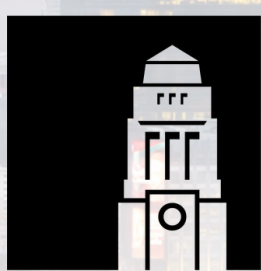


Measuring Land Subsidence Using Sentinel-1 Time-Series Techniques in Bangkok Metropolitan Region, Thailand

Sawitree Luachapichatikul^{1,2}, Prof John Elliott¹, Prof Andrew Hooper¹, Dr Milan Lazecky¹



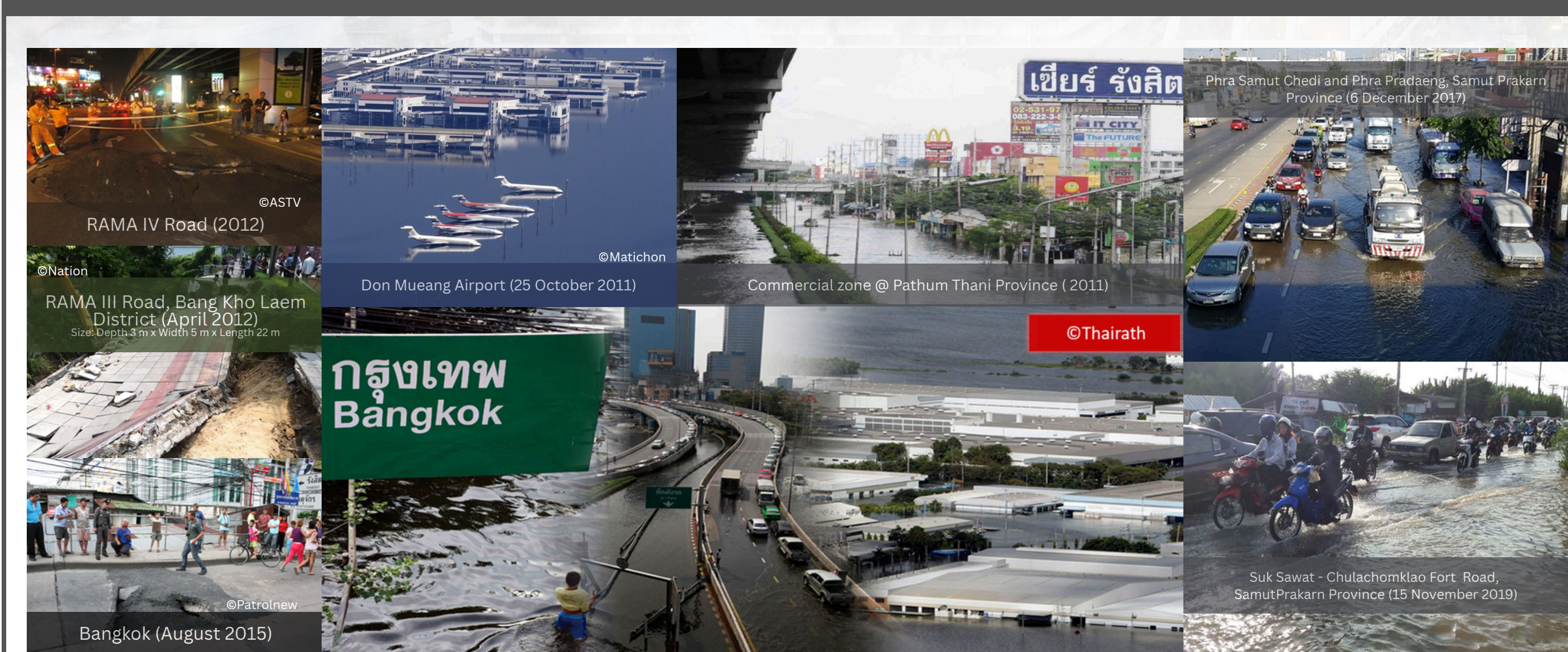
¹COMET, School of Earth and Environment, University of Leeds, Leeds, UK
²Department of Mineral Resources, Bangkok, Thailand
✉ jltl4516@leeds.ac.uk; sawitree.l@dmr.mail.go.th



