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InSAR-based City Infrastructure Monitoring: A case study in Nanjing, China

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City infrastructures (buildings, bridges, roads, airports, and underground tunnels) are facing an aging effects and lacking of maintenance due to a constrained operating budgets around the globe. Situated in the Yangtze River Delta region, Nanjing city has a prominent place in Chinese history and culture, having served as the capital of various Chinese dynasties. The Nanjing metropolitan region has perfect city infrastructures such as many bridges cross the Yangtze River and Qin Huai River, tunnels and high-rise buildings in the Hexi new town. However, with the rapid urbanization and population growth, the aging infrastructures in Nanjing have posed a risk on public security and caused loss of property and life such as due to the collapse of buildings and bridges.

Interferometric Synthetic Aperture Radar (InSAR) is a powerful technique that exploits the all-weather monitoring capabilities of SAR satellites such as COSMO-SkyMed constellation launched by Italian Space Agency. This technique has proven to be able to detect small displacement of infrastructures with millimeter-to-centimeter precision in an urban environment. Here, we illustrate how InSAR can be used in identifying displacement information of infrastructures over a whole city area-Nanjing city. We applied persistent scatterer interferometry (PSI) technique to process 49 COSMO-SkyMed images acquiring in ascending mode and covering the period from June 2012 to July 2016. Deformation maps show that the maximum land subsidence rate is up to 6 mm/yr during this period, and major infrastructure damages are observed. The results are of great interest in prioritizing maintenance for city infrastructures and helping for decision making and budgeting processes to assist in future urban development planning in Nanjing city.