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Surface deformation Surface deformation monitoring by InSar Techniques. Case study of the region of In Salah, Algeria.

Abed, M.[1], Bouarfa Abed, H.[2] and Tayeb, S.[3]

[1]University of Blida1, Faculty of Technology, Algeria, abedmed@yahoo.fr
[2]University of Blida1, Faculty of Sciences, Algeria
[3]University of Blida1, Faculty of Technology, Algeria

Across the world, many gas projects include a CO2 sequestration effort which consists of injecting millions of tons of CO2 into a deep saline formation close to a producing gas field. Depending on reservoir characteristics and depth, oil or gas production can induce surface subsidence or ground heave. This can lead to a substantial structural risk of the petroleum infrastructure, its transportation facilities or an ecological issue.

Mapping the surface effects, due to either fluid extraction or injection, usually requires the availability of hundreds of measurement points per square km with millimetre-level precision, which is time consuming and expensive to obtain using traditional monitoring techniques. Surface deformation measurements have proved to be a very effective way to monitor field operations with applications notably in oil/gas industry, water flooding, waste injection. Among the techniques of surface deformation measurements, InSAR is considered as a promising multiyear monitoring option for detecting surface deformations since it can provide information across a wide area. Several spaceborne SAR systems including ALOS PALSAR, JERS-1 SAR, ERS1/2 AMI, ENVISAT ASAR and Radarsat SAR, have been widely used for mapping of surface deformation. These are referred to as the active type sensors which transmit radar pulses towards the earth and receive echoes back off the Earth's surface.

The primary objective of this paper is to investigate the applicability of satellite-borne InSAR technique to the monitoring of surface deformation for a CO2 injection site. Also, an example of case study operated at In Salah, Algeria demonstrates a successful application of this modern practice. In this case, a technique that integrates remote-sensing analysis throughout surface features with conventional investigation methodologies is proved to be a potential tool to detect and understand areas that might be at risk of surface subsidence. The obtained results indicate that the best fit is obtained through a combination of reservoir and fault pressurization, rather than either alone. Finally as an outcome of this study, one can assert that InSAR technology provides a powerful tool for gaining good prediction of the land surface deformation.

References:

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