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Localized coastal subsidence in Miami Beach and Surfside, Florida

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We revisit our study of localized land subsidence in Miami Beach, which relied on SAR data from the 1990s (Fiaschi and Wdowinski, 2020) to detect changes in subsidence patterns and velocities. Our original study used ERS-1/2 data acquired during 1993-1999 and revealed that subsidence occurs in localized patches ($< 0.02 \text{ km}^2$) with a magnitude of up to 3 mm/yr. Most of the subsidence occurred in the western side of the city in urban areas built on reclaimed wetlands. We also detected one location of localized subsidence in the eastern part of the city, which centered at a 12-story condominium building. This building, Champlain's South Tower (CTS), collapsed on June 24th, 2021 resulting in the tragic death of 98 residents. The study revealed that the CTS slowly settled during the 6-years observation period (1993-1999), which may induce structural damage to the building, 20-30 years before the building's collapse.

Following the tragic collapse of the CTS, societally important questions were raised by investigating teams, the media, and the public. In the current study we address some of these important questions:

- Did the detected subsidence of the CTS in the 1990s have a differential component?
- Did the CTS building continue subsiding after 1999?
- Did other subsiding areas in Miami Beach continue to subside after 1999?
- Did other areas in Miami Beach start subsiding after 1999?
- What is the significance of these findings?

The answer to the first question is based on a new post-processing of the ERS-1/2 solution, which revealed a small (0.5 mm/yr) differential component of the CTS building during 1993-1999. The answers to the next three questions were obtained from the analysis of Sentinel-1 data acquired during 2016-2021, which revealed a somewhat different subsidence field compared to the ERS-1/2 results. Finally, we used soil consolidation theory to explain the significance of the ERS-1/2 and Sentinel-1 results in terms of primary and secondary soil consolidation processes.