



## **Risk assessment of subsiding areas in the city of Tuzla (BiH)**

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The wild brine pumping carried out in the suburban of Tuzla (BiH) during the last 60 years, leads to several ground problems such as severe subsidence, shallow-deep fractures, and presently water table rise. These factors, which individually represent a single hazard, induce an overall risk to the town, in relation to the vulnerability of buildings and infrastructures. The severity of the phenomenon really needs the implementation of a risk assessment procedure structured in a GIS environment. The hazards affecting a densely populated area, have been separately investigated by means of modern computer-aided technologies. Subsidence has been historically monitored by means of traditional topography, and actually by geodetic GPS surveys, which lead to the evaluation of the present sinking rates (up to 20 cm/y). Shallow fractures have been mapped, and deep fractures identified through a mathematical curvature analysis, implemented on the sinking surface. This hazard intensity is defined as fractures density value. The last considered hazard is the water table rise related to the termination of wild brine pumping. A piezometric monitoring shows a natural water table rise that is presently threatening of flooding the most collapsed area. All the considered hazards have been therefore represented by a raster map characterized by five intensity classes. In order to create an overall hazard map, multicriteria analysis has been implemented to define the relative weight of single hazards. A map resuming the hazards has been finally obtained by means of map algebra procedures. The buildings vulnerability map has been realized considering the objects density over high resolution satellite images, and dividing it into five classes as well. The overall risk map, obtained by the multiplication of hazard and vulnerability maps, highlights the most dangerous areas, where

the local governance must put their attention concerning the urban planning decisions.