

GROUND DEFORMATION MONITORING USING RADARSAT-2 DINSAR-MSBAS AT THE AQUISTORE CO₂ STORAGE SITE IN SASKATCHEWAN (CANADA)

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ABSTRACT:

The research objectives of the Aquistore CO₂ storage project are to design, adapt, and test non-seismic monitoring methods for measurement, and verification of CO₂ storage and to integrate data to determine subsurface fluid distributions, pressure changes and associated surface deformation. An array of monitoring techniques has been employed in the study area including satellite Differential Interferometric Synthetic Aperture Radar (DInSAR) technique, GPS, tiltmeters and piezometers. For measuring ground deformation at the Aquistore CO₂ study area we employed DInSAR - Multidimensional Small Baseline Subset (MSBAS) method, which combines multi-angle multi-temporal SAR images into a single set of vertical and horizontal deformation time series improving their temporal resolution and precision. The C-band RADARSAT-2 data has been collected since June 2012 in order to map background deformation over the study area. The RADARSAT-2 data is acquired with the individual frequency of 24 days. For this project we have collected data from five beams: ascending and descending geometries of Spotlight with very high resolution of 1.6x0.8 m, ascending and descending geometries of Wide Ultra-Fine with moderate resolution of 1.6x2.8 m and descending geometry of Fine Quad-Pol with coarse resolution of 5.2x7.6 m, in range and azimuth directions. Such acquisition configuration allowed us to increase image frequency to 6 days on average in order to achieve nearly continuous temporal SAR coverage. We provide updated DInSAR-MSBAS results based on over one hundred RADARSAT-2 images acquired during June 2012 - April 2014. These interferometric results indicate slow ground deformation of 1 cm/year related to natural and anthropogenic processes as: snow melting, surface moisture fluctuations, ground and surface water level changes and post-mining activity.