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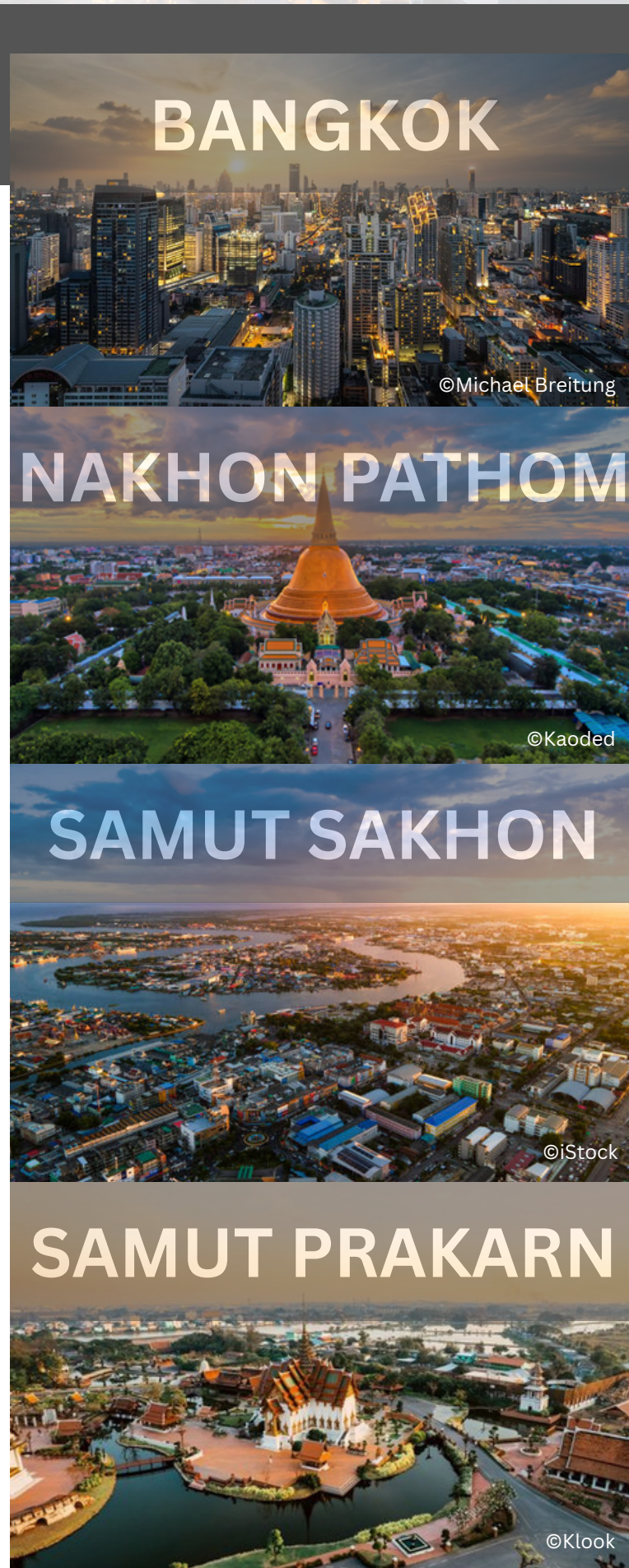
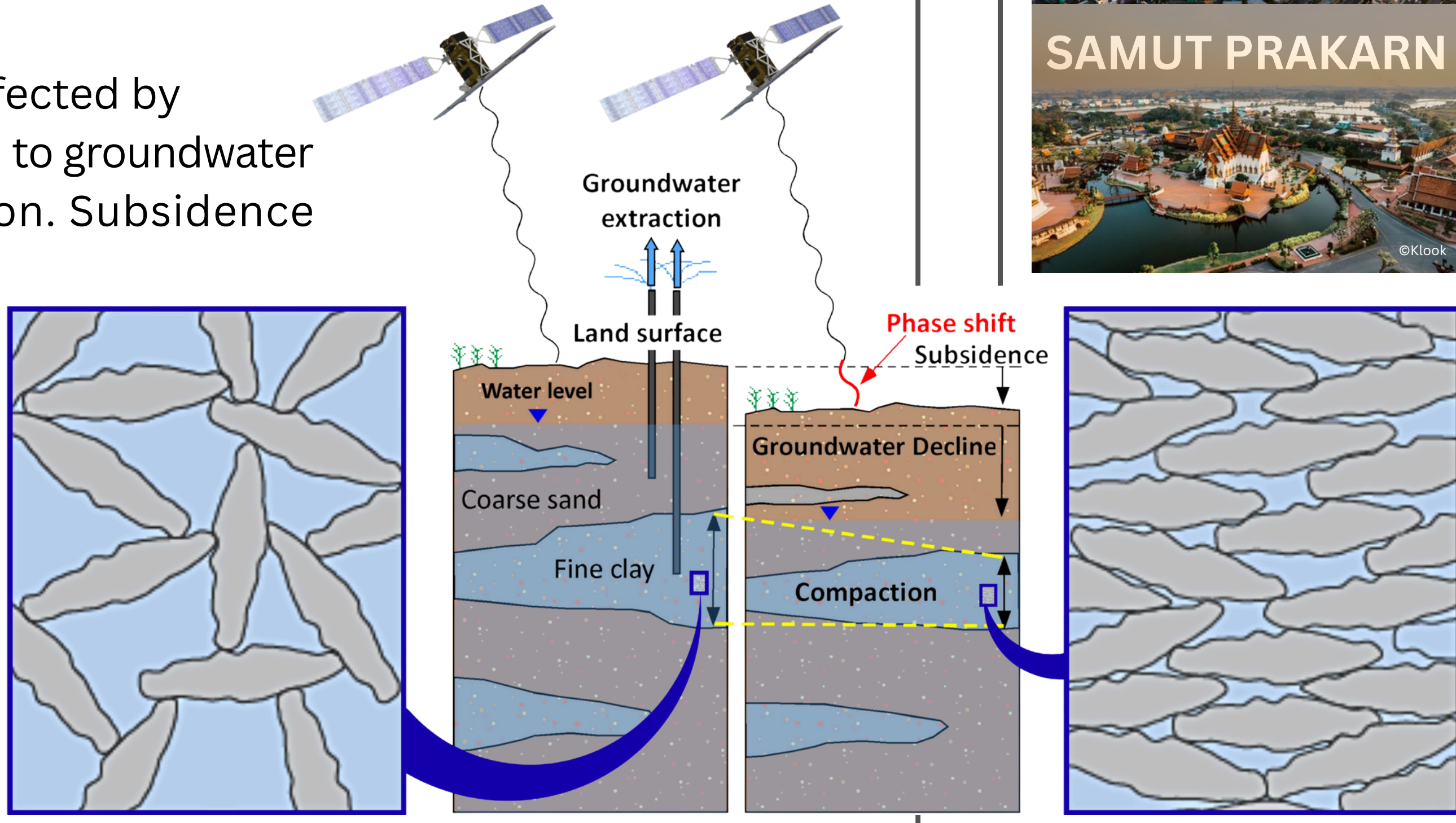


