Delineating the subsidence drivers in the Po River delta (Italy) by combining L- and X-band SAR Interferometry

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From leveling to SAR-based interferometry, the monitoring of land subsidence has improved significantly. However, the accurate assessment of the ground movements by SAR in deltaic regions, where marshlands, coastal infrastructures, river embankments, farmlands, and urbanized areas coexist, is still a challenge. Usually, relatively small built-up zones and infrastructures are scattered within large natural and rural lands. In this contribution we present a multi-band SAR methodology to integrate COSMO-SkyMed and ALOS-PALSAR images. The method consists in a proper combination of the very high-resolution X-band Persistent Scatterer Interferometry (PSI), which achieves high-density and precise measurements on single structures and constructed areas, with the L-band Short-Baseline SAR Interferometry (SBAS), properly implemented to rise its effectiveness in retrieving information in vegetated and wet zones. The combined methodology is applied on the Po River Delta, northern Italy, using 16 ALOS-PALSAR and 31 COSMO-SkyMed images covering the period between 2007 and 2011. After a proper calibration of the single PSI and SBAS solution using available GPS records, the dataset have been combined at both the regional and local scales. The measured displacements range from $\sim$0 mm/yr to -35 mm/yr. The results reveal the variable pattern of the subsidence characterizing the more natural and rural environments without losing the accuracy in quantifying the sinking of urban areas and infrastructures. Moreover, they allow improving the interpretation of the natural and anthropogenic processes responsible for the ongoing subsidence, helping to delineate the relative importance of the various drivers contributing to the cumulative subsidence.