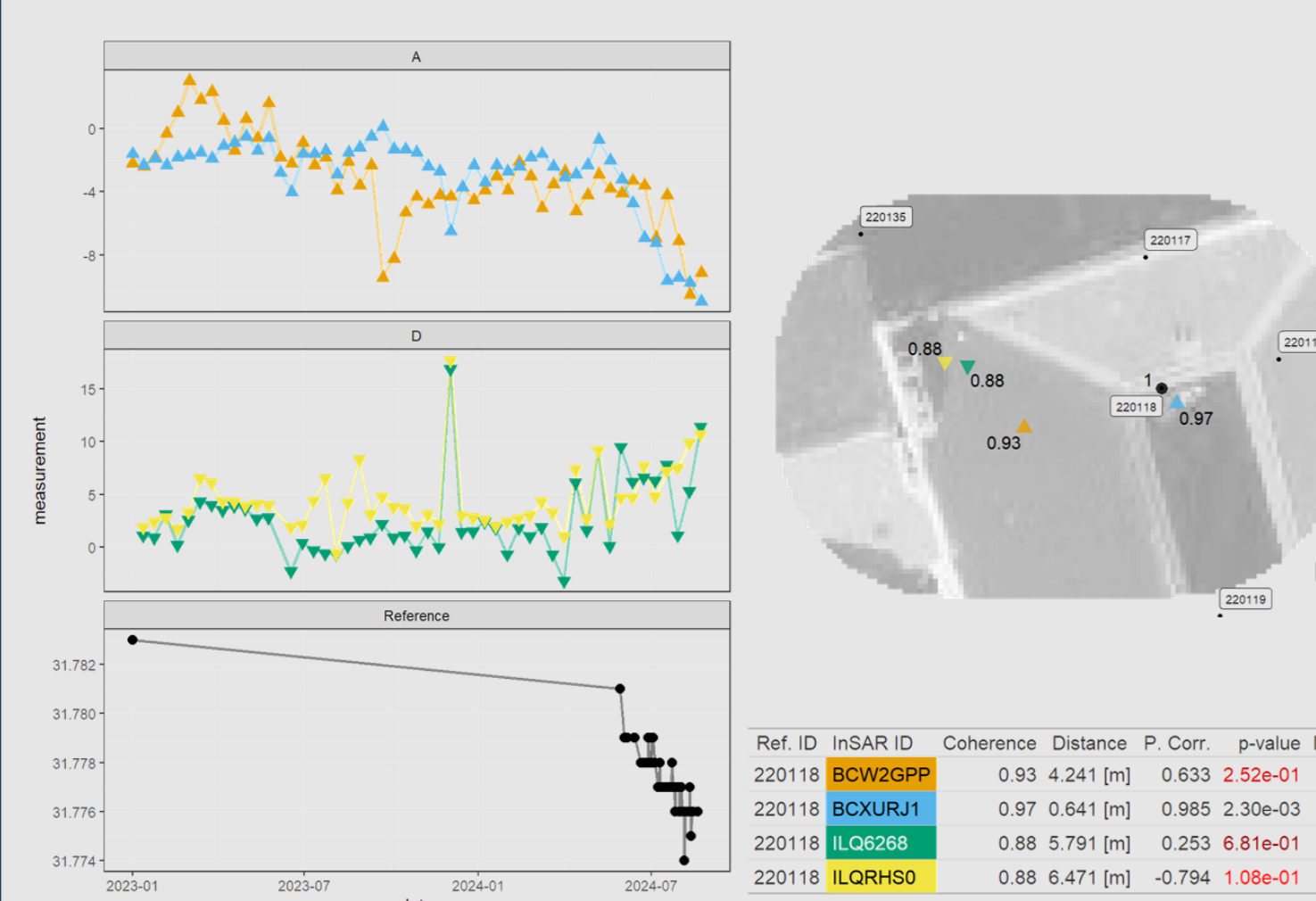


INSAR RESULT EXAMPLE



-64 mm/year InSAR results using ISCE and MintPy; the results shows a high surface deformation around the train station, and construction sites. (background @Esri)

VALIDATION



Correlation coefficient and trends analysis between InSAR results and in-situ data

Some examples of the relations are shown with these multivariate plots.