Problem Statements & Motivation

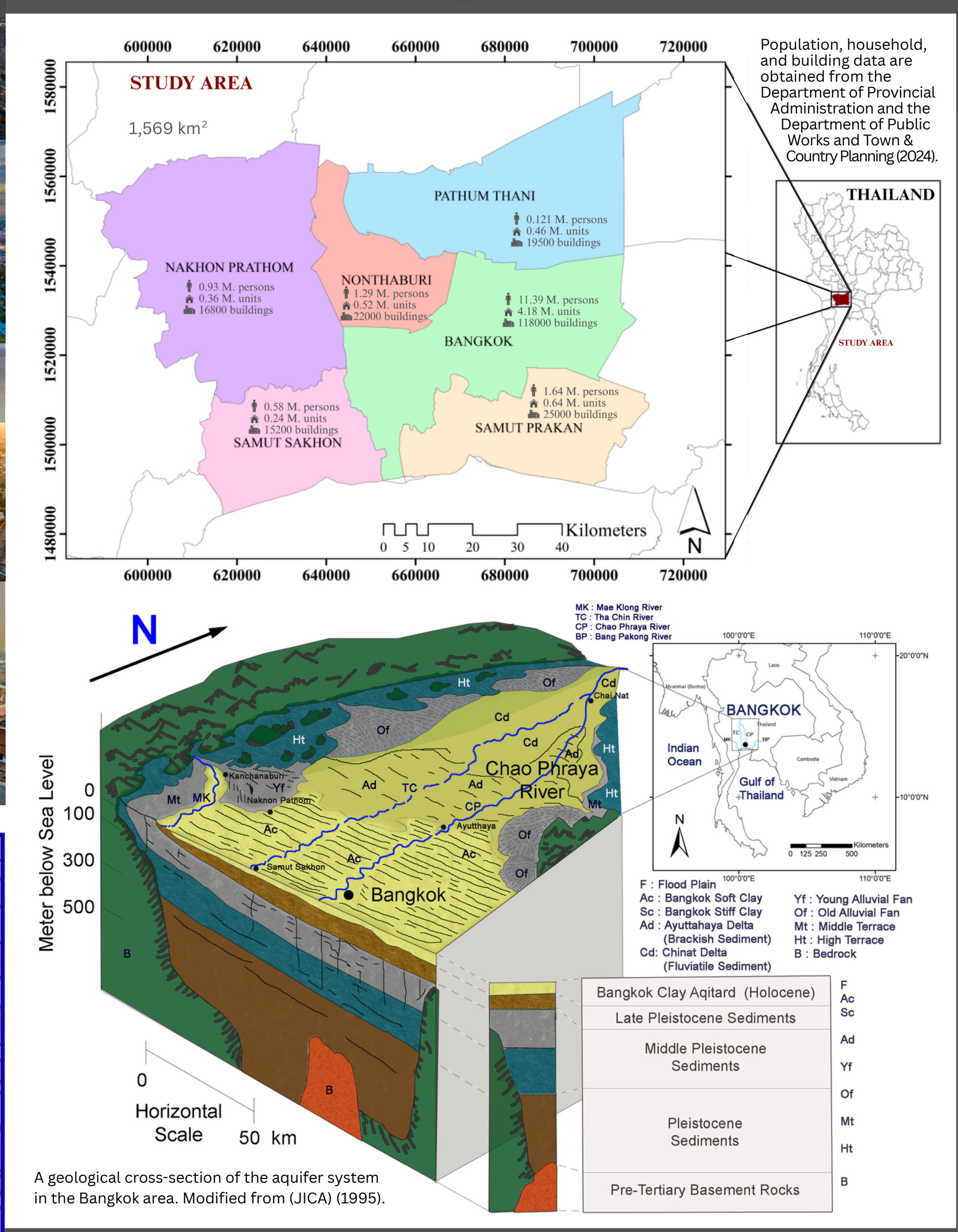


Bangkok Metropolitan Region

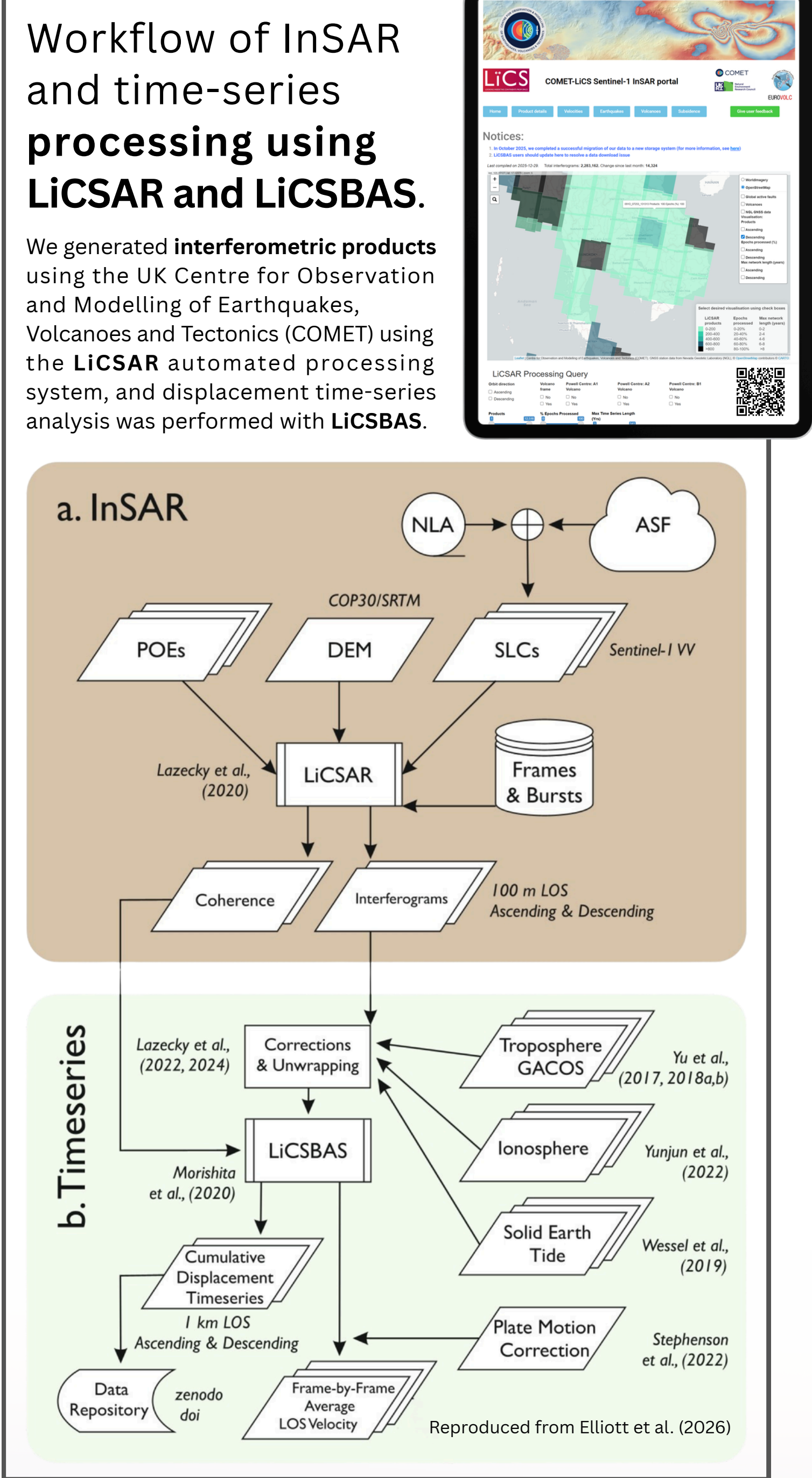
is a low-lying deltaic megacity affected by long-term land subsidence related to groundwater extraction and rapid urbanisation. Subsidence increases flood susceptibility, infrastructure damage, and vulnerability to sea-level rise. **Sentinel-1 time-series InSAR** enables millimetre-scale monitoring of ground deformation, supporting subsidence assessment, urban planning, and disaster risk reduction.



