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Relative sea-level rise scenario for 2100 along the coasts of south eastern Sicily by GNSS and InSAR data, satellite images and high-resolution topography

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The global sea-level rise (SLR) projections for the next decades are the basis for developing flooding maps that depict the expected hazard scenarios. However, the spatially variable land subsidence has generally not been considered in the current projections. In this study, we use geodetic data from global navigation satellite system (GNSS), synthetic aperture radar interferometric measurements (InSAR) and sea-level data from tidal stations to show subsidence rates and SLR along the coast between Catania and Marzamemi, in south-eastern Sicily (southern Italy). This is one of the most active tectonic areas of the Mediterranean basin, which is affected to accelerated SLR, continuous coastal retreat and increasing effects of flooding and storms surges. We focus on six selected areas, which show valuable coastal infrastructures and natural reserves where the expected SLR in the next years could be a potential cause of significant land flooding and morphological changes of the coastal strip. Through a multidisciplinary study, the multi-temporal flooding scenarios until 2100, have been estimated. Results are based on the spatially variable rates of vertical land movements (VLM), the topographic features of the area provided by airborne Light Detection And Ranging (LiDAR) data and the Intergovernmental Panel on Climate Change (IPCC) projections of SLR in the Representative Concentration Pathways RCP2.6 and RCP8.5 emission scenarios. In addition, from the analysis of the time series of optical satellite images, a coastal retreat up to 70 m has been observed at the Ciane river mouth (Siracusa) in the time span 2001-2019. Our results show a diffuse land subsidence locally exceeding 10 ± 2.0 mm/yr^{-1} in some areas, due to compacting artificial landfill, salt marshes and Holocene soft deposits. Given ongoing land subsidence a high end of RSLR in the RCP8.5 at 0.52± 0.05 m and

1.52±0.13 m is expected for 2050 AD and 2100 AD, respectively, with a projected area of about 9.7 km^2 that will be vulnerable to inundation in the next 80 years.