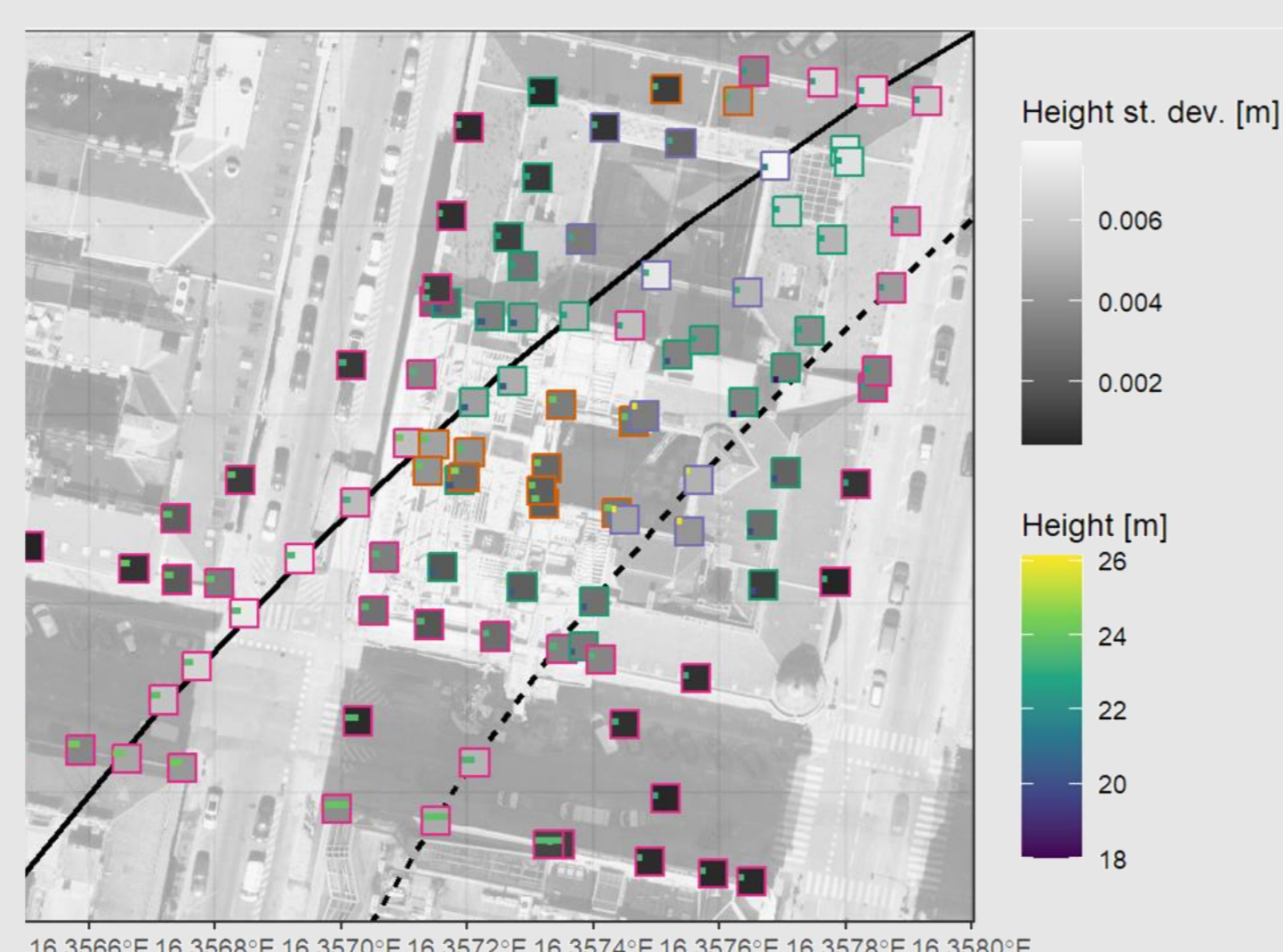
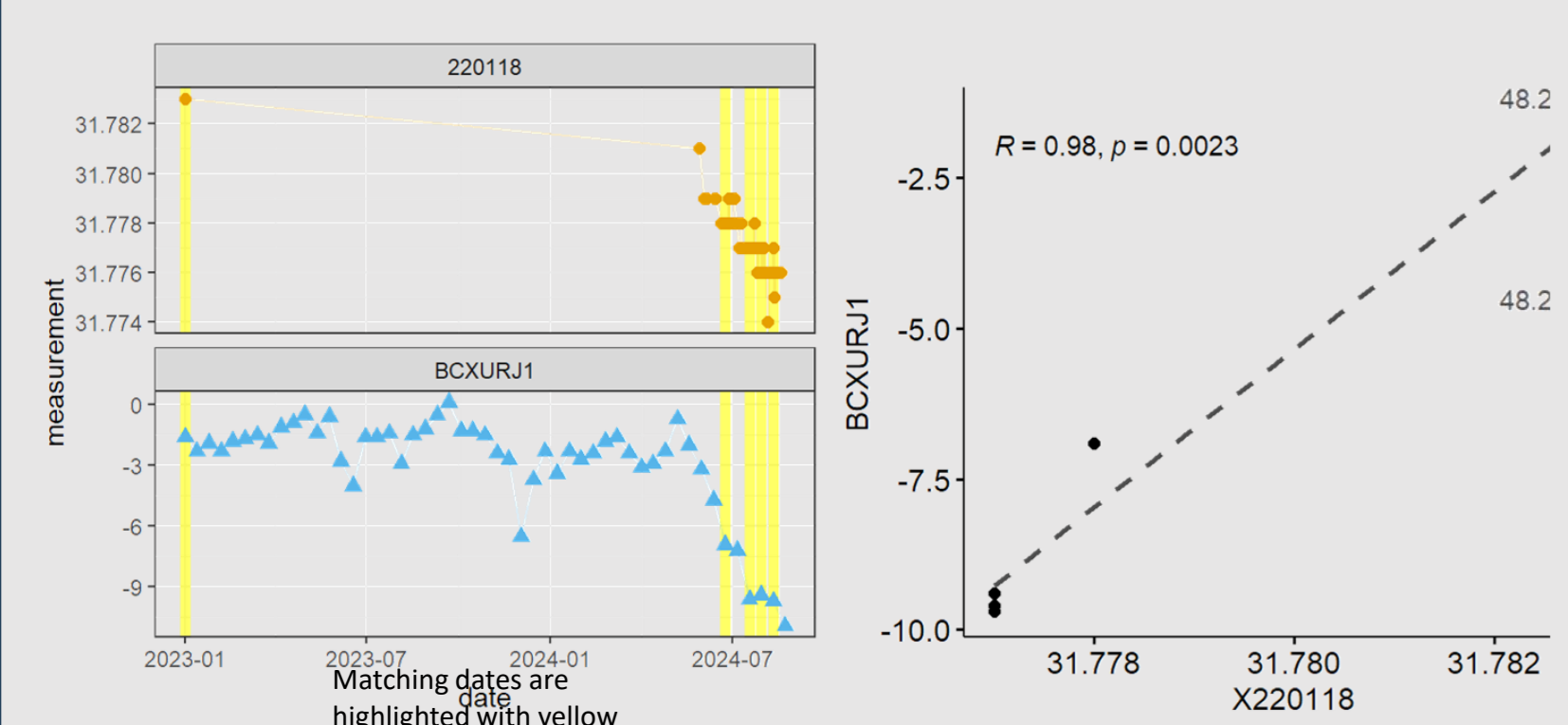
- The first two panels (left) show the InSAR measurements per LOS (in millimeters)
- A: Ascending, D: Descending.
- The bottom panel shows the in-situ reference data (in meters).

The map shows the location of the points:

- The larger black point shows the reference in-situ location.
- The other reference point IDs are shown for location purposes.

The table shows:

- The relation between the reference and each InSAR point, with its coherence value
- The distance between them
- The correlation coefficient with the p-value
- The number of matched dates which are used to calculate the correlation.



Example of validation

ID	Location	Type	Coherence
220225	FASSADE	Reference	1.00
220226	FASSADNF	Reference	1.00

CALL FOR COLLABORATION

Approach us and let's discuss if you would like your test to be evaluated in a real-world scenario and assess the applicability of your method in an operational setting.

zahra.dabiri@plus.ac.at

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† In the memory of our colleague and beloved friend Lorena Abad.