Carbolab: improving the knowledge of carbon storage and coal bed methane production by "insitu" underground tests

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Abstract *Maximum 500 words*	Amongst the various CO_2 geological storage options for reducing greenhouse gas emissions, storage in unmineable coal seams represents an economic potential for middle-term spreading but also reflects uncommon technical difficulties. Indeed, the profit from methane recovery should lessen the costs, but low and changing injectivity is to be expected, at least in European coal deposits. However, these coals have to date received little testing for this technique: in Europe, only one on-site project has been undertaken to give better assessments far from the laboratory benches. Such uncertainties make it difficult to demonstrate the feasibility of injecting CO_2 into coal seams and create a major drawback in terms of identifying the reliability and safety of this geological storage option. Therefore, the CARBOLAB project is working at an intermediate scale between laboratory and industrial pilot, studying an in-situ injection to test and upscale laboratory experiments (for example the CHARCO project) before further pilot-size injections. Our aim is to inject a significant, though not pilot-related, quantity of CO_2 into a coal seam lying at the bottom of the Monsacro mine in Asturias, Spain. Putting devices in the near vicinity of the CO_2 plume, only a few metres away, will allow data of much higher quality and density to be collected, and to adapt the injection and monitoring protocols accordingly. Data acquisition includes geophysics (both active and passive seismic and electrical methods) and geochemistry (chemical and isotopic measurements). These and other methods also provide an initial characterization of the coal seam and its surroundings. The injection and acquisition phase is to occur this summer. The in-situ work will be complemented by parallel laboratory experiments to provide intrinsic properties and characterisation of relationships between water, gases and coal. Afterwards, the data will be compared with results from simulations using existing analytical means as well as new developed ones. Until now, common reservoir simulators did not represent the adsorption process, which is a key point for explaining the gas storage and migration through coal seams. CO_2 sorption onto coal and the exchange with sorbed CH_4 are associated with mechanical processes like swelling/shrinkage. Two models are developed, a coupling between TOUGH2/EOS7C and ASTER_CODE (by BRGM), and a COMSOL-based tool (by INERIS). Their intercomparison and their validation with in-situ data have yet to be realised; they will give opportunities for long-term behaviour simulations, in order to provide a basis for the definition of safety criteria for undertaking enhanced coal bed methane projects associated with CO_2 injection. The overall aim is to make the impact on Man and the environment close to zero in the short, medium and long terms. However, site selection, risk analysis, storage security management, implementation and eventual remediation need to be studied. The CARBOLAB project is supported by the European Fund for Coal and Steel, involving partners from three European states: the leader Hunosa, owner of the mine, and Aitemin from Spain, BRGM and Ineris from France, GIG from Poland, and the company Total. It started in 2009 and will end in 2013.
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