Study Area

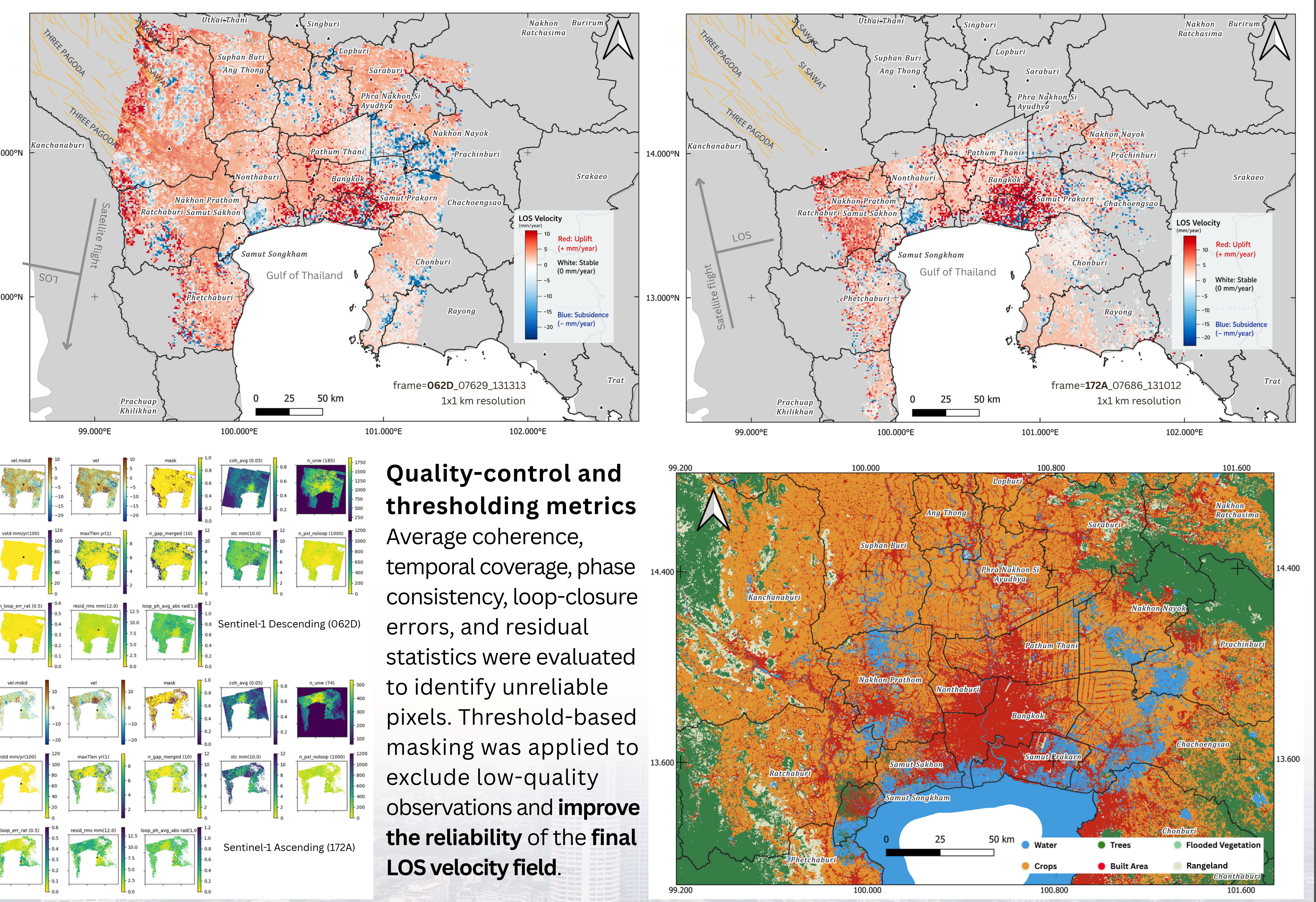


Methodology Workflow



Results: LOS Velocity (mm/year) from Sentinel-1 TS InSAR (2014–2025)

The Sentinel-1 LOS velocity maps show that **central Bangkok** is generally quite stable, with localised subsidence in some urban districts. Stronger subsidence is observed mainly in **Samut Sakhon** (Maximum LOS subsidence rates reach approximately **20 mm/year**), Samut Songkhram, Samut Prakan, Nakhon Pathom, and parts of Chachoengsao. This spatial variability highlights the need for continued InSAR monitoring to support subsidence assessment, flood-risk management, and urban planning.



