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TI: Investigating land movements of saline soils by SAR based methodologies
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AB: Solonchaks, more commonly known as saline soils, are a soil variety confined to the arid and semi-arid climatic zones. Theseflat areas are characterized by a shallow water table and an evapotranspiration considerably greater than precipitation. Salts dissolved in the soil moisture remain behind after evaporation/transpiration of the water and accumulate at the soil surface. Detecting ground displacement by SAR-based methodologies is challenging in these regions. On one hand, solonchaks have a stable soil structure becausea salt crust is well developed and are usually uncultivated. On the other hand, earth depressions are usually waterlogged due to groundwater capillary rise and hygroscopic water absorbed bysaltparticles. Moreover, sparse vegetation is present even if limited to halophytic shrubs. Although poorly developed, the assessment of land subsidence can be of interest when, as in the northern coast of the Caspian Sea, Kazakhstan, large exploitation of subsurface natural resources are planned. Due to the lack of traditional monitoring surveys,SAR-based interferometry represents the unique methodology that can be used to investigate the recent/present ground displacements of this large region. With a temperature ranging from-25 to +42°C and a precipitation less than 200 mm/yr, large depressions with solonchak in them characterize the whole area. The presence of salt-affected soils is in close relation to the oscillations of the sea level and the massive presence of salt domes. Due to the extreme flatness of the coastland, on the order of 0.001%, even a small land sinking produces a significant inland encroachment of the sea. Small BAseline Subset (SBAS) and Interferometric Point Target Analysis (IPTA) have been applied to understand the capability SAR-based techniques of monitoring land displacements in these environments. The SBAS approach is developed to maximize the spatial and temporal coherence through the construction of small baseline interferograms. Differently, IPTA extracts deformation signals on radar-bright and radar-phase-stable targets (PT) that are coherent over theentire time interval. We applied the two SAR procedures on a stack of 35 ENVISAT images centred on the Ural River delta and acquired from 2003 to 2009. A good coherence of the radar signal was detected with both the techniques for a large portion of the scene. With SBAS, 123 interferograms with baselines shorter than 200 m were computed and 29 of them characterized by a low coherence due to the presence of wet snow cover were removed. With IPTA all acquisitions were considered. As a consequence of snow-cover and frozen surfaces in winter together with atmospheric disturbances,a large noise level has been detected over the semi-desert areas, also in consideration of an image number at the limit of IPTA applicability. The two methods provide similar movements in the range of ±4 mm/yr with respect to the reference. As the interest is focussed on the regional movements and due to the small numbers of SAR imagescharacterizing these poorly-urbanized regions we conclude that SBAS is a more robust approach for the analysis of land subsidence in salt-affected soils.
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