Space Geodesy and Geochemistry Applied to the Monitoring, Verification of Carbon Capture and Storage (CCS): Training and Research

Background

Increased attention is being placed on research into technologies that capture and store carbon dioxide (CO_2). Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and, in turn, mitigating global climate change without adversely influencing energy use or hindering economic growth.

Deploying these technologies in commercial-scale applications requires a significantly expanded workforce trained in various CCS specialties that are currently under-represented in the United States. Education and training activities are needed to develop a future generation of geologists, scientists, and engineers who possess the skills required for implementing and deploying CCS technologies.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) has selected 43 projects to receive more than $12.7 million in funding, the majority of which is provided by the American Recovery and Reinvestment Act (ARRA) of 2009, to conduct geologic sequestration training and support fundamental research projects for graduate and undergraduate students throughout the United States. These projects will include such critical topics as simulation and risk assessment; monitoring, verification, and accounting (MVA); geological related analytical tools; methods to interpret geophysical models; well completion and integrity for long-term CO_2 storage; and CO_2 capture.

Project Description

NETL is partnering with the University of Miami to provide educational training by assisting in the development of an integrated, low cost methodology for assessing the fate of CO_2 pumped into various classes of geologic reservoirs. Project participants will assist in integrating geodetic, seismological, and geochemical data by using Interferometric Synthetic Aperture Radar (InSAR) data to construct interferograms (photographic records of optical interference phenomena) at several of the DOE's Regional Carbon Sequestration Partnership (RCSP) Validation Phase II "legacy" sites and RCSP Deployment Phase III sites. This technology will provide a gross characterization of upper crustal response for sequestration activities under

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PARTNERS

None

PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2012

COST

Total Project Value
$299,845

DOE/Non-DOE Share
$299,845/$0

Government funding for this project is provided in whole or in part through the American Recovery and Reinvestment Act.

a variety of conditions. Assessments of the geochemical environments in the sites, and the potential for more detailed geochemical modeling, will be completed and integrated with the geodetic studies.

Goals/Objectives

The primary objective of the project is to provide educational training for participants by assisting in the development of an integrated, low cost methodology for assessing the fate of sequestered CO_2. This methodology will integrate reconnaissance-scale spatial analysis techniques with detailed seismic and geochemical techniques, which includes:

- High-precision space geodesy (Global Positioning System (GPS) and InSAR) to measure surface displacements associated with CO_2 pumping induced pressure/volume changes.
- Analytical and numerical modeling to relate surface deformation to changes in pressure/volume at depth.
- New, state-of-the-art algorithms for determination of compressional velocity, shear-wave velocity, and attenuation from seismic data, to monitor fluid movement and porosity changes.
- Geochemical modeling to assess the fate of sequestered gas or fluid, and separate the effects of formation of new reaction products from leakage or loss of gas or fluid from the reservoir.
- Geochemical sampling to measure potential leakage using a combination of CO_2 concentration sensors and advanced field mass spectrometers to measure isotopic ratios.

Benefits

If proven to be successful, the developed methodology will become available for implementation at relatively low cost at most proposed sequestration sites, requiring only the installation of a network of GPS, seismic, and geochemical stations, and low cost commercial satellite imagery. The student participants will gain hands-on experience in the skills and competencies required for commercial-scale implementation of CCS technologies.

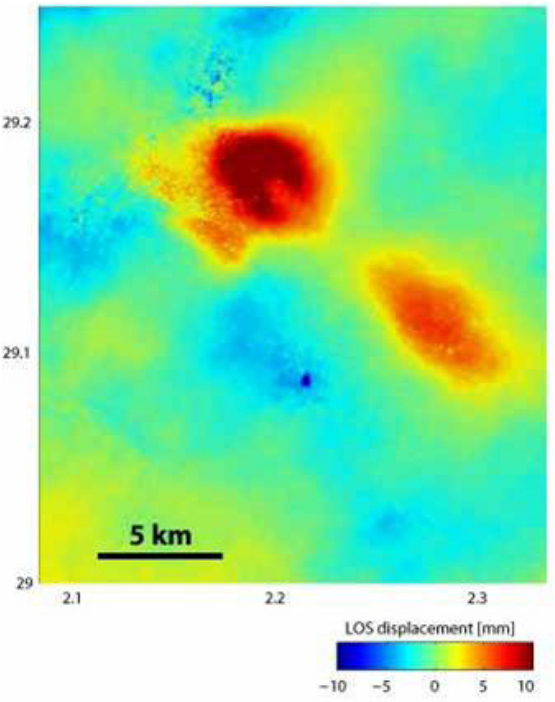

Figure 1. Movement of surface as a result of CO_2 as generated by University of Miami researchers from InSAR data.