Future Work

- Incorporating **Ascending and Descending Data**
- Vertical Displacement Analysis and **InSAR-decomposed** subsidence
- Integration of **Independence Data Constraints**
- **High-Resolution Data Processing**

References

Elliott, J. R., J. Fang, M. Lazecky, Y. Maghsoudi, Q. Ou, J. A. Payne, C. Rollins, D. Wang, A. Hooper, and T. J. Wright (2026), Deformation, strains and velocities for the Alpine Himalayan Belt from trans-continental Sentinel-1 InSAR & GNSS, Remote Sensing of Environment, 338, 115320, doi:10.1016/j.rse.2026.115320.
Lazecky, M., K. Spaans, P. J. Gonz'alez, Y. Maghsoudi, Y. Morishita, F. Albino, J. Elliott, N. Greenall, E. Hatton, A. Hooper, D. Juncu, A. McDougall, R. J. Walters, C. S. Watson, J. R. Weiss, and T. J. Wright, (2020), LiCSAR: An Automatic InSAR Tool for Measuring and Monitoring Tectonic and Volcanic Activity, Remote Sensing, 12 (15), doi:10.3390/rs12152430.
Lazecky, M., J. Fang, A. Hooper, and T. Wright, (2022), Improved Phase Unwrapping Algorithm Based on Standard Methods, in IAGRS2022 IEEE International Geoscience and Remote Sensing Symposium, pp. 743–746, doi:10.1109/IGARSS46834.2022.9884337.
Lazecky, M., Q. Ou, Q. Shen, L. McGrath, J. Payne, J. Esp'ın, P. Hooper, A. Wright, T., (2024), Strategies for improving and correcting unwrapped interferograms implemented in LiCSBAS. Procedia Computer Science, doi:10.1016/j.procs.2024.06.435.
Morishita, Y., Lazecky, M., Wright, T., Weiss, J., Elliott, J., Hooper, A., (2020), LiCSBAS: An Open-Source InSAR Time Series Analysis Package Integrated with the LiCSAR Automated Sentinel-1 InSAR Processor. Remote Sensing, 12, 424, doi:10.3390/rs12030424.
Morishita, Y. (2021). Nationwide urban ground deformation monitoring in Japan using Sentinel-1 LiCSAR products and LiCSBAS. Progress in Earth and Planetary Science 8, 6, doi:10.1186/s40645-020-00402-7.
Stephenson, O.L., Liu, Y.K., Yunjun, Z., Simons, M., Rosen, P., Xu, X., (2022). The Impact of Plate Motions on Long-Wavelength InSAR-Derived Velocity Fields. Geophysical Research Letters 49, e2022GL099835, doi:10.2078 1029/2022GL099835.
Yu, C., Z. Li, and N. P. Perna (2018a). Interferometric synthetic aperture radar atmospheric correction using a gps-based iterative tropospheric decomposition model. Remote Sensing of Environment, 204, 109–121.
Yu, C., Z. Li, N. T. Perna, and P. Cripps (2018b). Generic atmospheric correction model for interferometric synthetic aperture radar observations. Journal of Geophysical Research: Solid Earth, 123 (10), 9202–9222.
Wessel, P., Luis, J.F., Uieda, L., Scharroo, R., Wobbe, F., Smith, W.H.F., Tian, D., (2019). The Generic Mapping Tools Version 6. Geochemistry, Geophysics, Geosystems 20, 5556–5564, doi:10.1029/2019GC008515.