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Mining impact in a coal exploitation under an urban area: detection by Sentinel-1 SAR data

Jose Cuervas-Mons¹, María José Domínguez-Cuesta¹, Félix Mateos-Redondo², Oriol Monserrat³, and Anna Barra³

¹University of Oviedo, Department of Geology, Oviedo, Spain (jcuervas@geol.uniovi.es; dominguezmaria@uniovi.es)

²GEA Asesoría Geológica – S. COOP ASTUR, Llanera, Spain (felix@geaasesoriageologica.com)

³Geomatics Division, Centre Tecnològic de Telecomunicacions de Catalunya (CTTC/CERCA), Castelldefels, Spain (omonserrat@cttc.cat; abarra@cttc.cat)

In this work, the A-DInSAR techniques are applied in Central Asturias (N Spain). In this area, the presence of the most important cities in the region is remarkable, as well as industry and port infrastructures and a dense road network. Moreover, this region is specially known for their historical coal exploitation, which was developed mainly on the Central Coal Basin for almost 2 centuries, and is being abandoned from the beginning of the 21st. The main aim of this study is detecting and analysing deformations associated to this underground coal mining activity. For this, the following methodology was realised: 1) Acquisition and processing of 113 SAR images, provided by Sentinel-1A and B in descending trajectory between January 2018 and February 2020, by means of PSIG software; 2) Obtaining of Line of Sight mean deformation velocity map (in mm year⁻¹) and deformation time series (in mm); 3) Analysis of detected terrain displacements and definition of mining impact. The results show a Velocity Line of Sight (VLOS) range between -18.4 and 37.4 mm year⁻¹, and accumulated ground displacements of -69.1 and 75.6 mm. The analysis, interpretation and validation of these ground motion allow us to differentiate local sectors with recent deformation related to subsidence and uplift movements with maximum VLOS of -18.4 mm year⁻¹ and 9.5 mm year⁻¹. This study represents an important contribution to improve the knowledge about deformations produced by impact of coal mining activity in a mountain and urban region. In addition, this work corroborates the reliability and usefulness of the A-DInSAR techniques like powerful tools in the study and analysis of geological hazards at regional and local scales for the monitoring and control of underground mining infrastructures.